Echo Blaster 64, Echo Blaster 128, LS64, LS128, ClarUs, SmartUs, MicrUs and ArtUs Series Ultrasound Systems

Echo Wave II Software

Measurements and Calculations Reference Manual

TELEMED
ULTRASOUND MEDICAL SYSTEMS

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Content

Echo Wave II Software Measurements and Calculations Overview

This document presents equations and tables that are used for Echo Wave II measurements and calculations. **Available measurements and calculations depend on the used ultrasound scanner and its supported scanning modes.**

- B, Color Doppler, Elastography mode general measurements and calculations

  Distance
  Length (method: 1 trace)
  Area (methods: 1 ellipse, 1 trace, 1 distance, 1 rectangle)
  Circumference (methods: 1 ellipse, 1 trace, 1 distance)
  Volume (methods: 1 distance, 2 distances, 3 distances, 1 ellipse, 1 trace, 2 traces)
  Angle (methods: 2 distances, 3 distances)
  Stenosis % (methods: 2 distances, 2 ellipse or trace areas)
  A/B Ratio (methods: 2 distances, 2 ellipse or trace areas, 2 ellipse or trace circumferences)
  Average Gray Value (methods: 1 ellipse, 1 rectangle)
  Standard Deviation of Gray Values (methods: 1 ellipse, 1 rectangle)
  Histogram of Gray Values (methods: 1 ellipse, 1 rectangle)

- M mode general measurements and calculations

  Distance
  Time
  Velocity
  Heart Rate (methods: 1 beat, 2 beats)
  Stenosis % (method: 2 distances)
  A/B Ratio (methods: 2 distances, 2 times, 2 velocities)

- PW/CW mode general measurements and calculations

  One-point PW/CW measurements and calculations:
  - Velocity
  - Pressure Gradient (PG)

  Two-points PW/CW measurements and calculations:
  - Velocities difference
  - Pressure Gradients (PG) difference
  - Time interval
  - Acceleration
  - Resistivity Index (RI)
  - Heart Rate (1 beat, 2 beats)
  - Velocity minimum and maximum
  - Pressure Gradient (PG) minimum and maximum

  Trace-based PW/CW measurements and calculations:
  - Trace Time
  - Trace Velocity min, max, mean

Trace Pressure Gradient min, max, mean
Velocity Time Integral (VTI)
Pulsatility Index (PI)

A/B Ratios of one-point PW/CW measurements:
Velocities A/B Ratio
Pressure Gradients (PG) A/B Ratio

A/B Ratios of two-point PW/CW measurements:
Velocity differences A/B Ratio
Pressure Gradient (PG) differences A/B Ratio
Time differences A/B Ratio
Accelerations A/B Ratio
Resistivity Indexes A/B Ratio

A/B Ratios of trace-based PW/CW measurements:
Velocity means A/B Ratio
Pressure Gradient (PG) means A/B Ratio
Pulsatility Indexes A/B Ratio
Velocity Time Integrals A/B Ratio

Software supports multiple general measurements of each type.

- Human measurements and calculations packages

General
Obstetrics / Gynecology (OB / GYN)
Gynecology (GYN)
Abdominal
Urology
Endocrinology
Vascular
Cardiology
Musculoskeletal

- Veterinary measurements and calculations packages

General (Veterinary)
Cardiology (Veterinary)
Canine (OB)
Feline (OB)
Ovine (OB)
Bovine (OB)
Equine (OB)
Llama (OB)
Goat (OB)

- Human General exam measurements and calculations

  Calculations:
  Body Surface Area (BSA) via Height and Weight, BSA via Weight.

  PW/CW mode calculations:
  Heart Rate
  Stroke Volume (SV) using Flow Area
  Stroke Volume (SV) using Flow Diameter
  Stroke Volume Index (SI)
  Cardiac Output (CO)
  Cardiac Index (CI)
  Area calculation using Area and VTI (Continuity Equation)
  Area calculation using Area and Velocity (Continuity Equation)
  Area calculation using Diameter and VTI (Continuity Equation)
  Area calculation using Diameter and Velocity (Continuity Equation)
  Velocity Ratio S/D
  Velocity Ratio D/S
  Delta Pressure : Delta Time (dP:dt)
  Flow Volume using Diameter
  Flow Volume using Area
  Pressure Half Time (PHT)
  Mitral Valve Area using PHT

  Elastography mode calculations:
  Strain Ratio (SR)
  E/B Distances Ratio

- Human Obstetrics / Gynecology (OB / GYN) exam measurements and calculations

  B mode measurements:

LMP (Last Menstrual Period; entered or chosen from calendar), AC (Abdominal Circumference), BPD (Biparietal Diameter), FL (Femur Length), HC (Head Circumference), FTA (Fetal Trunk Abdominal area), AAPD (Abdominal Anterior-Posterior Diameter), ATD (Abdominal Transverse Diameter), TAPD (Thorax Anterior-Posterior Diameter), TTD (Thorax Transverse Diameter), CRL (Crown Rump Length), GS (Gestational Sac), HL (Humerus Length), TL (Tibia Length), UL (Ulna Length), OFD (Occipitofrontal Diameter), BOD (Binocular Distance), Cereb (Cerebellum), Clav (Clavicle), Rad (Radius), AFI (Amniotic Fluid Index), FHR (Fetal Heart Rate), NT (Nuchal Translucency).

  Doppler mode measurements:

Umbilical Artery (UA): RI (Resistivity Index), PI (Pulsatility Index), S (Systolic velocity), D (Diastolic velocity).

Middle Cerebral Artery (MCA): RI (Resistivity Index), PI (Pulsatility Index), PSV (Peak Systolic Velocity.

Ductus Arteriosus (DA): Diam (Diameter, B mode), PSV (Peak Systolic Velocity).

Main Pulmonary Artery (MPA): Diam (Diameter, B mode), PSV (Peak Systolic Velocity).

Uterine Artery (UtA): RI (Resistivity Index), PI (Pulsatility Index).

B mode calculations:

EDD(LMP), EDD(GA), EDD(AUA).

B mode ratios:

FL / AC, FL / HC, FL / BPD, HC / AC, CI (Cephalic Index).

Doppler mode calculations:

Umbilical Artery (UA): S/D ratio.

CPR (Cerebroplacental Ratio).

Estimated Fetal Weight (EFW) calculation methods:

EFW(AC) Campbell75, EFW(AC) Hadlock84, EFW(AC) Jordaan83, EFW(AC) Warsof77, EFW(AC,BPD) Hadlock84, EFW(AC,BPD) Hsieh87, EFW(AC,BPD) Jordaan83, EFW(AC,BPD) Merz88, EFW(AC,BPD) Shephard82, EFW(AC,BPD) Warsof77, EFW(AC,BPD) Woo85, EFW(FL) Warsof86, EFW(AC,FL) Warsof86, EFW(AC,FL) Woo85, EFW(AC,FL) Hadlock85, EFW(AC,HC) Hadlock84, EFW(AC,HC) Tohamy, EFW(AC,FL,HC) Hadlock85, EFW(AC,FL,HC) Ott86, EFW(AC,BPD,FL) Hadlock85, EFW(AC,BPD,FL) Hsieh87, EFW(AC,BPD,FL) Woo85, EFW(AC,BPD,HC) Jordaan83, EFW(AC,BPD,FL,HC) Hadlock84, EFW(AC,BPD,FL,HC) Hadlock85, EFW(BPD,FL,FTA) Osaka88, EFW(BPD,ATD) Eik-Nes and Grottum82, EFW(BPD,TTD) Hansmann86, EFW(BPD,TAPD,TTD) Tokyo87, EFW(BPD,FL,TAPD,TTD) Tokyo87.

Selected EFW values are used for calculation of Average EFW.

Gestational Age (GA) calculation tables:

GA(AC): Hadlock82, Hadlock83, Hadlock90, Hansmann79, Hansmann86, Jeanty82, Merz91, Tokyo96.

GA(BPD): Campbell71, Hadlock82, Hadlock90, Hadlock97, Hansmann85, Jeanty82, Jeanty83, Kurtz80, Merz91, Osaka88, Rempen91, Sabbagha76, Tokyo89, Tokyo96.

GA(CRL): Daya93, Hadlock92, Hansmann85, Jeanty83, Nelson81, Osaka89, Rempen91, Robinson75, Tokyo86, Tokyo89, Tokyo96.

GA(FL): Chitty97, Hadlock82, Hadlock84, Hadlock90, Hansmann85, Hohler82, Jeanty84, Merz91, Osaka89, Tokyo86, Tokyo89, Tokyo96, Warda85.

GA(GS): Hansmann79, Hansmann85, Hellman69, Hollander72, Merz91, Rempen91, Tokyo86.

GA(HC): Hadlock84, Hadlock90, Hansmann86, Merz91.

GA(HL): Jeanty84, Merz91, Osaka89.

GA(OFD): Hansmann86.

GA(TL): Jeanty84, Merz91.

GA(UL): Jeanty84, Merz91.

GA(HC/AC): Hadlock82.

GA(FTA): Osaka88.

GA(ATD): Hansmann79, Merz91.

GA(TAPD): Hansmann76.

GA(TTD): Hansmann85, Hansmann86.

GA(BOD): Jeanty84.

GA(Cereb): Chitty97, Goldstein87, Hill90.

GA(Clav): Yarkoni85.

Selected GA values are used for calculation of Average GA (Average Ultrasound Age - AUA).

Software supports unlimited number of user-defined GA tables.

Fetal Growth B mode estimation tables:

AC(GA): Hadlock84, Hansmann86, Jeanty84, Merz96, Tokyo96.
BPD(GA): Campbell85, Hadlock84, Hansmann86, Jeanty84, Merz96, Rempen91, Sabbagha76, Tokyo96.
CRL(GA): Hadlock92, Hansmann86, Rempen91, Robinson75, Tokyo96.
FL(GA): Chitty84, Hadlock84, Hansmann86, Jeanty84, Merz96, O'Brien81, Tokyo96, Warda85.
GS(GA): Hellman69, Rempen91.
HC(GA): Hadlock84, Hansmann86, Jeanty82, Merz96.
HL(GA): Jeanty84, Merz96.
OFD(GA): Hansmann86, Jeanty84, Merz96.
TL(GA): Jeanty84, Merz96.
UL(GA): Jeanty84, Merz96.
[FL/AC](GA): Hadlock84.
[FL/HC](GA): Hadlock84.
[HC/AC](GA): Campbell77.
EFW(GA): Brenner76, Hadlock91, Hansmann86, Tokyo94, Williams.
AAPD(GA): Merz96.
ATD(GA): Merz96.
TAPD(GA): Hansmann76.
TTD(GA): Hansmann86.
BOD(GA): Jeanty82.
Cereb(GA): Goldstein87, Hill90.
Rad(GA): Jeanty82, Merz96.
Clav(GA): Yarkoni85.
AFI(GA): Moore90, Magann00.
FHR(GA): Rempen90.
NT(CRL): Wright08, Hsu03, Mahale13, Chung04.

Fetal Growth Doppler mode estimation tables:

UA_RI(GA): Merz05, Kurmanavicius97, Chanprapaph00, Kofinas92.
UA_PI(GA): Merz05, Coppens96, Arduini90, Baschat03.
UA_RATIO_S_D(GA): Kofinas92, Chanprapaph00.
MCA_RI(GA): Tarzamni09, Kurmanavicius97, Bahlman02.
MCA_PI(GA): Mari92, Bahlmann02, Baschat03, Arduini90, Ebbing07, Tarzamni09.
MCA_PSV(GA): Tarzamni09, Ebbing07, Shrestha13.
CPR(GA): Ebbing07, Baschat03.
DA_DIAM(GA): Mielke00, Tan92.
DA_PSV(GA): Mielke00, Brezinka92.
MPA_DIAM(GA): Mielke00, Ruano07.
MPA_PSV(GA): Mielke00, Groenenberg90.
UTA_RI(GA): Merz05, Kurmanavicius97.
UTA_PI(GA): Merz05, Gomez08.

Selected Growth Tables are visualized as Fetal Growth Curves.
Software supports unlimited number of user-defined Growth Tables.

- Human Gynecology (GYN) exam measurements and calculations

Measurements: length, height, width of uterus, cervix, ovaries, renals, follicles.
Calculations: volumes of uterus, cervix, ovaries, renals, follicles.

- Human Abdominal exam measurements and calculations

Liver: Volume (CC, AP, LL diameters).
Gallbladder: Volume, Wall Thickness, Extrahepatic Bile Duct (EBD), Common Bile Duct (CBD), Common Hepatic Duct (CHD).
Pancreas: Head Diameter, Body Diameter, Tail Diameter, Pancreatic Duct Head, Pancreatic Duct Body.
Spleen: Volume (length, width, thickness).
Gastrointestinal Tract: Appendix Wall Thickness, Appendix Diameter, Bowel Wall Thickness (at Stomach, Small Bowel, Large Bowel).
Urinary Bladder: Volume (length, height, width).
Right / Left Kidney: Volume (length, height, width), Pelvis Diameter.
Liver to Kidney Ratio (LKR). For regions of interest (ROIs) at Liver, Right Kidney, Left Kidney are calculated ROI Area (ellipse), ellipse short and long axis length, ROI Distance, ROI average gray value (Avg), ROI standard deviation (Std Dev) of gray values. For kidneys is calculated Liver to Kidney Ratio (LKR).

- Human Urology exam measurements and calculations

Measurements: length, height, width of kidneys, bladder, prostate, testes.
Calculations: volumes of kidneys, bladder, prostate, prostate adenoma, testes; PSAD (Prostate Specific Antigen Density); RUV (Residual Urine Volume).

- Human Endocrinology exam measurements and calculations

Measurements: length, width, thickness of thyroid lobes.
Calculations: volumes of thyroid lobes; volume of thyroid.

- Human Musculoskeletal exam measurements and calculations

Calculations: Hip Angles (α, β), Femoral Head Coverage (FHC).

- Human Vascular exam measurements and calculations

Software supports the following vascular calculations:

Distance and area -based stenosis and VFD (Volume Flow) calculations at left (right) sides and proximal, middle, distal locations of the following vessels:

Subclavian, CCA (Common Carotid Artery), Bulb, ICA (Internal Carotid Artery), ECA (External Carotid Artery), Vertebral;

Upper Extremity (hand) Arteries (UEA): Subclavian, Axillary, Brachial, Radial, Ulnar;

Upper Extremity (hand) Veins (UEV): Subclavian, Axillary, Brachial, Upper Cephalic, Lower Cephalic, Upper Basilic, Lower Basilic, Radial, Ulnar;

Lower Extremity (leg) Arteries (LEA): Common Illiac, Internal Illiac, External Illiac, Common Femoral, Deep Femoral, Femoral, Popliteal, Anterior Tibial, Posterior Tibial, Peroneal, Dorsalis Pedis;

Lower Extremity (leg) Veins (LEV): Common Illiac, Internal Illiac, External Illiac, Common Femoral, Deep Femoral, Femoral, Popliteal, Great Saphenous, Small Saphenous, Anterior Tibial, Posterior Tibial, Peroneal, Dorsalis Pedis.

PSV/EDV (Peak Systole Velocity / End Diastole Velocity) ratios for each vessel and location.

Ratios of velocities ICA PSV/CCA PSV, ICA EDV/CCA EDV, ICA PSV/CCA EDV, ECA PSV/CCA PSV, ECA EDV/CCA EDV, ECA PSV/CCA EDV at Rt. (Lt.) Prox. (Mid., Dist.) locations.

- Human Cardiology exam measurements and calculations

Software supports the following measurements of Left Ventricle, Aortic Valve, Left Atrial:
IVSd (Interventricular Septal Thickness, diastole), LVIDd (Left Ventricle Internal Diameter, diastole), LVPWd (Left Ventricle Posterior Wall Thickness, diastole), AOd (Aortic Root Dimension, diastole), IVSs (Interventricular Septal Thickness, systole), LVIDs (Left Ventricle Internal Diameter, systole), LVPWs (Left Ventricle Posterior Wall Thickness, systole), LADs (Left Atrial Dimension, systole).

Cardiology measurements package automatically displays hint images that show where and how appropriate measurements must be performed.

Cardiology calculations: HR (Heart Rate), BSA (Body surface Area), Left ventricle volume (methods: Cubed, Teichholz, Gibson, Simpson's LVAM-LVAP, Simpson's single plane, Simpson's biplane, Bullet, Ellipsoid single plane, Ellipsoid biplane), SV (Stroke Volume), SI (Stroke Volume Index), EF (Ejection Fraction), CO (Cardiac Output), CI (Cardiac Index), STIVS (Interventricular Shortening), FS (Fractional Shortening), STPW (Posterior Wall Shortening), LVM (Left Ventricle Cardiac Mass), CMI (Cardiac Mass Index), LA/AO Ratio.

PW/CW mode Human Cardiology measurements and calculations:

Left Ventricle: LVOT Diam, LVOT VTI, LVOT Vmax, SV (Stroke Volume), SI (Stroke Volume Index), CO (Cardiac Output), CI (Cardiac Index), dP:dt (Delta Pressure : Delta Time), LV MPI (Left Ventricle Myocardial Performance Index).

Mitral Valve: MVA(PHT) (Mitral Valve Area using Pressure Half Time), MVA using Continuity Equation (LVOT Diam, MV VTI; LVOT Diam, MV Vmax), dP:dt, E/A ratio.

Aortic Valve: AVA (Aortic Valve Area) using Continuity Equation (LVOT Diam, AV VTI; LVOT Diam, AV Vmax), AVI (Aortic Valve Index), DPI (Dimensionless Performance Index), AV PHT (Aortic Valve Pressure Half Time).

Right Ventricle: RVOT Diam, RVOT VTI, RVOT Vmax, dP:dt, RV MPI (Right Ventricle Myocardial Performance Index), MPAP (Mean Pulmonary Artery Pressure).

Tricuspid Valve: TVA (Tricuspid Valve Area) using Continuity Equation (RVOT Diam, TV VTI; RVOT Diam, TV Vmax); TV E/A ratio, TV PHT.

Pulmonic Valve: PVA (Pulmonic Valve Area) using Continuity Equation (RVOT Diam, PV VTI; RVOT Diam, PV Vmax), PVI (Pulmonic Valve Index), DPI (Dimensionless Performance Index), PV PHT (Pulmonic Valve Pressure Half Time).

Pulmonary Vein; Hepatic Vein.

Shunts: Qp:Qs (Pulmonary-Systemic Flow Ratio).

Proximal Isovelocity Surface Area (PISA) method for mitral, aortic, tricuspid and pulmonary regurgitation: RFlow (Regurgitant Flow), EROA (Effective Regurgitant Orifice Area), RVol (Regurgitant Volume).

- Canine exam measurements and calculations

Measurements:

GS (Gestational Sac Diameter), CRL (Crown Rump Length), HD (Head Diameter), BD (Body Diameter).

Gestational Age (GA) calculation tables:

GA(BD): Nyland95, Yeager92.
GA(CRL): Nyland95, Yeager92.
GA(GS): Nyland95, Yeager92.
GA(HD): Nyland95, Yeager92.

Selected GA values are used for calculation of Average GA.
Software supports unlimited number of user-defined GA tables.

- Feline exam measurements and calculations

Measurements:
HD (Head Diameter), BD (Body Diameter).

Gestational Age (GA) calculation tables:

GA(BD): Nyland95.
GA(HD): Nyland95.

Selected GA values are used for calculation of Average GA.
Software supports unlimited number of user-defined GA tables.

- Ovine exam measurements and calculations

    Measurements:
    CRL (Crown Rump Length).

    Gestational Age (GA) calculation tables:

    GA(CRL): Gonzalez98.

    Selected GA values are used for calculation of Average GA.
    Software supports unlimited number of user-defined GA tables.

- Bovine exam measurements and calculations

    Measurements:
    BD (Body Diameter), CRL (Crown Rump Length), HD (Head Diameter), UD (Uterine Diameter).

    Gestational Age (GA) calculation tables:

    GA(BD): Wright88.
    GA(CRL): EW1, Wright88.
    GA(HD): Wright88.
    GA(UD): Hansen2005.

    Selected GA values are used for calculation of Average GA.
    Software supports unlimited number of user-defined GA tables.

- Equine exam measurements and calculations

    Measurements:
    AOD (Aorta Diameter), BPD (Biparietal Diameter), CRL (Crown Rump Length), EOD (Eye Orbit Diameter), GS (Gestational Sac Diameter).

    Gestational Age (GA) calculation tables:

    GA(AOD): Ven2004.
    GA(BPD): Ven2004.
    GA(CRL): Limerick2006.
    GA(EOD): Ven2004.
    GA(GS): EW1.

    Selected GA values are used for calculation of Average GA.
    Software supports unlimited number of user-defined GA tables.

- Llama exam measurements and calculations

Measurements:
BPD (Biparietal Diameter).

Gestational Age (GA) calculation tables:

GA(BPD): Haibel89.

Selected GA values are used for calculation of Average GA.
Software supports unlimited number of user-defined GA tables.

- Goat exam measurements and calculations

Measurements:
BPD (Biparietal Diameter).

Gestational Age (GA) calculation tables:

GA(BPD): Haibel90 (Angora), Haibel90 (Finn), Haibel90 (Nubian), Haibel90 (Pigmy), Haibel90 (Suffolk), Haibel90 (Toggenburg).

Selected GA values are used for calculation of Average GA.
Software supports unlimited number of user-defined GA tables.

- Veterinary Cardiology measurements and calculations

Software supports the following measurements of Left Ventricle, Aortic Valve, Left Atrial:
IVSd (Interventricular Septal Thickness, diastole), LVIDd (Left Ventricle Internal Diameter, diastole), LVPWd (Left Ventricle Posterior Wall Thickness, diastole), IVSs (Interventricular Septal Thickness, systole), LVIDs (Left Ventricle Internal Diameter, systole), LVPWs (Left Ventricle Posterior Wall Thickness, systole), ET (Ejection Time), AOd (Aortic Root Dimension, diastole), LADs (Left Atrial Dimension, systole).

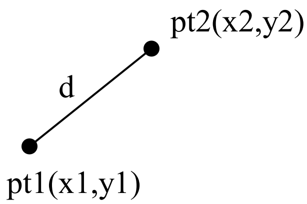
Cardiology measurements package automatically displays hint images that show where and how appropriate measurements must be performed.

Cardiology calculations: HR (Heart Rate), Left ventricle volume (methods: Cubed, Teichholz, Gibson), SV (Stroke Volume), EF (Ejection Fraction), CO (Cardiac Output), STIVS (Interventricular Shortening), FS (Fractional Shortening), STPW (Posterior Wall Shortening), VCF (Velocity of Circumferential Fibre Shortening), LA/AO Ratio.

1 General measurements and calculations

1.1 B mode general measurements and calculations

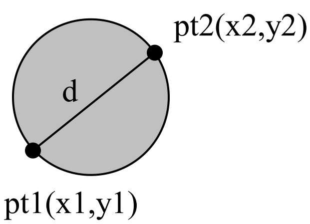
1.1.1 B Distance



Distance d between points pt1 and pt2 is calculated using the following equation:

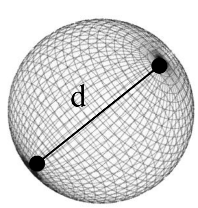
$$d(pt1, pt2) = \sqrt{(x1 - x2)^2 + (y1 - y2)^2} .$$

Area S and circumference P (perimeter) of circle with diameter d are calculated using the following equations:



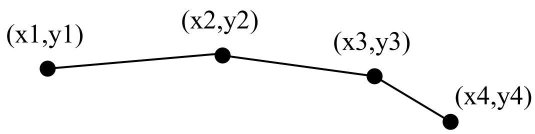
$$S = \frac{\pi \cdot d^2}{4},\ P = \pi \cdot d \text{, here } \pi = 3.14159265 .$$

Volume V of a sphere with diameter d is calculated using the following equation:



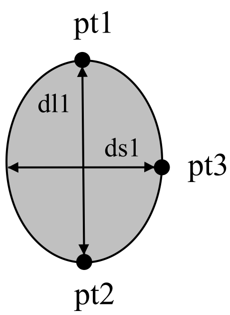
$$V = \frac{\pi \cdot d^3}{6} .$$

1.1.2 B Length (Trace)



The length of polyline (curve) is calculated by summing the lengths of all its linear segments. The length of one linear segment (distance between 2 corresponding points) is calculated using equation that is presented in section "B Distance".

1.1.3 B Area (Ellipse)

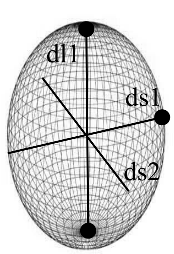


During measurements and calculations we assume that ellipse axis between two circular marker points pt1 and pt2 is "long axis", and axis with one circular endpoint marker pt3 is "short axis". And this "long axis" and "short axis" notation remains unchanged no matter what are real lengths of these axes.

Area S and circumference P (perimeter) of an ellipse with long axis length dl1 and short axis length ds1 are calculated using the following equations:

$$S = \frac{\pi \cdot dl1 \cdot ds1}{4}, \; P = \pi \cdot \sqrt{\frac{1}{2}\left((dl1)^2 + (ds1)^2\right)}.$$

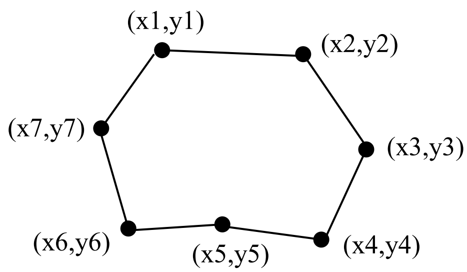
Volume V of an ellipsoid with axes lengths dl1, ds1, and ds2=ds1 is calculated using the following equation:



$$V = \frac{\pi \cdot dl1 \cdot ds1 \cdot ds2}{6}.$$

Average gray value of pixels inside ellipse is calculated using equation described in section "Average Gray Value" below. Standard deviation of gray values of pixels inside ellipse is calculated using equation described in section "Standard Deviation of Gray Values" below.

1.1.4 B Area (Trace)



Circumference (perimeter) of the polygon is calculated by summing the lengths of all its sides. The length of each side (distance between 2 corresponding points) is calculated using equation that is presented in section "B Distance".

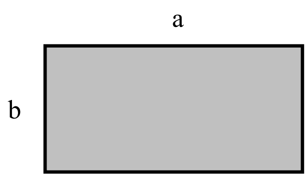
Area S of the polygon is calculated using the following equation:

$$S = \left| \frac{1}{2} \sum_{i=1}^{N} \left(x_i \cdot y_{i+1} - x_{i+1} \cdot y_i \right) \right|$$

here N (e.g., N=7) is the number of polygon's vertices and $x_{N+1} = x_1$, $y_{N+1} = y_1$.

Please note that polygon must be painted without intersecting lines (lines must not intersect each other).

1.1.5 B Area (Rectangle)



Circumference (perimeter) P of the rectangle is calculated by summing the lengths of all its sides:

P = 2*a + 2*b.

Area S of the rectangle is calculated using the following equation:

S = a*b,

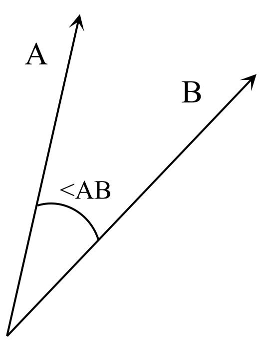
here a and b are the lengths of rectangle sides.

The length of each side (distance between 2 corresponding points) is calculated using equation that is presented in section "B Distance".

Average gray value of pixels inside rectangle is calculated using equation described in section “Average Gray Value” below. Standard deviation of gray values of pixels inside rectangle is calculated using equation described in section “Standard Deviation of Gray Values” below.

1.1.6 B Angle (2 lines)

Angle (<AB) between 2 vectors A and B is calculated using the following equations:



$$< AB = \operatorname{acos}\left(\frac{\overline{A} \cdot \overline{B}}{\left|\overline{A}\right| \cdot \left|\overline{B}\right|}\right),$$

$$\overline{A} \cdot \overline{B} = (v1x2 - v1x1) \cdot (v2x2 - v2x1) + (v1y2 - v1y1) \cdot (v2y2 - v2y1),$$

$$\left|\overline{A}\right| = \sqrt{(v1x2 - v1x1)^2 + (v1y2 - v1y1)^2},$$

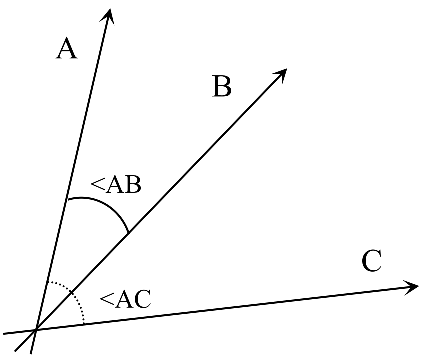
$$\left|\overline{B}\right| = \sqrt{(v2x2 - v2x1)^2 + (v2y2 - v2y1)^2},$$

here first (starting) point of A is (v1x1,v1y1), second point of A is (v1x2,v1y2);
first point of B is (v2x1,v2y1), second point of B is (v2x2,v2y2).

Please note that in presented image arrows denote directions of vectors (and second point of each line).

1.1.7 B Angle (3 lines)

Two angles (<AB and <AC) between 3 vectors A, B, C are calculated using the same equations that are presented in section "B Angle (2 lines)". Arrows denote second point of each line. Position/ordering of vectors must be adjusted depending on desired to measure objects.



1.1.8 Hip Angles

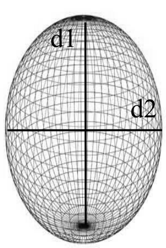
See section "B Angle (3 lines)" and also exam-specific measurements of human "Musculoskeletal" exam type.

1.1.9 B Volume (1 distance)

See "B Distance" section.

1.1.10 B Volume (2 distances)

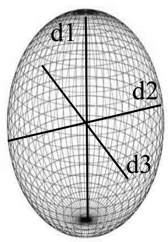
Using 2 measured distances d1 and d2 is calculated volume V of an ellipsoid using the following equation:



$$V = \frac{\pi \cdot d1 \cdot d2 \cdot d2}{6}.$$

1.1.11 B Volume (3 distances)

Using 3 measured distances d1, d2, d3 is calculated volume V of an ellipsoid using the following equation:

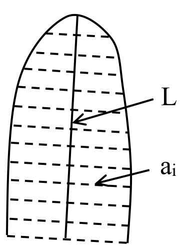


$$V = \frac{\pi \cdot d1 \cdot d2 \cdot d3}{6}.$$

1.1.12 B Volume (1 ellipse)

See "B Area (Ellipse)" section.

1.1.13 B Volume (1 trace)



Volume using single plane Simpson's method (method of disks) is calculated using the following equation:

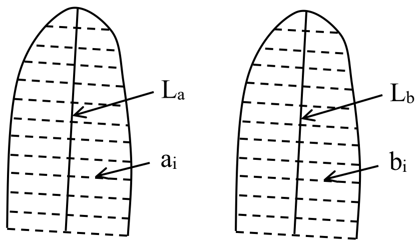
$$V = \frac{\pi}{4} \cdot \sum_{i=1}^{N} a_i^2 \frac{L}{N},$$

here
V - volume [ml],
L - long axis length [cm],
a_i - i-th disk's diameter [cm],
N - the number of disks (e.g., N=20).

Reference:

Schiller, N.B., et al., Recommendations for Quantification of the LV by Two-Dimensional Echocardiography. Journal of the American Society of Echocardiography, Sept-Oct 1989, Vol.2, No. 5, p. 364.

1.1.14 B Volume (2 traces)



Volume using biplane Simpson's method (method of disks) is calculated using the following equation:

$$V = \frac{\pi}{4} \cdot \sum_{i=1}^{N} a_i b_i \frac{L}{N},$$

here
V - volume [ml],
L - long axis length [cm],
$L=\max(L_a,L_b)$, L_a, L_b - long axis in each plane,
a_i - i-th disk's diameter in one plane [cm],
b_i - i-th disk's diameter in another (perpendicular) plane [cm],
N - the number of disks (e.g., N=20).

Reference:

Schiller, N.B., et al., Recommendations for Quantification of the LV by Two-Dimensional Echocardiography. Journal of the American Society of Echocardiography, Sept-Oct 1989, Vol.2, No. 5, p. 364.

1.1.15 B Stenosis %

Stenosis % using 2 distances (or 2 areas) is calculated using the following equation:

$$Steno = \frac{|d1 - d2|}{\max(d1, d2)} \cdot 100\%,$$

here d1 and d2 are two distances (or two areas).

1.1.16 B Distances, Areas, and Circumferences A/B Ratio

A/B ratio using 2 distances (or 2 areas or 2 circumferences) is calculated using the following equation:

$$RatioAB = d1/d2,$$

here d1 - first distance, and d2 - second distance. d1 and d2 can be distances, areas or circumferences (perimeters) depending on what ratio we wish to calculate.

1.1.17 Average Gray Value

Average gray value of selected image region is calculated using the following equation:

$$\bar{x} = \frac{1}{N} \cdot \sum_{i=1}^{N} x_i ,$$

here N is the number of pixels in region, and x_i is pixel gray value from the interval [0;255].

Reference:
https://en.wikipedia.org/wiki/Average

1.1.18 Standard Deviation of Gray Values

Standard deviation s of gray values of selected image region is calculated using the following equation:

$$s = \sqrt{\frac{1}{N-1} \cdot \sum_{i=1}^{N} \left(x_i - \bar{x}\right)^2} , \ \bar{x} = \frac{1}{N} \cdot \sum_{i=1}^{N} x_i ,$$

here N is the number of pixels in region, and x_i is pixel gray value from the interval [0;255].

Reference:
https://en.wikipedia.org/wiki/Standard_deviation

1.1.19 Histogram of Gray Values

Histogram H of gray values [0..255] of selected image region is calculated using the following equation:

$$\underset{j=0..255}{H[j]} = \sum_{i=1}^{N} \begin{cases} 1, \text{if } x_i = j \\ 0, \text{if } x_i \neq j \end{cases},$$

here H[j] is single histogram bin which value is equal to the number of pixels in region for that image pixel gray value x_i is equal to j. N is the number of pixels in region. Gray values j and pixel values x_i are from the interval [0;255].

When histogram is plotted, its height is adjusted by dividing each value by maximal histogram value (max(H[j]), where j=0..255) and multiplying by desired plot height (for example, 150 pixels).

1.2 Vascular puncture measurements and calculations

1.2.1 Occupied Vessel Diameter Percentage (OVD%)

Occupied Vessel Diameter Percentage (OVD%) is calculated using the following equation:

$$OVD\% = (CND / VD) \cdot 100\%,$$

here

OVD [%]	- Occupied Vessel Diameter Percentage,
CND [mm]	- catheter or needle diameter that is selected at software user interface,
VD [mm]	- vessel diameter that is selected at software user interface.

1.2.2 Occupied Vessel Area Percentage (OVA%)

Occupied Vessel Area Percentage (OVA%) is calculated assuming that areas are defined by two circles with known diameters and using the following equation:

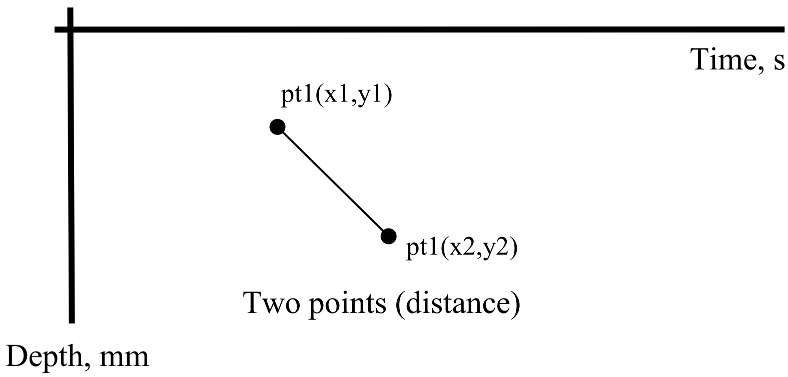
$$OVA\% = \frac{\pi \cdot CND^2 / 4}{\pi \cdot VD^2 / 4} \cdot 100\% = \left(CND / VD\right)^2 \cdot 100\%$$

here

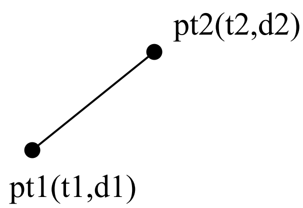
OVA [%]	- Occupied Vessel Area Percentage,
CND [mm]	- catheter or needle diameter that is selected at software user interface,
VD [mm]	- vessel diameter that is selected at software user interface.

1.3 M mode general measurements and calculations

Usually in M mode ultrasound image horizontal axis (x-axis) represents time (in seconds), and vertical axis (y-axis) represents depth (in millimeters). On M mode image are usually performed two-point -based measurements and calculations. For measurements and calculations we use (time [s], depth [mm]) coordinate system, where each point can be described by its time (in seconds [s]) and depth (in millimeters [mm]). For example, notation pt1(x1,y1)=(5,120) means that coordinates of point pt1 are x1=5s and y1=120mm.



1.3.1 Two-points M measurements



For two-point M measurements we use coordinates (time,depth) of two end-points pt1 and pt2 of one line (distance).

1.3.1.1 M Distance

Distance between points pt1 and pt2 is calculated using the following equation:

d = abs (d1 - d2),

here

d [mm] - distance,

d1 [mm] - depth at point pt1,

d2 [mm] - depth at point pt2,

abs(…) means that is calculated absolute value.

1.3.1.2 M Time

Time interval (difference) between points pt1 and pt2 is calculated using the following equation:
t = abs (t1 - t2),
here

t [s] - time interval (difference),
t1 [s] - time at point pt1,
t2 [s] - time at point pt2.

1.3.1.3 M Velocity

Velocity between points pt1 and pt2 is calculated using the following equation:
Vel = abs (d2 - d1) / abs (t2 - t1),
here

Vel [mm/s] - velocity,
t1 [s] - time at point pt1,
d1 [mm] - depth at point pt1,
t2 [s] - time at point pt2,
d2 [mm] - depth at point pt2.

1.3.1.4 M Heart Rate (HR)

Heart Rate (HR) using markers pt1 and pt2 is calculated according to the following equation:
HR = 60*beats_num / abs(t2-t1),
here

HR [beats/min] - Heart Rate in beats per minute,
abs(t2-t1) [s] - time interval between markers pt1 and pt2,
beats_num [beats] - the number of heart beats in measured time interval (usually 1 or 2).

1.3.2 Calculations using two two-point M measurements

For calculations are used two two-point (distance) measurements.

1.3.2.1 M Stenosis %

Stenosis % using 2 distances is calculated using the following equation:

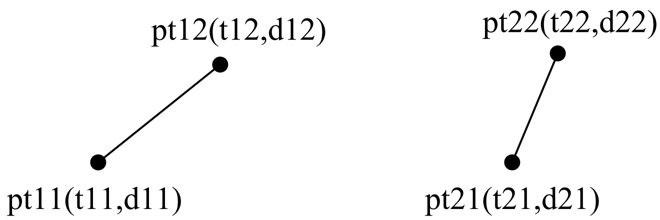
$$Steno = \frac{abs(d1 - d2)}{\max(d1, d2)} \cdot 100\%,$$

d1 = abs (d11 - d12),
d2 = abs (d21 - d22),

here

Steno [%]	- stenosis,
d1 [mm]	- distance between points pt11 and pt12,
d2 [mm]	- distance between points pt21 and pt22,
d11 [mm]	- depth at point pt11,
d12 [mm]	- depth at point pt12,
d21 [mm]	- depth at point pt21,
d22 [mm]	- depth at point pt22.

1.3.3 A/B Ratios of two-point M measurements



Ratios of two-point M measurements are calculated using two two-point (distance) measurements.

1.3.3.1 M Distances A/B Ratio

Distances ratio of two two-point measurements is calculated using the following equation:

RatioAB(d1,d2) = d1 / d2,
d1 = abs (d11 - d12),
d2 = abs (d21 - d22),

here

RatioAB(d1,d2) [unitless]	- ratio,
d1 [mm]	- distance between points pt11 and pt12,
d2 [mm]	- distance between points pt21 and pt22,
d11 [mm]	- depth at point pt11,
d12 [mm]	- depth at point pt12,
d21 [mm]	- depth at point pt21,
d22 [mm]	- depth at point pt22.

1.3.3.2 M Times A/B Ratio

Times (time intervals) ratio of two two-point measurements is calculated using the following equation:

RatioAB(t1,t2) = d1 / d2,
t1 = abs (t11 - t12),
t2 = abs (t21 - t22),

here

RatioAB(t1,t2) [unitless]	- ratio,
t1 [mm]	- time interval between points pt11 and pt12,
t2 [mm]	- time interval between points pt21 and pt22,
t11 [s]	- time at point pt11,
t12 [s]	- time at point pt12,
t21 [s]	- time at point pt21,
t22 [s]	- time at point pt22.

1.3.3.3 M Velocities A/B Ratio

Velocities ratio of two two-point measurements is calculated using the following equation:
RatioAB(Vel1,Vel2) = Vel1 / Vel2,
Vel1 = abs (d12 - d11) / abs (t12 - t11),
Vel2 = abs (d22 - d21) / abs (t22 - t21),

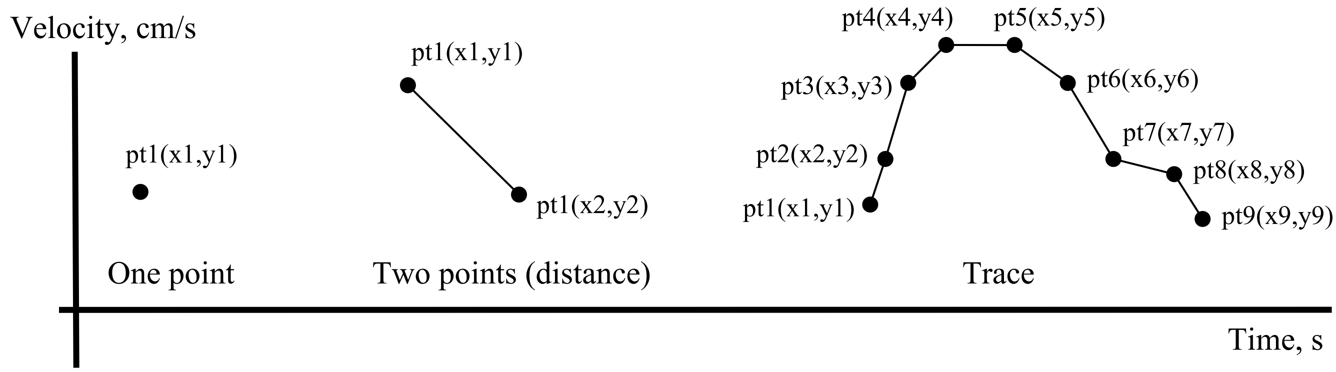
here

RatioAB(Vel1,Vel2) [unitless]	- ratio,
Vel1 [mm/s]	- velocity between points pt11 and pt12,
Vel2 [mm/s]	- velocity between points pt21 and pt22,
t11 [s]	- time at point pt11,
t12 [s]	- time at point pt12,
t21 [s]	- time at point pt21,
t22 [s]	- time at point pt22,
d11 [mm]	- depth at point pt11,
d12 [mm]	- depth at point pt12,
d21 [mm]	- depth at point pt21,
d22 [mm]	- depth at point pt22.

1.4 PW/CW mode general measurements and calculations

Pulsed Wave (PW) Doppler and Continuous Wave (CW) Doppler mode measurements and calculations are available only for scanners that support PW/CW Doppler scanning modes.

Usually in PW/CW Doppler mode ultrasound image horizontal axis (x-axis) represents time (in seconds), and vertical axis (y-axis) represents velocity (in centimeters per second). On PW/CW image we can perform one-point (one-marker), two-point, and trace-based measurements and calculations. For measurements and calculations we use (time [s], velocity [cm/s]) coordinate system, where each point can be described by its time (in seconds [s]) and velocity (in centimeters per second [cm/s]). For example, notation pt1(x1,y1)=(5,20) means that coordinates of point pt1 are x1=5s and y1=20cm/s.



1.4.1 One-point PW/CW measurements

1.4.1.1 PW/CW Velocity

pt(x,y)=(time [s], velocity [cm/s])=(t,V)

If y axis of PW/CW ultrasound image represents velocities, then velocity V at point pt is equal to this point’s y coordinate value. Velocities may have both positive and negative values.

1.4.1.2 PW/CW Pressure Gradient (PG)

pt(t,V)

Pressure Gradient (PG) at point pt is calculated using the following equation:

$PG = 4 \cdot V^2$,

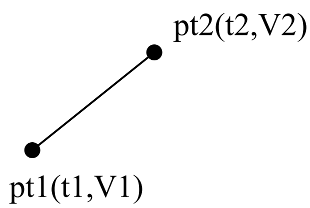
here

PG [mmHg] - Pressure Gradient,
V [m/s] - velocity,
1 m/s = 100 cm/s.

Reference:

Oh, J.K., J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 64.

1.4.2 Two-points PW/CW measurements



For two-point PW/CW measurements we use coordinates (time,velocity) of two end-points pt1 and pt2 of one line (distance).

1.4.2.1 PW/CW Velocities difference

Velocity difference between points pt1 and pt2 is calculated using the following equation:

$Vel\_diff = abs (V1 - V2)$,

here

Vel_diff [cm/s] - velocities difference,
V1 [cm/s] - velocity at point pt1,
V2 [cm/s] - velocity at point pt2,
abs(…) means that is calculated absolute value.

1.4.2.2 PW/CW Pressure Gradients (PG) difference

Pressure Gradients (PG) difference between points pt1 and pt2 is calculated using the following equation:

$PG\_diff = abs (PG1 - PG2)$,

here

PG_diff [mmHg] - Pressure Gradients (PG) difference,
PG1 [mmHg] - Pressure Gradient at point pt1,
PG2 [mmHg] - Pressure Gradient at point pt2.

For Pressure Gradient (PG) calculation please see "PW/CW Pressure Gradient" section.

1.4.2.3 PW/CW Time

Time difference (time interval) between points pt1 and pt2 is calculated using the following equation:

$t = abs (t2 - t1)$,

here

t [s] - time difference (time interval),
t1 [s] - time at point pt1,
t2 [s] - time at point pt2.

1.4.2.4 PW/CW Acceleration

Acceleration between points pt1 and pt2 is calculated using the following equation:
Acc = abs (V2 - V1) / abs (t2 - t1),
here

Acc [cm/s2]	- acceleration,
t1 [s]	- time at point pt1,
V1 [cm/s]	- velocity at point pt1,
t2 [s]	- time at point pt2,
V2 [cm/s]	- velocity at point pt2.

Reference:

Zwiebel, W.J. Introduction to Vascular Ultrasonography. 4th ed., W.B. Saunders Company, (2000), p. 52.

1.4.2.5 PW/CW Resistivity Index (RI)

Resistivity Index (RI) between points pt1 and pt2 is calculated using the following equation:
RI = abs (abs(V1) - abs(V2)) / max (abs(V1), abs(V2)),
here

RI [unitless]	- Resistivity Index,
V1 [cm/s]	- velocity at point pt1,
V2 [cm/s]	- velocity at point pt2,

max(…,…) means that we get maximal value from two passed values.

References:

Evans, D.H., N. McDicken. Doppler Ultrasound: Physics, Instrumentation and Signal Processing. Second Edition. John Wiley & Sons, (2000), p. 456.

Burns, Peter N. The Physical Principles of Doppler and Spectral Analysis. Journal of Clinical Ultrasound, November/December, 1987, vol. 15, no. 9, p.586.

Kurtz, A.B., W.D. Middleton. Ultrasound - the Requisites. Mosby Year Book, Inc., (1996), p. 467.

1.4.2.6 PW/CW Heart Rate (HR)

Heart Rate (HR) using markers pt1 and pt2 is calculated according to the following equation:
HR = 60*beats_num / abs(t2-t1),
here

HR [beats/min]	- Heart Rate in beats per minute,
abs(t2-t1) [s]	- time interval between markers pt1 and pt2,
beats_num [beats]	- the number of heart beats in measured time interval (usually 1 or 2).

1.4.2.7 PW/CW Velocity minimum and maximum

Velocity minimum and maximum of two points pt1 and pt2 is calculated using the following equations:

$$V_{\min} = \begin{cases} V_1, \text{abs}(\text{V}_1) < \text{abs}(\text{V}_2) \\ V_2, \text{otherwise} \end{cases},$$

$$V_{\max} = \begin{cases} V_1, \text{abs}(\text{V}_1) \geq \text{abs}(\text{V}_2) \\ V_2, \text{otherwise} \end{cases},$$

here

Vmin [cm/s]	- velocity minimum,
Vmax [cm/s]	- velocity maximum,
V1 [cm/s]	- velocity at point pt1,
V2 [cm/s]	- velocity at point pt2.

1.4.2.8 PW/CW Pressure Gradient (PG) minimum and maximum

Pressure Gradient minimum and maximum of two points pt1 and pt2 is calculated using the following equations:

$$PG_{\min} = 4 \cdot V_{\min}^2,$$

$$PG_{\max} = 4 \cdot V_{\max}^2,$$

here

PGmin [mmHg]	- Pressure Gradient minimum,
PGmax [mmHg]	- Pressure Gradient maximum,
Vmin [m/s]	- velocity minimum,
Vmax [m/s]	- velocity maximum,

1 m/s = 100 cm/s.

For more information see sections "PW/CW Pressure Gradient" and "PW/CW Velocity minimum and maximum".

1.4.3 Trace-based PW/CW measurements

For trace-based PW/CW measurements calculations we use poly-line of N points with coordinates $pt_i(t_i, V_i)$, where t_i - time [s], V_i - velocity [cm/s] at i-th point, and $i = 1...N$.

1.4.3.1 PW/CW Trace Time

Trace time interval is calculated using the following equation:

$$t = abs(\max_{i=1...N}[t_i] - \min_{i=1...N}[t_i]),$$

here

t [s] - time interval.

t_i [s] - time of i-th poly-line point.

1.4.3.2 PW/CW Trace Velocity min, max, mean

Velocity minimum, maximum, and mean values Vmin, Vmax, and Vmean are calculated using the following equations:

$$V_{\min} = V_j, \text{ where } j = \arg\min_{i=1...N}[abs(V_i)],$$

$$V_{\max} = V_j, \text{ where } j = \arg\max_{i=1...N}[abs(V_i)],$$

$$V_{mean} = \sum_{i=1}^{N-1}\left(\overline{V}_i \cdot \Delta t_i\right) \Big/ \sum_{i=1}^{N-1}\Delta t_i,$$

$$\overline{V}_i = \left(V_{i+1} + V_1\right)/2,$$

$$\Delta t_i = t_{i+1} - t_i,$$

here

Vmin [cm/s] - velocity minimum,

Vmax [cm/s] - velocity maximum,

Vmean [cm/s] - velocity mean,

t_i [s] - time of i-th poly-line (trace) point,

V_i [cm/s] - velocity of i-th poly-line point.

Notes.

Vmean calculation assumes that time intervals between different trace points may be different.

1.4.3.3 PW/CW Trace Pressure Gradient min, max, mean

Pressure Gradient (PG) minimum, maximum, and mean values PGmin, PGmax, and PGmean are calculated using the following equations:

$$PG_{\min} = 4 \cdot V_{\min}^2 ,$$

$$PG_{\max} = 4 \cdot V_{\max}^2 ,$$

$$PG_{mean} = 4 \cdot \sum_{i=1}^{N-1} \left(\overline{V}_i^2 \cdot \Delta t_i \right) \Big/ \sum_{i=1}^{N-1} \Delta t_i ,$$

$$\overline{V}_i = \left(V_{i+1} + V_1 \right) / 2 ,$$

$$\Delta t_i = t_{i+1} - t_i ,$$

here

PGmin [mmHg]	- Pressure Gradient minimum,
PGmax [mmHg]	- Pressure Gradient maximum,
PGmean [mmHg]	- mean Pressure Gradient,
Vmin [m/s]	- velocity minimum,
Vmax [m/s]	- velocity maximum,
V_i [m/s]	- velocity of i-th poly-line (trace) point,
t_i [s]	- time of i-th poly-line (trace) point.

1 m/s = 100 cm/s.

For more information see section "PW/CW Pressure Gradient".

Note. PGmean calculation assumes that time intervals between different trace points may be different.

Reference:

Yoganathan, Ajit P., et al. (1988). Review of Hydrodinamic Principles for the Cardiologist: Applications to the Study of Blood Flow and Jets by Imaging Techniques. Journal of American College of Cardiology, 1988, vol. 12, pp. 1344-1353.

Nanda, Navin C. (1993). Doppler Echocardiography. Second Edition. Lea and Febiger, Philadelphia, 1993, p. 29.

1.4.3.4 PW/CW Trace Velocity Time Integral (VTI)

Velocity Time Integral (VTI) is calculated using the following equation:

$$VTI = \sum_{i=1}^{N-1} VTI_i \,,$$

$$VTI_i = \overline{V}_i \cdot \Delta t_i \,,$$

$$\overline{V}_i = (V_{i+1} + V_1)/2 \,,$$

$$\Delta t_i = t_{i+1} - t_i \,,$$

here

VTI [cm]	- Velocity Time Integral (area below PW trace),
VTI_i [cm]	- VTI for time interval Δt_i,
V_i [cm/s]	- velocity of i-th poly-line (trace) point,
t_i [s]	- time of i-th poly-line (trace) point.

Notes.

VTI calculation assumes that time intervals between different trace points may be different.

If poly-line segment crosses y=0 axis, then this segment is divided into two segments and are calculated two areas (and then are summed their values).

Reference:

Reynolds, Terry. (2000). The Echocardiographer's Pocket Reference. 2nd ed. School of Cardiac Ultrasound, Arizona Heart Institute, 2000, p. 464.

1.4.3.5 PW/CW Trace Pulsatility Index (PI)

Pulsatility Index (PI) is calculated using the following equation:

$$PI = abs(V_{\max} - V_{\min}) / abs(V_{mean}) \,,$$

here

PI [unitless]	- Pulsatility Index,
Vmin [cm/s]	- minimum velocity,
Vmax [cm/s]	- maximum velocity,
Vmean [cm/s]	- mean velocity.

Note. For Vmin, Vmax, and Vmean calculation please see "PW/CW Velocity min, max, mean " section. Here Vmin, Vmax, and Vmean are signed values (can be positive and negative).
If for PW trace are automatically detected Peak Systole and End Diastole points, then instead of max and min velocities in above presented equations are used velocities PSV and EDV of detected points.

Reference:

Burns, Peter N. The Physical Principles of Doppler and Spectral Analysis. Journal of Clinical Ultrasound, November/December, 1987, vol. 15, no. 9, p.586.

1.4.3.6 PW/CW Resistivity Index (RI)

Resistivity Index (RI) between points pt1 and pt2 is calculated using the following equation:
RI = abs (abs(V1) - abs(V2)) / max (abs(V1), abs(V2)),
here

RI [unitless] - Resistivity Index,
V1 [cm/s] - velocity at point pt1,
V2 [cm/s] - velocity at point pt2,
max(…,…) means that we get maximal value from two passed values.

Resistivity Index for PW/CW trace is calculated only if are detected Peak Systole and End Diastole points that have velocities V1=PSV and V2=EDV.

References:

Evans, D.H., N. McDicken. Doppler Ultrasound: Physics, Instrumentation and Signal Processing. Second Edition. John Wiley & Sons, (2000), p. 456.

Burns, Peter N. The Physical Principles of Doppler and Spectral Analysis. Journal of Clinical Ultrasound, November/December, 1987, vol. 15, no. 9, p.586.

Kurtz, A.B., W.D. Middleton. Ultrasound - the Requisites. Mosby Year Book, Inc., (1996), p. 467.

1.4.4 A/B Ratios of one-point PW/CW measurements

●
pt1(t1,V1)

●
pt2(t2,V2)

Ratios of one-point PW/CW measurements are calculated using two PW/CW points.

1.4.4.1 PW/CW Velocities A/B Ratio

Velocities ratio of two points pt1 and pt2 is calculated using the following equation:
RatioAB(V1,V2) = abs(V1) / abs(V2),

here

RatioAB(V1,V2) [unitless]	- velocities ratio,
V1 [cm/s]	- velocity at point pt1,
V2 [cm/s]	- velocity at point pt2.

1.4.4.2 PW/CW Pressure Gradients (PG) A/B Ratio

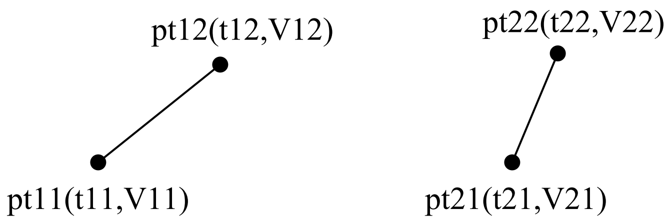
Pressure Gradients (PG) ratio at points pt1 and pt2 is calculated using the following equation:
RatioAB(PG1,PG2) = PG1 / PG2,

here

RatioAB(PG1,PG2) [unitless]	- Pressure Gradients ratio,
PG1 [mmHg]	- Pressure Gradient at point pt1,
PG2 [mmHg]	- Pressure Gradient at point pt2.

For Pressure Gradient (PG) calculation please see "PW/CW Pressure Gradient" section.

1.4.5 A/B Ratios of two-point PW/CW measurements



Ratios of two-point PW/CW measurements are calculated using two two-point (distance) measurements.

1.4.5.1 PW/CW Velocity differences A/B Ratio

Velocitiy differences ratio is calculated using the following equation:
RatioAB(Vel_diff1,Vel_diff2) = Vel_diff1 / Vel_diff2,
here
Vel_diff1 = abs(V11-V12),
Vel_diff2 = abs(V21-V22),

RatioAB(Vel_diff1,Vel_diff2) [unitless]	- velocity differences ratio,
Vel_diff1 [cm/s]	- velocity difference between points pt11 and pt12,
Vel_diff2 [cm/s]	- velocity difference between points pt21 and pt22.
V11 [cm/s]	- velocity at point pt11,
V12 [cm/s]	- velocity at point pt12,
V21 [cm/s]	- velocity at point pt21,
V22 [cm/s]	- velocity at point pt22.

1.4.5.2 PW/CW Pressure Gradient (PG) differences A/B Ratio

Pressure Gradient differences ratio is calculated using the following equation:
RatioAB(PG_diff1,PG_diff2) = PG_diff1 / PG_diff2,
here
PG_diff1 = abs(PG11-PG12),
PG_diff2 = abs(PG21-PG22),

RatioAB(PG_diff1,PG_diff2) [unitless]	- Pressure Gradient (PG) differences ratio,
PG_diff1 [mmHg]	- PG difference between points pt11 and pt12,
PG_diff2 [mmHg]	- PG difference between points pt21 and pt22.
PG11 [mmHg]	- PG at point pt11,
PG12 [mmHg]	- PG at point pt12,
PG21 [mmHg]	- PG at point pt21,
PG22 [mmHg]	- PG at point pt22.

For Pressure Gradient (PG) calculation please see "PW/CW Pressure Gradient" section.

1.4.5.3 PW/CW Time differences A/B Ratio

Time differences ratio is calculated using the following equation:
RatioAB(t_diff1,t_diff2) = t_diff1 / t_diff2,
here
t_diff1 = abs(t11-t12),
t_diff2 = abs(t21-t22),

RatioAB(t_diff1,t_diff2) [unitless]	- time differences ratio,
t_diff1 [s]	- time difference between points pt11 and pt12,
t_diff2 [s]	- time difference between points pt21 and pt22.
t11 [s]	- time at point pt11,
t12 [s]	- time at point pt12,
t21 [s]	- time at point pt21,
t22 [s]	- time at point pt22.

1.4.5.4 PW/CW Accelerations A/B Ratio

Accelerations ratio is calculated using the following equation:
RatioAB(Acc1,Acc2) = abs(Acc1) / abs(Acc2),
here

RatioAB(Acc1,Acc2) [unitless]	- accelerations ratio,
Acc1 [cm/s2]	- acceleration for points pt11 and pt12,
Acc2 [cm/s2]	- acceleration for points pt21 and pt22.

For acceleration calculation please see "PW/CW Acceleration" section.

1.4.5.5 PW/CW Resistivity Indexes A/B Ratio

Resistivity Indexes ratio is calculated using the following equation:
RatioAB(RI1,RI2) = abs(RI1) / abs(RI2),
here

RatioAB(RI1,RI2) [unitless]	- Resistivity Indexes (RI) ratio,
RI1 [unitless]	- Resistivity Index for points pt11 and pt12,
RI2 [unitless]	- Resistivity Index for points pt21 and pt22.

For Resistivity Index calculation please see "PW/CW Resistivity Index " section.

1.4.6 A/B Ratios of trace-based PW/CW measurements

Ratios of trace-based PW/CW measurements are calculated using two PW/CW traces.

1.4.6.1 PW/CW Velocity means A/B Ratio

Velocity means ratio is calculated using the following equation:
RatioAB(Vmean1,Vmean2) = abs(Vmean1) / abs(Vmean2),
here

RatioAB(Vmean1,Vmean2) [unitless]	- velocity means ratio,
Vmean1 [cm/s]	- velocity mean of first trace,
Vmean2 [cm/s]	- velocity mean of second trace.

For velocity mean calculation please see "PW/CW Trace Velocity min, max, mean" section.

1.4.6.2 PW/CW Pressure Gradient means A/B Ratio

Pressure Gradient (PG) means ratio is calculated using the following equation:
RatioAB(PGmean1,PGmean2) = PGmean1 / PGmean2,
here

RatioAB(PGmean1,PGmean2) [unitless]	- Pressure Gradient means ratio,
PGmean1 [mmHg]	- PG mean of first trace,
PGmean2 [mmHg]	- PG mean of second trace.

For PG mean calculation please see "PW/CW Trace Pressure Gradient min, max, mean" section.

1.4.6.3 PW/CW Pulsatility Indexes A/B Ratio

Pulsatility Indexes (PI) ratio is calculated using the following equation:
RatioAB(PI1,PI2) = PI1 / PI2,
here

RatioAB(PI1,PI2) [unitless]	- Pulsatility Indexes ratio,
PI1 [unitless]	- Pulsatility Index (PI) of first trace,
PI2 [unitless]	- Pulsatility Index (PI) of second trace.

For Pulsatility Index (PI) calculation please see "PW/CW Trace Pulsatility Index" section.

1.4.6.4 PW/CW Velocity Time Integrals A/B Ratio

Velocity Time Integrals (VTI) ratio is calculated using the following equation:
RatioAB(VTI1,VTI2) = abs(VTI1) / abs(VTI2),

here

RatioAB(VTI1,VTI2) [unitless]	- Velocity Time Integrals ratio,
VTI1 [cm]	- Velocity Time Integral (VTI) of first trace,
VTI2 [cm]	- Velocity Time Integral (VTI) of second trace.

For Velocity Time Integral (VTI) calculation please see "PW/CW Trace Velocity time Integral" section.

1.5 Conversion of measurement units

1 cm	= 10 mm
1 cm2	= 100 mm2
1 cm3	= 1000 mm3
1 cm3	= 1 ml
1 m/s	= 100 cm/s
1 cm/s	= 10 mm/s
1 kg	= 1000 g
1 min	= 60 s
1 week	= 7 days

2 Human Obstetrical/Gynecological (OB/GYN) exam measurements and calculations

2.1 Human OB B mode measurements

OB calculations are performed using the following entered values and measurements:

LMP	Last Menstrual Period
AC	Abdominal Circumference
BPD	Biparietal Diameter
FL	Femur Length
HC	Head Circumference
FTA	Fetal Trunk Abdominal area
AAP	Abdominal Anterior-Posterior diameter
ATD	Abdominal Transverse Diameter
TTD	Thorax Transverse Diameter
TAPD	Thorax Anterior-Posterior Diameter
CRL	Crown Rump Length
GS	Gestational Sac
HL	Humerus Length
TL	Tibia Length
UL	Ulna Length
OFD	Occipitofrontal Diameter
BOD	Binocular Distance
Cereb	Cerebellum
Clav	Clavicle
Rad	Radius

2.2 Human OB Doppler mode measurements

OB Doppler mode calculations are performed using the following measurements:

Umbilical Artery (UA):

RI	Resistivity Index (UA_RI)
PI	Pulsatility Index (UA_PI)
S	Systolic velocity
D	Diastolic velocity

Middle Cerebral Artery (MCA):

RI	Resistivity Index (MCA_RI)
PI	Pulsatility Index (MCA_PI)
PSV	Peak Systolic Velocity (MCA_PSV)

Ductus Arteriosus (DA):

Diam	Diameter (DA_DIAM, measured on B mode image)
PSV	Peak Systolic Velocity (DA_PSV)

Main Pulmonary Artery (MPA):

Diam	Diameter (MPA_DIAM, measured on B mode image)
PSV	Peak Systolic Velocity (MPA_PSV)

Uterine Artery (UtA):

RI	Resistivity Index (UTA_RI)
PI	Pulsatility Index (UTA_PI)

2.3 Human OB B mode calculations

After measuring of appropriate OB/GYN parameters, are calculated unitless ratios (FL/AC, FL/HC, FL/BPD, HC/AC) that are described in the following sections.

2.3.1 FL/AC

FL / AC, valid if 21 ≤ AUA ≤ 42 w

Hadlock F.P., R. L. Deter, R. B. Harrist, E. Roecker, and S.K. Park. “A Date Independent Predictor of Intrauterine Growth Retardation: Femur Length/Abdominal Circumference Ratio. American Journal of Roentgenology, November 1983; 141: 979-984.

Hadlock FP, et al. Use of Femur Length / Abdominal Circumference ratio in detecting the macrosomic fetus. Radiology, 1985; 154: 503-505.

2.3.2 FL/HC

FL / HC

Hadlock F.P., R. B. Harrist, Y. Shah, and S. K. Park. The Femur Length/Head Circumference Relation in Obstetric Sonography. Journal of Ultrasound in Medicine, October 1984; 3: 439-442.

2.3.3 FL/BPD

FL / BPD, valid if 23 ≤ AUA ≤ 40 w

The typical range for FL/BPD ratio is: 0.776 (23 weeks age) to 0.81 (40 weeks age).

Hohler, C.W., and T.A. Quetel. Comparison of Ultrasound Femur Length and Biparietal Diameter in Late Pregnancy. American Journal of Obstetrics and Gynecology, December 1981; 141 (7): 759-762.

2.3.4 HC/AC

HC / AC, valid if 13 ≤ AUA ≤ 42 w

S. Campbell, T. Alison. Ultrasound Measurements of the Fetal Head to Abdomen Circumference Ratio in the Assessment of Growth Retardation. British Journal of Obstetrics and Gynaecology, March 1977; 84: 165-174.

2.3.5 Cephalic Index (CI)

Input:

BPD	(Biparietal Diameter)	[cm]
OFD	(Occipitofrontal Diameter)	[cm]

Result:

CI	(Cephalic Index)	[unitless]

Equation:

$$CI = 100 * BPD / OFD, \quad \text{valid if } 14 \le AUA \le 40 \text{ w}$$

Cephalic Index: The ratio of the breadth of the head to its length. The index is obtained by dividing the maximum width of the cranium by its maximum length and multiplying by 100.

CI values for normal human are 75 - 80.

A cephalic index of 80 or more is called brachycephalic or broad.

A measurement between 75 and 80 is mesaticephalic.

Below 75 is considered dolicocephalic or long.

References:

Bezjian, Alex A., Normal and Abnormal Fetal Growth. Presented at the Advanced ultrasound Seminar, Lake Buena Vista, Florida, January 1982.

Dorland's Illustrated Medical Dictionary, ed. 27, W.B. Sanders Co., Philadelphia, Pennsylvania, 1988, p. 830.

Hadlock, F.P., et al., Estimating Fetal Age: Effect of Head Shape on BPD. Amer J Roentgen, 1981; 137: 83-85.

2.3.6 Amniotic Fluid Index (AFI)

Input:

Q1, Q2, Q3, Q4	(distances in four quadrants)	[cm]

Result:

AFI	(Amniotic Fluid Index)	[cm]

Equation:

$$AFI = Q1 + Q2 + Q3 + Q4.$$

The Amniotic Fluid Index is calculated as the sum of the (usually vertical) distances of the largest amniotic fluid pocket in each quadrant of the uterus. The normal range for AFI is 8.1 cm to 18.0 cm.

Reference:

Rutherford S, et al., "Four Quadrant Assessment of Amniotic Fluid Volume," J Reprod Med, 1987;32:587-589.

2.4 Human OB Doppler mode calculations

2.4.1 Umbilical Artery Resistivity Index (RI)

Input:

RI1, RI2	(Resistivity Index)	[unitless]

Result:

RI	(Resistivity Index UA_RI)	[unitless]

Equations:

RI = (RI1 + RI2)/2, if RI1<>0 and RI2<>0;
otherwise RI = RI1, if RI1<>0;
otherwise RI = RI2, if RI2<>0;
otherwise RI = 0.

2.4.2 Umbilical Artery Pulsatility Index (PI)

Input:

PI1, PI2	(Pulsatility Index)	[unitless]

Result:

PI	(Pulsatility Index UA PI)	[unitless]

Equations:

PI = (PI1 + PI2)/2, if PI1<>0 and PI2<>0;
otherwise PI = PI1, if PI1<>0;
otherwise PI = PI2, if PI2<>0;
otherwise PI = 0.

2.4.3 Umbilical Artery S/D ratio

Input:

S1, S2	(systolic velocity)	[cm/s]
D1, D2	(diastolic velocity)	[cm/s]

Result:

S/D	(S/D ratio UA_RATIO_S_D)	[unitless]

Equations:

Ratio1 = S1/D1;
Ratio2 = S2/D2;
S/D Ratio = (Ratio1 + Ratio2)/2, if Ratio1<>0 and Ratio2<>0;
otherwise Ratio = Ratio1, if Ratio1<>0;
otherwise Ratio = Ratio2, if Ratio2<>0;
otherwise Ratio = 0;

2.4.4 Cerebroplacental Ratio (CPR)

Input:

MCA PI	(Middle Cerebral Artery Pulsatility Index)	[unitless]
UA PI	(Umbilical Artery Pulsatility Index)	[unitless]

Result:

CPR	(Cerebroplacental Ratio)	[unitless]

Equations:

CPR = (MCA PI) / (UA PI).

Reference:

Ebbing,C.,Rasmussen,S.,Kiserud,T. Middle cerebral artery blood flow velocities and pulsatility index and the cerebroplacental pulsatility ratio: longitudinal reference ranges and terms for serial measurements. Ultrasound Obstet Gynecol, 2007. 30(3): p. 287-96.

2.4.5 Uterine Artery Resistivity Index (RI)

Input:

Lt RI, Rt RI (Left/Right artery Resistivity Index) [unitless]

Result:

RI (Resistivity Index UTA_RI) [unitless]

Equations:

RI = (Lt RI + Rt RI)/2, if Lt RI<>0 and Rt RI<>0;
otherwise RI = Lt RI, if Lt RI<>0;
otherwise RI = Rt RI, if Rt RI<>0;
otherwise RI = 0.

2.4.6 Uterine Artery Pulsatility Index (PI)

Input:

Lt PI, Rt PI (Left/Right artery Pulsatility Index) [unitless]

Result:

PI (Pulsatility Index UTA_PI) [unitless]

Equations:

PI = (Lt PI + Rt PI)/2, if Lt PI<>0 and Rt PI<>0;
otherwise PI = Lt PI, if Lt PI<>0;
otherwise PI = Rt PI, if Rt PI<>0;
otherwise PI = 0.

2.5 Human OB Estimated Fetal Weight (EFW) calculations

2.5.1 EFW(AC) Campbell75

Input:

AC (Abdominal Circumference) [cm]

Result:

EFW (Estimated Fetal Weight) [g]

Equation:

EFW(AC) = 1000*exp(-4.564 + 0.282*AC - 0.00331*AC*AC),

here exp(x) = e^x (constant e is raised to the power x), and constant e = 2.718281828.

Reference:

Campbell S., Wilkin D. Ultrasonic measurement of fetal abdomen circumference in the estimation of fetal weight. British Journal of Obstetrics and Gynecology, 1975; 82:689-697.

2.5.2 EFW(AC) Hadlock84

Input:

AC (Abdominal Circumference) [cm]

Result:

EFW (Estimated Fetal Weight) [g]

Equation:

EFW(AC) = exp(2.695 + 0.253*AC - 0.00275*AC*AC),

here exp(x) = e^x (constant e is raised to the power x), and constant e = 2.718281828.

Reference:

Hadlock F.P., Harrist R.B., Carpenter R.J., Deter R.L., Park S.K. Sonographic estimation of fetal weight: the value of femur length in addition to head and abdomen measurements. Radiology 1984; 150:535-540.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.3 EFW(AC) Jordaan83

Input:

AC	(Abdominal Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC) = pow(10, 0.6328 + 0.1881*AC - 0.0043*AC*AC + 0.000036239*AC*AC*AC),

here pow(x,y) = x^y (x is raised to the power y).

Reference:

Jordaan H.V. Estimation of fetal weight by ultrasound. J. Clin. Ultrasound 1983; 11:59-66.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.4 EFW(AC) Warsof77

Input:

AC	(Abdominal Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC) = 1000*pow(10, -1.8367 + 0.092*AC - 0.000019*AC*AC*AC),

here pow(x,y) = x^y (x is raised to the power y).

Reference:

Warsof S.L., Gohari P., Berkowitz R.L., Hobbins J.C. The estimation of fetal weight by computer-assisted analysis. Am. J. Obstet. Gynecol. 1977; 128:881-892.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.5 EFW(AC,BPD) Hadlock84

Input:

AC	(Abdominal Circumference)	[cm]	range 15.5 - 40.0 cm
BPD	(Biparietal Diameter)	[cm]	range 3.1 - 10.0 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = pow(10, 1.1134 + 0.05845*AC - 0.000604*AC*AC - 0.007365*BPD*BPD + 0.000595*BPD*AC + 0.1694*BPD),

here pow(x,y) = x^y (x is raised to the power y).

Reference:

Hadlock FP, et al. Sonographic estimation of fetal weight. Radiology 1984; 150: 535-540.

2.5.6 EFW(AC,BPD) Hsieh87

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = pow(10, 1.1134 + 0.05845*AC - 0.000604*AC*AC - 0.007365*BPD*BPD + 0.000595*BPD*AC + 0.1694*BPD).

Reference:

Hsieh F.J., Chang F.M., Huang H.C., Lu C.C., Ko T.M., Chen H.Y. Computer-assisted analysis for prediction of fetal weight by ultrasound-comparison of biparietal diameter (BPD), abdominal circumference (AC) and femur length (FL). Taiwan Yi Xue Hui Za Zhi 1987; 86:957-964.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.7 EFW(AC,BPD) Jordaan83

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = pow(10, -1.1683 + 0.0377*AC + 0.095*BPD - 0.0015*BPD*AC.

Reference:

Jordaan H.V. Estimation of fetal weight by ultrasound. J. Clin. Ultrasound 1983; 11:59-66.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.8 EFW(AC,BPD) Merz88

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = -3200.40479 + 157.07186*AC + 15.90391*BPD*BPD.

Reference:

E. Merz, H. Lieser, K.H. Schicketanz, J. Harle. Intrauterine fetal weight assessment using ultrasound. A comparison of several weight assessment methods and development of a new formula for the determination of fetal weight. Ultraschall Med. 1988; 9: 15–24.

2.5.9 EFW(AC,BPD) Shephard82

Input:

AC	(Abdominal Circumference)	[cm]	range 15.0 - 40.0 cm
BPD	(Biparietal Diameter)	[cm]	range 3.1 - 10.0 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = 1000*pow(10, -1.7492 + 0.166*BPD + 0.046*AC - 0.002646*AC*BPD).

Reference:

Shephard MJ, et al. An evaluation of two equations for predicting fetal weight by ultrasound. Amer. J. Ob. Gyn., January 1982; 142 (1): 47-54.

2.5.10 EFW(AC,BPD) Warsof77

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = 1000*pow(10, -1.599 + 0.144*BPD + 0.032*AC - 0.000111*BPD*BPD*AC).

Reference:

Warsof S.L., Gohari P., Berkowitz R.L., Hobbins J.C. The estimation of fetal weight by computer-assisted analysis. Am. J. Obstet. Gynecol. 1977; 128:881-892.

2.5.11 EFW(AC,BPD) Woo85

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD) = pow(10, 1.63 + 0.16*BPD + 0.00111*AC*AC - 0.0000859*BPD*AC*AC).

Reference:

Woo J.S., Wan C.W., Cho K.M. Computer-assisted evaluation of ultrasonic fetal weight prediction using multiple regression equations with and without the fetal femur length. J. Ultrasound Med. 1985; 4:65-67.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.12 EFW(FL) Warsof86

Input:

FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(FL) = exp(4.6914 + 0.151*FL*FL - 0.0119*FL*FL*FL),

here exp(x) = e^x (constant e is raised to the power x), and constant e = 2.718281828.

Reference:

Warsof S.L., Wolf P., Coulehan J., Queenan J.T. Comparison of fetal weight estimation formulas with and without head measurements. Obstet. Gynecol. 1986; 67:569-573.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.13 EFW(AC,FL) Warsof86

Input:

AC	(Abdominal Circumference)	[cm]
FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,FL) = exp(2.792 + 1.08*FL + 0.0036*AC*AC - 0.027*FL*AC),

here exp(x) = e^x (constant e is raised to the power x), and constant e = 2.718281828.

Reference:

Warsof S.L., Wolf P., Coulehan J., Queenan J.T. Comparison of fetal weight estimation formulas with and without head measurements. Obstet. Gynecol. 1986; 67:569-573.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.14 EFW(AC,FL) Woo85

Input:

AC	(Abdominal Circumference)	[cm]
FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,FL) = pow(10, 0.59 + 0.08*AC + 0.28*FL - 0.00716*AC*FL).

Reference:

Woo J.S., Wan C.W., Cho K.M. Computer-assisted evaluation of ultrasonic fetal weight prediction using multiple regression equations with and without the fetal femur length. J. Ultrasound Med. 1985; 4:65-67.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.15 EFW(AC,FL) Hadlock85

Input:

AC	(Abdominal Circumference)	[cm]	range 15.0 - 40.0 cm
FL	(Femur Length)	[cm]	range 1.0 - 8.0 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,FL) = pow(10, 1.304 + 0.05281*AC + 0.1938*FL - 0.004*AC*FL).

Reference:

Hadlock F.P., et al. Estimation of fetal weight with the use of head, body, and femur measurements - a prospective study. American Journal of Obstetrics and Gynecology, 1985; 151 (3): 333-337.

2.5.16 EFW(AC,HC) Hadlock84

Input:

AC	(Abdominal Circumference)	[cm]
HC	(Head Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,HC) = pow(10, 1.182 + 0.0273*HC + 0.07057*AC - 0.00063*AC*AC - 0.0002184*AC*HC).

Reference:

Hadlock FP, et al. Sonographic estimation of fetal weight. Radiology 1984; 150: 535-540.

2.5.17 EFW(AC,HC) Tohamy

Input:

AC	(Abdominal Circumference)	[cm]
HC	(Head Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,HC) = -95.2960 + (94.3548*HC)/AC + 0.0082*HC*AC + 100 + 1.92547 * pow(10, -7) * pow(HC*AC*100, 2).

Reference:

2.5.18 EFW(AC,FL,HC) Hadlock85

Input:

AC	(Abdominal Circumference)	[cm]	range 10.0 - 37.0 cm
FL	(Femur Length)	[cm]	range 1.0 - 8.0 cm
HC	(Head Circumference)	[cm]	range 10.0 - 40.0 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,FL,HC) = pow(10, 1.326 - 0.00326*AC*FL + 0.0107*HC + 0.0438*AC + 0.158*FL).

Reference:

Hadlock F.P., et al. Estimation of fetal weight with the use of head, body, and femur measurements - a prospective study. American Journal of Obstetrics and Gynecology, 1985; 151 (3): 333-337.

2.5.19 EFW(AC,FL,HC) Ott86

Input:

AC	(Abdominal Circumference)	[cm]
FL	(Femur Length)	[cm]
HC	(Head Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,FL,HC) = 1000*pow(10, -2.0661 + 0.04355*HC + 0.05394*AC - 0.0008582*HC*AC + (1.2594*FL/AC)).

Reference:

Ott W.J., Doyle S., Flamm S., Wittman J. Accurate ultrasonic estimation of fetal weight: prospective analysis of new ultrasonic formulas. Am. J. Perinatol. 1986; 3:307-310.

2.5.20 EFW(AC,BPD,FL) Hadlock85

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]
FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,FL) = pow(10, 1.335 - 0.0034*AC*FL + 0.0316*BPD + 0.0457*AC + 0.1623*FL).

Reference:

Hadlock F.P., et al. Estimation of fetal weight with the use of head, body, and femur measurements - a prospective study. American Journal of Obstetrics and Gynecology, 1985; 151 (3): 333-337.

2.5.21 EFW(AC,BPD,FL) Hsieh87

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]
FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,FL) = pow(10, 2.7193 + 0.0094962*AC*BPD - 0.1432*FL - 0.00076742*AC*BPD*BPD + 0.001745*FL*BPD*BPD).

Reference:

Hsieh F.J., Chang F.M., Huang H.C., Lu C.C., Ko T.M., Chen H.Y. Computer-assisted analysis for prediction of fetal weight by ultrasound-comparison of biparietal diameter (BPD), abdominal circumference (AC) and femur length (FL). Taiwan Yi Xue Hui Za Zhi 1987; 86:957-964.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.22 EFW(AC,BPD,FL) Woo85

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]
FL	(Femur Length)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,FL) = pow(10, 1.54 + 0.15*BPD + 0.00111*AC*AC - 0.0000764*BPD*AC*AC + 0.05*FL - 0.000992*FL*AC).

Reference:

Woo J.S., Wan C.W., Cho K.M. Computer-assisted evaluation of ultrasonic fetal weight prediction using multiple regression equations with and without the fetal femur length. J. Ultrasound Med. 1985; 4:65-67.

Lyndon Hill. 2006. Fetal Weight. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 47-50.

2.5.23 EFW(AC,BPD,HC) Jordaan83

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]
HC	(Head Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,HC) = pow(10, 2.3231 + 0.02904*AC + 0.0079*HC - 0.0058*BPD).

Reference:

Jordaan H.V. Estimation of fetal weight by ultrasound. J. Clin. Ultrasound 1983; 11:59-66.

2.5.24 EFW(AC,BPD,FL,HC) Hadlock84

Input:

AC	(Abdominal Circumference)	[cm]	range 15.0 - 40.0 cm
BPD	(Biparietal Diameter)	[cm]	range 3.1 - 10.0 cm
FL	(Femur Length)	[cm]	range 1.0 - 8.0 cm
HC	(Head Circumference)	[cm]	range 10.0 - 40.0 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,FL,HC) = pow(10, 1.5115 + 0.0436*AC + 0.1517*FL - 0.00321*AC*FL + 0.0006923*BPD*HC).

Reference:

Hadlock F.P., et al. Sonographic estimation of fetal weight. Radiology 1984; 150: 535-540.

2.5.25 EFW(AC,BPD,FL,HC) Hadlock85

Input:

AC	(Abdominal Circumference)	[cm]
BPD	(Biparietal Diameter)	[cm]

FL	(Femur Length)	[cm]
HC	(Head Circumference)	[cm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(AC,BPD,FL,HC) = pow(10, 1.3596 + 0.0064*HC + 0.0424*AC + 0.174*FL + 0.00061*BPD*AC - 0.00386*AC*FL).

Reference:

Hadlock F.P, Harrist R.B, Sharman R.S, Deter R.L, Park S.K. Estimation of fetal weight with the use of head, body, and femur measurements: a prospective study. Am. J. Obstet. Gynecol. 1985; 151:333-337.

2.5.26 EFW(BPD,FL,FTA) Osaka88

Input:

BPD	(Biparietal Diameter)	[cm]	range 3.1 - 10.0 cm
FL	(Femur Length)	[cm]	range 1.0 - 8.0 cm
FTA	(Fetal Trunk Abdominal area)	[cm2]	range 20.0 - 180.0 cm2

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(BPD,FL,FTA) = 1.25647*pow(PBD,3) + 3.50665*FTA*FL + 6.3.

Reference:

Nobuaki Mitsuda, Yoshiro Ohtsuki, Nagatoshi Sugita, Tetsu Takagi, and Osamu Tanizawa. Image Diagnosis of Fetal Growth. Obstetrical and Gynecological Practice, (in Japanese), 1988; 37 (10): 1459-1470.

2.5.27 EFW(BPD,ATD) Eik-Nes and Grottum82

Input:

BPD	(Biparietal Diameter)	[mm]
ATD	(Abdominal Transverse Diameter)	[mm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(BPD,ATD) = 1.43149 * pow(10, -3) * pow(BPD, 1.85628) * pow(ATD, 1.34008).

References:

Eik-Nes SH, Grottum P. Estimation of fetal weight by ultrasound measurement I. Development of a new formula. Acta Obstet er Gynecol Scand, 1982; 61: 299-305.

Eik-Nes SH, Grottum P, Andersson NJ. Estimation of fetal weight by ultrasound measurement II. Clinical application of a new formula. Acta Obstet er Gynecol Scand, 1982; 61: 307-312.

2.5.28 EFW(BPD,TTD) Hansmann86

Input:

BPD	(Biparietal Diameter)	[cm]	range 6.0 - 10.9 cm
TTD	(Thorax Transverse Diameter)	[cm]	range 4.9 - 12.1 cm

Result:

EFW	(Estimated Fetal Weight)	[g]	range 206 - 4888 g

Equation:

EFW(BPD,TTD) = 1000*(-1.05775*BPD + 0.649145*TTD + 0.0930707*BPD*BPD - 0.020562*TTD*TTD + 0.515263).

Reference:

Hansmann, Hackeloer, Staudach and Wittman. Estimated Fetal Weight estimated by Biaparietal Diameter and Transverse Thoracic Diameter. Ultrasound Diagnosis in Obstetrics and Gynecology, Springer-Verlag, New York, 1986.

2.5.29 EFW(BPD,TAPD,TTD) Tokyo87

Input:

BPD	(Biparietal Diameter)	[mm]
TAPD	(Thorax Anterior-Posterior diameter)	[mm]
TTD	(Thorax Transverse Diameter)	[mm]

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(BPD,TAPD,TTD) = 0.00173*pow(BPD,3) + 0.238*TAPD*TTD - 217.

Reference:

Norio Shinozuka, Takashi Okai, Shiro Kohzuma, Masaaki Mukubo, Chen-Ting Shih, Tsugio Maeda, Yoshinori Kuwabara, and Masahiko Mizuno. Formulas for Fetal Weight Estimation by Ultrasound Measurements Based on Neonatal Specific Gravities and Volumes. American Journal of Obstetrics and Gynecology, 1987; 157 (5): 1140-1145.

2.5.30 EFW(BPD,FL,TAPD,TTD) Tokyo87

Input:

BPD	(Biparietal Diameter)	[cm]	range 3.1 - 10 cm
FL	(Femur Length)	[cm]	range 1 - 8 cm
TAPD	(Thorax Anterior-Posterior diameter)	[cm]	range 5 - 15 cm
TTD	(Thorax Transverse Diameter)	[cm]	range 5 - 15 cm

Result:

EFW	(Estimated Fetal Weight)	[g]

Equation:

EFW(BPD,FL,TAPD,TTD) = 1.07*pow(BPD,3) + 3.42*TAPD*TTD*FL.

Reference:

Norio Shinozuka, Takashi Okai, Shiro Kohzuma, Masaaki Mukubo, Chen-Ting Shih, Tsugio Maeda, Yoshinori Kuwabara, and Masahiko Mizuno. Formulas for Fetal Weight Estimation by Ultrasound Measurements Based on Neonatal Specific Gravities and Volumes. American Journal of Obstetrics and Gynecology, 1987; 157 (5): 1140-1145.

2.6 Human OB Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. Software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB results View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

2.6.1 GA(AC) Hadlock82

GA(AC) Hadlock82
AC - Abdominal Circumference

Reference:

Hadlock FP, Deter RL, Harrist RB, Park SK. Fetal abdominal Circumference as a Predictor of Menstrual Age. American Journal of Roentgenology, 139:367-370, 1982.

AC(mm)	GA(w+d)	SD(d)
100	15+4	13
105	16+1	13
110	16+4	13
115	16+6	16
120	17+2	13
125	17+6	13
130	18+1	14
135	18+4	14
140	19+1	14
145	19+4	14
150	20+0	14
155	20+3	14
160	20+6	14
165	21+2	14
170	21+5	14
175	22+1	14
180	22+4	14
185	23+1	14
190	23+4	14
195	24+0	15
200	24+4	15
205	24+6	15
210	25+3	15
215	25+6	15
220	26+2	15
225	26+6	15
230	27+2	15
235	27+5	15
240	26+2	15

AC(mm)	GA(w+d)	SD(d)
245	28+5	15
250	29+1	15
255	29+5	15
260	30+1	18
265	30+4	21
270	31+1	21
275	31+4	21
280	32+1	21
285	32+4	21
290	33+1	21
295	33+4	21
300	34+1	21
305	34+4	21
310	35+1	21
315	35+4	21
320	36+1	18
325	36+4	18
330	37+1	18
335	37+4	18
340	38+1	18
345	38+5	18
350	39+1	18
355	39+5	18
360	40+1	18
365	40+6	18

2.6.2 GA(AC) Hadlock83

GA(AC) Hadlock83
AC - Abdominal Circumference

References:

Hadlock FP, Deter RL, Harrist RB, et al. Estimating fetal age: Computer-assisted analysis of multiple fetal growth parameters. Radiology 152 (2): 497-501, 1984.

Deter RL, Hadlock FP and Harrist RB. Evaluation of fetal growth and the detection of intrauterine growth retardation. In Callen PW (ed.), Ultrasonography in Obstetrics and Gynecology. W.B. Saunders co., Philadelphia, pp. 113-140, 1983.

AC(mm)	GA(w+d)	SD(d)
51	12+1	12
60	12+6	12
70	13+4	12
80	14+3	12
90	15+1	12
100	16+0	12
110	16+6	12
120	17+5	12
130	18+3	15
140	19+3	15
150	20+1	15
160	21+1	15
170	22+0	15
180	22+6	15
190	23+5	15
200	24+4	15
210	25+3	15
220	26+3	15
230	27+3	15
240	28+2	15
250	29+1	15
260	30+1	21
270	31+1	21
280	32+0	21
290	33+0	21
300	34+0	21
310	34+6	21
320	35+6	21
330	36+6	21
340	37+6	21
350	38+6	21
360	39+6	21
370	40+6	21

2.6.3 GA(AC) Hadlock90

GA(AC) Hadlock90
AC - Abdominal Circumference

Equation:	GA = 7.61 + 0.7645*AC + 0.00393* pow(AC,2).
Equation input:	AC (cm).
Equation output:	GA (weeks).

Reference:

Hadlock F., "Sonographic Estimation of Fetal Age and Weight". Radiologic Clinics of North America . Vol.28, No. 1, January 1990.

AC(mm)	GA(w+d)	SD(d)
80	13+6	9
85	14+1	9
90	14+4	9
95	15+0	9
100	15+4	9
105	16+1	9
110	16+4	9
115	16+6	9
120	17+2	9
125	17+6	9
130	18+1	9
135	18+4	9
140	19+1	9
145	19+4	9
150	20+0	9
155	20+3	9
160	20+6	9
165	21+2	9
170	21+5	9
175	22+1	9
180	22+4	9
185	23+1	9
190	23+4	9
195	24+0	9
200	24+4	9
205	24+6	9
210	25+4	9
215	25+6	9

AC(mm)	GA(w+d)	SD(d)
220	26+2	9
225	26+6	9
230	27+2	9
235	27+5	9
240	28+1	9
245	28+5	9
250	29+1	9
255	29+5	9
260	30+1	9
265	30+4	9
270	31+1	9
275	31+4	9
280	32+1	9
285	32+4	9
290	33+1	9
295	33+4	9
300	34+1	9
305	34+4	9
310	35+1	9
315	35+4	9
320	36+1	9
325	36+4	9
330	37+1	9
335	37+4	9
340	38+1	9
345	38+5	9
350	39+1	9
355	39+5	9

2.6.4 GA(AC) Hansmann79

GA(AC) Hansmann79
AC - Abdominal Circumference

Reference:
M. Hansmann, A. Geburtsh. Frauenheilk 39: 656, 1979.

AC(mm)	GA(w+d)
53	11+1
54	11+2
55	11+2
56	11+3
57	11+3
58	11+4
59	11+4
60	11+5
61	11+6
62	12+0
63	12+1
64	12+2
65	12+2
66	12+3
67	12+3
68	12+4
69	12+5
70	12+5
71	12+6
72	12+6
73	13+0
74	13+0
75	13+1
76	13+2
77	13+2
78	13+3
79	13+3
80	13+4
81	13+4
82	13+5
83	13+6
84	14+0
85	14+1
86	14+2
87	14+2
88	14+3
89	14+3
90	14+4
91	14+5
92	14+5

AC(mm)	GA(w+d)
93	14+6
94	14+6
95	15+0
96	15+0
97	15+1
98	15+2
99	15+2
100	15+3
101	15+4
102	15+5
103	15+5
104	15+6
105	16+0
106	16+0
107	16+1
108	16+2
109	16+3
110	16+3
111	16+4
112	16+5
113	16+6
114	16+6
115	17+0
116	17+1
117	17+2
118	17+2
119	17+3
120	17+3
121	17+4
122	17+4
123	17+5
124	17+6
125	18+0
126	18+1
127	18+2
128	18+3
129	18+3
130	18+4
131	18+5
132	18+6

AC(mm)	GA(w+d)
133	18+6
134	19+0
135	19+1
136	19+2
137	19+2
138	19+3
139	19+3
140	19+4
141	19+4
142	19+5
143	19+6
144	20+0
145	20+1
146	20+2
147	20+2
148	20+3
149	20+3
150	20+4
151	20+4
152	20+5
153	20+6
154	21+0
155	21+1
156	21+2
157	21+2
158	21+3
159	21+3
160	21+4
161	21+4
162	21+5
163	21+6
164	22+0
165	22+1
166	22+2
167	22+3
168	22+4
169	22+5
170	22+5

(Continuation on next page)

GA(AC) Hansmann79 (Continued)

AC(mm)	GA(w+d)
171	22+6
172	23+0
173	23+1
174	23+2
175	23+2
176	23+3
177	23+3
178	23+4
179	23+4
180	23+5
181	23+6
182	24+0
183	24+1
184	24+2
185	24+3
186	24+4
187	24+5
188	24+5
189	24+6
190	25+0
191	25+1
192	25+2
193	25+2
194	25+3
195	25+4
196	25+4
197	25+5
198	25+5
199	25+6
200	26+0
201	26+0
202	26+1
203	26+2
204	26+3
205	26+3
206	26+4
207	26+5
208	26+6
209	26+6
210	27+0
211	27+1
212	27+2
213	27+2
214	27+3
215	27+4
216	27+4
217	27+5
218	27+5
219	27+6
220	28+0

AC(mm)	GA(w+d)
221	28+0
222	28+1
223	28+2
224	28+3
225	28+4
226	28+5
227	28+5
228	28+6
229	29+0
230	29+1
231	29+2
232	29+2
233	29+3
234	29+3
235	29+4
236	29+4
237	29+5
238	29+6
239	30+0
240	30+1
241	30+2
242	30+3
243	30+3
244	30+4
245	30+5
246	30+6
247	30+6
248	31+0
249	31+1
250	31+2
251	31+3
252	31+3
253	31+4
254	31+5
255	31+6
256	31+6
257	32+0
258	32+1
259	32+2
260	32+2
261	32+3
262	32+3
263	32+4
264	32+4
265	32+5
266	32+6
267	33+0
268	33+1
269	33+2
270	33+3

AC(mm)	GA(w+d)
271	33+3
272	33+4
273	33+5
274	33+6
275	33+6
276	34+0
277	34+1
278	34+2
279	34+2
280	34+3
281	34+3
282	34+4
283	34+4
284	34+5
285	34+6
286	35+0
287	35+1
288	35+2
289	35+3
290	35+3
291	35+4
292	35+5
293	35+6
294	35+6
295	36+0
296	36+1
297	36+2
298	36+2
299	36+3
300	36+3
301	36+4
302	36+4
303	36+5
304	36+6
305	37+0
306	37+1
307	37+2
308	37+3
309	37+3
310	37+4
311	37+5
312	37+6
313	37+6
314	38+0
315	38+1
316	38+2
317	38+4
318	38+5
319	39+0
320	39+1

2.6.5 GA(AC) Hansmann86

GA(AC) Hansmann86
AC - Abdominal Circumference

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p.431.

AC(mm)	GA(w+d)
53	12+0
63	13+0
75	14+0
85	15+0
97	16+0
107	17+0
116	18+0
126	19+0
135	20+0
145	21+0
155	22+0
165	23+0
173	24+0
183	25+0
191	26+0
202	27+0
211	28+0
222	29+0
230	30+0
240	31+0
249	32+0
258	33+0
268	34+0
277	35+0
287	36+0
296	37+0
306	38+0
315	39+0
320	40+0

2.6.6 GA(AC) Jeanty82

GA(AC) Jeanty82
AC - Abdominal Circumference

Reference:
P. Jeanty. Radiology 143: 513, 1982.

AC(mm)	GA(w+d)	AC(mm)	GA(w+d)
50	11+2	185	24+1
55	11+5	190	24+4
60	12+1	195	25+1
65	12+5	200	25+4
70	13+1	205	26+0
75	13+4	210	26+4
80	14+1	215	27+0
85	14+4	220	27+3
90	15+0	225	28+0
95	15+4	230	28+3
100	16+0	235	29+0
105	16+3	240	29+3
110	17+0	245	30+0
115	17+3	250	30+4
120	17+6	255	31+1
125	18+3	260	31+5
130	18+6	265	32+2
135	19+2	270	32+6
140	19+6	275	33+3
145	20+2	280	34+1
150	20+6	285	34+6
155	21+2	290	35+4
160	21+5	295	36+2
165	22+2	300	37+0
170	22+5	305	37+6
175	23+1	310	38+6
180	23+5	315	39+6

2.6.7 GA(AC) Merz91

GA(AC) Merz91
AC - Abdominal Circumference

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 308-338, 1991.

AC(mm)	5%	GA(w+d) 50%	95%
56	10+6	12+1	13+2
58	11+1	12+2	13+4
60	11+2	12+4	13+5
62	11+4	12+5	13+6
64	11+5	12+6	14+1
66	11+6	13+1	14+2
68	12+0	13+2	14+4
70	12+1	13+4	14+5
72	12+3	13+4	14+6
74	12+4	13+6	15+1
76	12+6	14+0	15+2
78	12+6	14+1	15+4
80	13+1	14+3	15+5
82	13+2	14+4	15+6
84	13+4	14+6	16+1
86	13+5	15+0	16+2
88	13+6	15+1	16+4
90	14+0	15+3	16+5
92	14+1	15+4	16+6
94	14+3	15+5	17+1
96	14+4	15+6	17+2
98	14+6	16+1	17+4
100	14+6	16+2	17+5
102	15+1	16+4	17+6
104	15+2	16+5	18+1
106	15+4	16+6	18+2
108	15+5	17+1	18+3
110	15+6	17+2	18+4
112	16+0	17+3	18+6
114	16+1	17+4	19+0
116	16+3	17+6	19+1
118	16+4	18+0	19+3
120	16+6	18+1	19+4
122	17+0	18+3	19+6
124	17+1	18+4	20+0
126	17+2	18+6	20+1
128	17+4	19+0	20+3
130	17+5	19+1	20+4

AC(mm)	5%	GA(w+d) 50%	95%
132	17+6	19+2	20+6
134	18+0	19+4	21+0
136	18+1	19+5	21+1
138	18+3	19+6	21+3
140	18+4	20+1	21+4
142	18+6	20+2	21+6
144	19+0	20+4	22+0
146	19+1	20+5	22+1
148	19+2	20+6	22+3
150	19+4	21+1	22+4
152	19+5	21+1	22+6
154	19+6	21+3	23+0
156	21+1	21+4	23+1
158	20+1	21+6	23+3
160	23+3	22+0	23+4
162	20+4	22+1	23+6
164	20+6	22+3	24+0
166	21+0	22+4	24+1
168	21+1	22+6	24+3
170	21+2	23+0	24+4
172	21+4	23+1	24+6
174	21+5	23+2	25+0
176	21+6	23+4	25+1
178	22+1	23+5	25+3
180	22+1	23+6	25+4
182	22+3	24+1	25+6
184	22+4	24+2	26+0
186	22+6	24+4	26+1
188	23+0	24+5	26+3
190	23+1	24+6	26+4
192	23+2	25+0	26+6
194	23+4	25+1	27+0
196	23+5	25+3	27+1
198	23+6	25+4	27+3
200	24+1	25+6	27+4

(Continuation on next page)

GA(AC) Merz91 (Continued)

AC(mm)	5%	GA(w+d) 50%	95%
202	24+2	26+0	27+6
204	24+3	26+1	27+6
206	24+4	26+3	28+1
208	24+6	26+4	28+2
210	25+0	26+6	28+4
212	25+1	27+0	28+5
214	25+2	27+1	28+6
216	25+4	27+2	29+1
218	25+5	27+4	29+2
220	25+6	27+5	29+4
222	26+1	27+6	29+5
224	26+2	28+1	29+6
226	26+3	28+2	30+1
228	26+4	28+4	30+2
230	26+6	28+5	30+4
232	27+0	28+6	30+5
234	27+1	29+0	30+6
236	27+3	29+1	31+1
238	27+4	29+3	31+2
240	27+5	29+4	31+4
242	27+6	29+6	31+5
244	28+1	30+0	31+6
246	28+2	30+1	32+1
248	28+3	30+3	32+2
250	28+4	30+4	32+4
252	28+6	30+6	32+5
254	29+0	30+6	32+6
256	29+1	31+1	33+1
258	29+3	31+2	33+2
260	29+4	31+4	33+4
262	29+5	31+5	33+5
246	29+6	31+6	33+6
266	30+1	32+1	34+1
268	30+2	32+2	34+2
270	30+4	32+4	34+4
272	30+4	32+5	34+5
274	30+6	32+6	34+6
276	31+0	33+0	35+1
278	31+1	33+1	35+2
280	31+3	33+3	35+4
282	31+4	33+4	35+5
284	31+5	33+6	35+6
286	31+6	34+0	36+1
288	32+1	34+1	36+2
290	32+2	34+3	36+4
292	32+4	34+4	36+5
294	32+4	34+5	36+6
296	32+6	34+6	37+1
298	33+0	35+1	37+1
300	33+1	35+2	37+3
302	33+3	35+4	37+4
304	33+4	35+5	37+6
306	33+5	35+6	38+0
308	33+6	36+1	38+1
310	34+1	36+2	38+3
312	34+2	36+4	38+4
314	34+4	36+4	38+6
316	34+4	36+6	39+0
318	34+6	37+0	39+1
320	35+0	37+1	39+3
322	35+1	37+3	39+4
324	35+3	37+4	39+6
326	35+4	37+6	40+0
328	35+5	38+0	40+1
330	35+6	38+1	40+3
332	36+1	38+3	40+4
334	36+2	38+4	40+6
336	36+4	38+5	41+0
338	36+5	38+6	41+1
340	36+6	39+1	41+3
342	37+0	39+2	41+4
344	37+1	39+4	41+6
346	37+3	39+5	42+0
348	37+4	39+6	42+1

2.6.8 GA(AC) Tokyo96

GA(AC) Tokyo96
AC - Abdominal Circumference

Reference:
Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

AC(mm)	GA(w+d)	SD(d)
100	15+3	8
105	16+0	8
110	16+4	8
115	17+0	8
120	17+4	9
125	18+0	9
130	18+4	9
135	19+0	9
140	19+4	9
145	20+0	9
150	20+3	10
155	21+0	10
160	21+3	10
165	22+0	10
170	22+3	10
175	22+6	10
180	23+3	11
185	23+6	11
190	24+3	11
195	24+6	11
200	25+3	11
205	25+6	11
210	26+3	12
215	27+0	12
220	27+3	12
225	28+0	12
230	28+4	12
235	29+0	12
240	29+4	13
245	30+1	13
250	30+5	13
255	31+2	13
260	31+6	13
265	32+3	13
270	33+1	13
275	33+5	14
280	34+2	14
285	35+0	14
290	35+4	14
295	36+2	14
300	36+0	14
305	37+5	14
310	38+2	15
315	39+0	15
320	39+6	15
325	40+4	15
330	41+2	15

2.6.9 GA(BPD) Campbell71

GA(BPD) Campbell71
BPD - Biparietal Diameter

Reference:

S. Campbell, G.B. Newman. Growth of the fetal biparietal diameter during normal pregnancy. The Journal of Obstetrics and Gynecology of the British Commonwealth. 78:513, June 1971.

BPD(mm)	GA(w+d)	SD(d)
23	13+1	1
34	15+1	3
57	22+0	3
64	23+6	4
75	27+5	4
89	33+1	7
95	37+0	13
98	40+0	15

2.6.10 GA(BPD) Hadlock82

GA(BPD) Hadlock82
BPD - Biparietal Diameter

Reference:
Hadlock F.P., Deter R.L., Harrist R.B., Park S.K., Fetal Biparietal Diameter: A Critical Re-evaluation of the Relation to Menstrual Age by Means of Real-time Ultrasound. J. Ultrasound Med. 1:97, april 1982.

BPD(mm)	GA(w+d)	SD(d)
20	12+1	6
25	13+4	6
30	15+0	6
35	16+4	6
40	18+0	6
45	19+3	10
50	21+1	10
55	22+6	10
60	24+4	9
65	26+3	9
70	28+2	9
75	30+3	14
80	32+4	14
85	34+5	14
90	37+0	25
95	39+3	25
100	42+0	25

2.6.11 GA(BPD) Hadlock90

GA(BPD) Hadlock90
BPD - Biparietal Diameter

Equation: GA = 6.895 + 2.63*BPD + 0.0088*pow(BPD,3).
Equation input: BPD (cm).
Equation output: GA (weeks).

Reference:
Hadlock F., "Sonographic Estimation of Fetal Age and Weight". Radiologic Clinics of North America. Vol.28, No. 1, January 1990.

BPD(mm)	GA(w+d)	SD(d)
26	13+6	11
27	14+1	11
28	14+4	11
29	14+5	11
30	15+0	11
31	15+2	11
32	15+4	11
33	15+6	11
34	16+1	11
35	16+4	11
36	16+6	11
37	17+1	11
38	17+3	11
39	17+5	11
40	18+0	11
41	18+2	11
42	18+4	11
43	18+6	11
44	19+1	11
45	19+4	11
46	19+6	11
47	20+1	11
48	20+4	11
49	20+6	11
50	21+1	11
51	21+4	11
52	21+6	11
53	22+1	11
54	22+4	11
55	22+6	11
56	23+1	11
57	23+4	11
58	23+6	11
59	24+1	11
60	24+4	11
61	25+0	11

BPD(mm)	GA(w+d)	SD(d)
62	25+2	11
63	25+5	11
64	26+1	11
65	26+3	11
66	26+6	11
67	27+1	11
68	27+4	11
69	28+0	11
70	28+2	11
71	28+5	11
72	29+1	11
73	29+4	11
74	29+6	11
75	30+3	11
76	30+6	11
77	31+1	11
78	31+4	11
79	32+0	11
80	32+4	11
81	32+6	11
82	33+2	11
83	33+6	11
84	34+1	11
85	34+5	11
86	35+1	11
87	35+4	11
88	36+1	11
89	36+4	11
90	37+0	11
91	37+4	11
92	38+0	11
93	38+4	11
94	38+6	11
95	39+3	11
96	39+6	11
97	40+4	11

2.6.12 GA(BPD) Hadlock97

GA(BPD) Hadlock97
BPD - Biparietal Diameter

Reference:
Hadlock FP, Deter RL, Harrist RB, Park SK, Journal of Ultrasound in Medicine, 97-104, 1997.

BPD(mm)	GA(w+d)	SD(d)
14	11+6	9
16	12+2	9
18	12+6	9
20	13+1	9
22	13+4	9
24	14+1	9
26	14+4	9
28	15+0	9
30	15+4	9
32	16+0	9
34	16+4	9
36	17+0	9
38	17+4	9
40	18+1	14
42	18+5	14
44	19+2	14
46	19+6	14
48	20+4	14
50	21+1	14
52	21+6	14
54	22+3	14
56	23+1	14
58	23+6	14
60	24+4	16
62	25+1	16
64	25+6	16
66	26+4	16
68	27+3	16
70	28+1	16
72	28+6	16
74	29+5	16
76	30+4	22
78	31+2	22
80	32+1	22
82	33+0	22
84	33+6	22
86	34+5	22
88	35+4	22
90	36+4	24
92	37+3	24
94	38+2	24
96	39+1	24
98	40+1	24
100	41+1	24

2.6.13 GA(BPD) Hansmann85

GA(BPD) Hansmann85
BPD - Biparietal Diameter

Reference:

M.Hansmann, B.-J. Hackeloer, A. Staudach. Ultraschalldiagnostik in Geburtshilfe und Gynakologie. Lehrbuch und Atlas, Springer Verlag, 413-443, 1985.

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer-Verlag, New York, 1986. p.440.

BPD(mm)	5%	GA(w+d) 50%	95%
29	12+2	13+3	14+3
30	12+5	13+5	14+5
31	12+6	14+0	15+1
32	13+2	14+2	15+3
33	13+3	14+4	15+6
34	15+3	15+0	16+2
35	14+1	15+2	16+3
36	14+3	15+4	16+6
37	14+6	16+0	17+1
38	15+0	16+2	17+4
39	15+3	16+4	17+6
40	15+5	17+0	18+1
41	16+0	17+2	18+4
42	16+3	17+4	18+6
43	16+4	17+6	19+1
44	16+6	18+1	19+3
45	17+2	18+4	19+6
46	17+4	18+6	20+1
47	17+6	19+1	20+4
48	18+0	19+3	20+6
49	18+1	19+5	21+2
50	18+4	20+0	21+1
51	19+0	20+3	21+6
52	19+2	20+5	22+1
53	19+3	21+0	22+4
54	20+0	21+3	22+6
55	20+2	21+5	23+0
56	20+5	22+0	23+2
57	21+0	22+2	23+4
58	21+3	22+5	23+6
59	21+4	23+0	24+3
60	21+6	23+2	24+4
61	22+1	23+4	25+0
62	22+4	24+0	25+3
63	22+6	24+2	25+4
64	23+1	24+4	26+0
65	23+4	24+6	26+2
66	23+6	25+1	26+5
67	24+1	25+3	27+1
68	24+3	25+6	27+2

BPD(mm)	5%	GA(w+d) 50%	95%
69	24+6	26+1	27+4
70	25+0	26+3	27+6
71	25+2	26+5	28+3
72	25+4	27+1	28+4
73	26+0	27+3	29+2
74	26+1	27+6	29+4
75	26+3	28+1	29+6
76	26+5	28+4	30+2
77	27+1	28+6	30+5
78	27+2	29+2	31+3
79	27+3	29+5	32+0
80	27+6	30+0	32+1
81	28+2	30+3	32+4
82	28+6	31+0	33+1
83	29+0	31+2	33+5
84	29+3	31+6	34+2
85	29+6	32+2	34+4
86	30+1	32+5	35+1
87	30+2	33+2	36+1
88	31+0	32+5	36+3
89	31+4	34+2	37+0
90	32+0	34+5	37+3
91	32+1	35+1	38+5
92	33+2	35+6	39+2
93	33+5	36+5	39+5
94	34+5	37+3	40+1
95	35+2	38+3	41+0
96	35+2	38+6	41+3
97	35+6	39+0	42+0
98	36+3	39+2	42+0
99	36+4	39+3	42+4
100	36+5	39+4	42+2
101	37+1	39+5	42+4
102	37+1	39+6	42+2
103	37+2	40+0	42+2
104	37+3	40+1	42+2
105	37+6	40+2	42+2

2.6.14 GA(BPD) Jeanty82

GA(BPD) Jeanty82
BPD - Biparietal Diameter

Reference:

Jeanty. Radiology 143: 513, 1982.
Jeanty P., Romero R. "Obstetrical Ultrasound". McGraw-Hill Book Company, pages 57-61, 1984.

BPD(mm)	5%	GA(w+d)	95%
10	6+4	9+1	11+6
11	6+6	9+4	12+1
12	7+0	9+5	12+3
13	7+2	10+0	12+5
14	7+4	10+2	12+6
15	7+6	10+4	13+1
16	8+1	10+6	13+3
17	8+3	11+1	13+5
18	8+4	11+2	14+0
19	8+6	11+4	14+1
20	9+1	11+6	14+4
21	9+3	12+1	14+6
22	9+5	12+3	15+0
23	9+6	12+4	15+2
24	10+1	12+6	15+4
25	10+4	13+1	15+6
26	10+5	13+3	16+1
27	11+0	13+5	16+3
28	11+2	14+0	16+4
29	11+4	14+1	16+6
30	11+6	14+4	17+1
31	12+1	14+6	17+3
32	12+2	15+1	17+5
33	12+4	15+2	18+0
34	12+6	15+4	18+2
35	13+1	15+6	18+4
36	13+4	16+1	18+6
37	13+5	16+3	19+1
38	14+0	16+5	19+3
39	14+2	17+0	19+5
40	14+4	17+2	19+6
41	14+6	17+4	20+1
42	15+1	17+6	20+4
43	15+3	18+1	20+6
44	15+5	18+3	21+1
45	16+0	18+5	21+3
46	16+2	19+0	21+5
47	16+4	19+2	22+0
48	16+6	19+4	22+2
49	17+1	19+6	22+4
50	17+4	20+2	22+6
51	17+6	20+4	23+1
52	18+1	20+6	23+4
53	18+4	21+1	23+6

BPD(mm)	5%	GA(w+d)	95%
54	18+6	21+4	24+1
55	19+1	21+6	24+4
56	19+4	22+1	24+6
57	19+6	22+4	25+1
58	20+1	22+6	25+4
59	20+4	23+1	25+6
60	20+6	23+4	26+1
61	21+1	23+6	26+4
62	21+4	24+1	26+6
63	21+6	24+4	27+1
64	22+1	24+6	27+4
65	22+4	25+2	27+6
66	22+6	25+4	28+2
67	23+2	26+0	28+4
68	23+5	26+3	29+0
69	24+0	26+5	29+3
70	24+3	27+1	29+6
71	24+6	27+4	30+1
72	25+1	27+6	30+4
73	25+4	28+2	30+6
74	26+0	28+5	31+2
75	26+3	29+1	31+5
76	26+6	29+4	32+1
77	27+1	29+6	32+4
78	27+4	30+2	33+0
79	29+0	30+5	33+3
80	28+4	31+1	33+6
81	28+6	31+4	34+2
82	29+2	32+0	34+5
83	29+6	32+4	35+1
84	30+1	32+6	35+4
85	30+5	33+3	36+0
86	31+1	33+6	36+4
87	31+4	34+2	37+0
88	32+1	34+6	37+3
89	32+4	35+2	37+6
90	33+0	35+5	38+3
91	33+4	36+1	38+6
92	34+0	36+5	39+3
93	34+4	37+1	39+6
94	35+0	37+5	40+3
95	35+4	38+2	40+6

2.6.15 GA(BPD) Jeanty83

GA(BPD) Jeanty83
BPD - Biparietal Diameter

References:

Jeanty, Philippe. Obstetrical Ultrasound. McGraw Hill, p.58, 1983.

Benson, Carol B., Doubilet, Peter M. Sonographic Prediction of Gestational Age: Accuracy of Second and Third Trimester Fetal Measurements. ARJ, 157: 1275-1277, December 1991.

BPD(mm)	GA(w+d)	SD(d)
28	14+0	17
29	14+1	18
30	14+3	18
31	14+6	18
32	15+1	18
33	15+2	18
34	15+3	19
35	15+6	19
36	16+1	19
37	16+3	19
38	16+5	19
39	17+0	19
40	17+2	19
41	17+3	19
42	17+6	19
43	18+1	19
44	18+3	19
45	18+5	19
46	19+0	19
47	19+2	19
48	19+3	18
49	19+6	18
50	20+2	18
51	20+3	18
52	20+6	18
53	21+1	18
54	21+3	18
55	21+6	18

BPD(mm)	GA(w+d)	SD(d)
56	22+1	18
57	22+3	18
58	22+6	18
59	23+1	18
60	23+3	18
61	23+6	18
62	24+1	18
63	24+3	18
64	24+6	18
65	25+2	18
66	25+3	18
67	26+0	18
68	26+3	18
69	26+5	18
70	27+1	18
71	27+3	18
72	27+6	18
73	28+2	18
74	28+5	18
75	29+1	18
76	29+3	18
77	29+6	18
78	30+2	19
79	30+5	19

2.6.16 GA(BPD) Kurtz80

GA(BPD) Kurtz80
BPD - Biparietal Diameter

Reference:

Kurtz A.B., Wapner R.J., Kurtz R.J., Dershaw D., Rubin C.S., Cole-Beuglet C., Goldberg B.B, "Analysis of Biparietal Diameter as an Accurate Indicator of Gestational Age". J Clin Ultrasound 8:319-326; August 1980.

BPD(mm)	5%	GA(w+d)	95%
20	12+0	12+0	12+0
21	12+0	12+0	12+0
22	12+1	12+4	13+1
23	12+3	13+0	13+4
24	12+4	13+1	13+6
25	12+6	13+3	14+1
26	13+1	13+5	14+2
27	13+3	14+0	14+4
28	13+4	14+2	15+0
29	13+6	14+3	15+1
30	14+1	14+6	15+4
31	14+2	15+0	15+6
32	14+4	15+2	16+1
33	14+5	15+4	16+4
34	15+0	15+6	16+6
35	15+1	16+1	17+1
36	15+3	16+3	17+3
37	15+4	16+5	17+6
38	15+6	17+0	18+1
39	16+1	17+2	18+4
40	16+3	17+4	18+6
41	16+4	17+6	19+2
42	16+4	18+1	19+6
43	16+6	18+3	20+1
44	16+6	18+5	20+5
45	17+0	19+0	21+1
46	17+3	19+3	21+3
47	17+6	19+5	21+4
48	18+1	20+0	21+6
49	18+4	20+2	22+0
50	19+0	20+4	22+1
51	19+2	20+6	22+4
52	19+4	21+1	22+6
53	19+6	21+3	23+1
54	20+1	21+6	23+5
55	20+3	22+1	24+0
56	20+5	22+3	24+2
57	21+1	22+6	24+4
58	21+4	23+1	24+6
59	21+6	23+3	25+1
60	22+2	23+6	25+4
61	22+4	24+1	25+6
62	23+1	24+4	26+1
63	23+3	24+6	26+3
64	23+6	25+2	26+6
65	24+1	25+4	27+1
66	24+4	26+0	27+4
67	25+0	26+3	27+6
68	25+2	26+5	28+1
69	25+6	27+1	28+3
70	26+2	27+3	28+5
71	26+5	27+6	29+1
72	27+1	28+2	29+3
73	27+4	28+5	29+6
74	28+1	29+1	30+1
75	28+4	29+4	30+4
76	29+0	30+0	31+0
77	29+1	30+2	31+3
78	29+4	30+5	32+0
79	29+6	31+1	32+4
80	30+1	31+4	33+0
81	30+5	32+1	33+4
82	31+1	32+4	34+0
83	31+4	33+0	34+4
84	31+6	33+3	35+1
85	32+2	34+0	35+5
86	32+6	34+3	36+1
87	33+3	35+0	36+4
88	33+6	35+3	37+1
89	34+4	36+0	37+4
90	35+1	36+4	38+1
91	35+6	37+1	38+4
92	36+5	37+5	38+6
93	37+2	38+2	39+2
94	37+6	39+0	40+1
95	38+4	39+5	40+6
96	39+1	40+2	41+4
97	39+6	41+0	42+1
98	40+4	41+6	43+1

2.6.17 GA(BPD) Merz91

GA(BPD) Merz91
BPD - Biparietal Diameter

Reference:

E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 308-338, 1991.

BPD(mm)	5%	GA(w+d) 50%	95%
21	10+5	12+1	13+5
22	10+6	12+3	13+6
23	11+1	12+5	14+1
24	11+4	13+0	14+4
25	11+5	13+1	14+5
26	12+0	13+4	15+0
27	12+1	13+6	15+3
28	12+4	14+1	15+5
29	12+5	14+2	15+6
30	13+0	14+4	16+1
31	13+2	14+6	16+4
32	13+4	15+1	16+6
33	13+6	15+3	17+0
34	14+0	15+5	17+3
35	14+2	16+0	17+5
36	14+4	16+2	18+0
37	14+6	16+4	18+1
38	15+1	16+6	18+4
39	15+3	17+1	18+6
40	15+5	17+3	19+1
41	15+6	17+5	19+4
42	16+1	18+0	19+6
43	16+4	18+2	20+1
44	16+6	18+4	20+3
45	17+1	18+6	20+5
46	17+3	19+1	21+0
47	17+4	19+3	21+1
48	17+6	19+5	21+4
49	18+1	20+0	21+6
50	18+4	20+3	22+1
51	18+6	20+5	22+4
52	19+1	21+0	22+6
53	19+3	21+2	23+1
54	19+5	21+4	23+4
55	20+0	21+6	23+6
56	20+2	22+1	24+1
57	20+4	22+4	24+3
58	20+6	22+6	24+5
59	21+1	23+1	25+1
60	21+4	23+4	25+4
61	21+6	23+6	25+6
62	22+1	24+1	26+1
63	22+4	24+4	26+4
64	22+6	24+6	26+6
65	23+1	25+1	27+1
66	23+4	25+4	27+4
67	23+6	25+6	27+6
68	24+1	26+1	28+2
69	24+3	26+4	28+4
70	24+5	26+6	28+6
71	25+1	27+1	29+2
72	25+4	27+4	29+5
73	25+6	27+6	30+0
74	26+1	28+2	30+3
75	26+4	28+4	30+5
76	26+4	29+0	31+1
77	27+1	29+3	31+4
78	27+4	29+6	32+0
79	27+6	30+1	32+2
80	28+2	30+4	32+5
81	28+5	30+6	33+1
82	29+1	31+2	33+4
83	29+4	31+5	33+6
84	29+6	32+1	34+2
85	30+2	32+4	34+5
86	30+6	32+6	35+1
87	31+0	33+2	35+4
88	31+4	33+6	36+1
89	31+6	34+1	36+4
90	32+2	34+4	36+6
91	32+6	35+1	37+3
92	33+1	35+4	37+6
93	33+4	35+6	38+1
94	34+0	36+3	38+6
95	34+4	36+6	39+2
96	34+6	37+2	39+5
97	35+3	37+6	40+1
98	36+6	38+2	40+5
99	36+6	38+6	41+1
100	36+6	39+2	41+6
101	37+2	39+6	42+2
102	37+6	40+2	42+6

2.6.18 GA(BPD) Osaka88

GA(BPD) Osaka88
BPD - Biparietal Diameter

Reference:
Nobuaki Mitsuda, Yoshiro Ohtsuki, Nagatoshi Sugita, Tetsu Takagi, and Osamu Tanizawa. Image Diagnosis of Fetal Growth. Obstetrical and Gynecological Practice, (in Japaneese) 1988; 37(10): 1459-1470.

BPD(mm)	GA(w+d)
13.3	10+0
17.2	11+0
20.9	12+0
24.6	13+0
28.2	14+0
31.8	15+0
35.2	16+0
38.6	17+0
42	18+0
45.3	19+0
48.5	20+0
51.7	21+0
57.9	23+0
60.9	24+0
63.9	25+0
66.7	26+0
69.5	27+0
72.3	28+0
74.9	29+0
77.4	30+0
79.8	31+0
82.1	32+0
84.3	33+0
86.2	34+0
88	35+0
89.6	36+0
91	37+0
92.1	38+0
93	39+0
93.6	40+0

2.6.19 GA(BPD) Rempen91

GA(BPD) Rempen91
BPD - Biparietal Diameter

Reference:

A. Rempen, UFK Wurzburg. Biometrie in der Fruhgraviditat (I Trimenon). Der Frauenarzt, 32, 1991.

BPD(mm)	5%	GA(w+d) 50%	95%
3	5+6	6+6	8+0
4	6+0	7+1	8+2
5	6+2	7+3	8+4
6	6+4	7+5	8+6
7	6+6	8+0	9+1
8	7+1	8+2	9+3
9	7+3	8+4	9+5
10	7+5	8+6	10+0
11	8+0	9+1	10+2
12	8+2	9+3	10+4
13	8+4	9+5	10+6
14	8+6	10+0	11+1
15	9+1	10+2	11+3
16	9+3	10+4	11+5
17	9+4	10+6	12+1
18	10+0	11+1	12+2
19	10+2	11+3	12+4
20	10+4	11+5	12+6
21	10+6	12+0	13+1
22	11+1	12+2	13+3
23	11+3	12+4	13+5
24	11+5	12+6	14+0
25	12+0	13+1	14+2
26	12+2	13+3	14+4
27	12+4	13+5	14+6

2.6.20 GA(BPD) Sabbagha76

GA(BPD) Sabbagha76
BPD - Biparietal Diameter

Reference:

Sabbagha R.E., Barton B.A., Barton F.B., Kingas E., Orgill J., Turner J.H. "Sonar biparietal diameter II. Predictive of three fetal growth patterns leading to a closer assessment of gestational age and neonatal weight". American Journal of Obstetrics and Gynecology; October 15; 1976; pp.485-490.

BPD(mm)	5%	GA(w+d)	95%
35	15+0	16+0	17+3
36	15+0	16+2	18+0
37	16+0	16+5	19+0
38	16+0	17+0	19+0
39	16+0	17+2	19+3
40	16+0	17+5	19+3
41	16+0	18+0	19+3
42	16+0	18+2	20+0
43	16+4	18+5	20+0
44	17+0	19+0	20+3
45	17+0	19+2	21+0
46	17+4	19+5	21+0
47	18+0	20+0	21+3
48	18+0	20+2	21+3
49	18+4	20+5	22+0
50	19+0	21+0	22+0
51	19+0	21+2	22+3
52	19+4	21+5	23+0
53	20+0	21+5	23+0
54	20+0	22+0	24+0
55	20+4	22+2	24+0
56	21+0	22+5	24+0
57	21+0	23+0	24+3
58	21+0	23+2	25+0
59	21+4	23+5	25+0
60	21+4	24+0	25+3
61	22+0	24+2	26+0
62	22+0	24+5	26+0
63	22+4	25+0	26+3
64	23+0	25+2	27+0
65	23+4	25+5	27+3

BPD(mm)	5%	GA(w+d)	95%
66	23+4	26+0	28+0
67	24+0	26+2	28+0
68	24+0	26+5	28+3
69	24+4	27+0	29+0
70	24+4	27+2	29+3
71	25+0	27+5	30+0
72	25+0	27+5	31+0
73	25+4	28+0	31+0
74	26+0	28+2	32+0
75	26+0	28+5	32+0
76	26+4	29+0	33+0
77	27+0	29+5	33+0
78	27+0	30+0	33+0
79	27+4	30+2	33+3
80	28+0	30+5	34+0
81	28+0	31+0	34+3
82	28+4	31+2	35+0
83	29+0	32+0	36+0
84	29+0	32+2	36+0
85	29+0	33+0	36+3
86	29+0	33+2	36+3
87	29+4	34+0	37+0
88	30+0	34+2	37+0
89	31+0	35+2	38+0
90	31+4	35+5	38+3
91	32+0	36+2	39+0
92	33+0	36+2	39+0
93	33+4	36+5	39+3
94	34+0	37+0	40+0
95	34+4	37+2	40+0

2.6.21 GA(BPD) Tokyo89

GA(BPD) Tokyo89
BPD - Biparietal Diameter

Reference:

Masahiko Mizuno, Takashi Okai, and Norio Shinozuka. Assessment of Fetal Growth using Ultrasound Measurements. Nichidoku Iho (Japanisch-Deutsche Medizinische Berichte) (in Japanese), 1989; 34(3): 537-554.

BPD(mm)	GA(w+d)	SD(d)
20	12+0	7
24	13+0	7
27.6	14+0	7
31	15+0	7
33.8	16+0	7
37.2	17+0	8
40.5	18+0	8
43.9	19+0	9
47.1	20+0	9
50.4	21+0	10
53.5	22+0	10
56.7	23+0	11
59.7	24+0	11
62.7	25+0	12
65.6	26+0	12
68.4	27+0	13
71.2	28+0	13
73.8	29+0	14
76.4	30+0	15
78.8	31+0	16
81.2	32+0	16
83.4	33+0	18
85.5	34+0	20
87.4	35+0	25
89.2	36+0	25
90.8	37+0	25
92.3	38+0	25
93.6	39+0	25
94.7	40+0	25

2.6.22 GA(BPD) Tokyo96

GA(BPD) Tokyo96
BPD - Biparietal Diameter

Reference:
Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

BPD(mm)	GA(w+d)	SD(d)
13	10+1	4
14	10+3	4
15	10+5	4
16	11+0	4
17	11+2	4
18	11+4	4
19	11+6	4
20	12+1	4
21	12+3	4
22	12+6	4
23	13+1	5
24	13+3	5
25	13+5	5
26	14+0	5
27	14+2	5
28	14+4	5
29	14+6	5
30	15+1	5
31	15+3	5
32	15+5	5
33	16+0	5
34	16+2	5
35	16+4	5
36	16+6	6
37	17+1	6
38	17+4	6
39	17+6	6
40	18+1	6
41	18+3	6
42	18+5	6
43	19+0	6
44	19+2	6
45	19+4	6
46	20+0	7
47	20+2	7
48	20+4	7
49	20+6	7
50	21+1	7
51	21+3	7
52	21+6	7
53	22+1	8
54	22+3	8
55	22+5	8
56	23+1	8
57	23+3	8
58	23+5	8
59	24+1	8
60	24+3	9
61	24+5	9
62	25+1	9
63	25+3	9
64	25+5	9
65	26+1	9
66	26+3	10
67	26+6	10
68	27+2	10
69	27+4	10
70	28+0	10
71	28+3	10
72	28+5	11
73	29+1	11
74	29+4	11
75	30+0	11
76	30+3	11
77	30+6	12
78	31+2	12
79	31+5	12
80	32+1	12
81	32+5	12
82	33+1	13
83	33+5	13
84	34+2	13
85	34+6	13
86	35+3	14
87	36+0	14
88	36+5	14
89	37+4	14
90	38+3	15

2.6.23 GA(CRL) Daya93

GA(CRL) Daya93
CRL - Crown Rump Length

Reference:

Daya, S. "Accuracy of gestational age estimation by means of fetal crown-rump length measurement". Am J Obstet Gynecol; March 1993; pages 903-908.

CRL(mm)	2.5%	GA(w+d) 50%	97.5%
2	5+3	6+1	6+6
3	5+4	6+2	6+6
4	5+5	6+3	7+1
5	5+6	6+4	7+2
6	6+0	6+5	7+3
7	6+1	6+6	7+4
8	6+2	7+0	7+5
9	6+4	7+1	7+6
10	6+4	7+2	8+0
11	6+6	7+3	8+1
12	6+6	7+4	8+2
13	7+0	7+5	8+3
14	7+1	7+6	8+4
15	7+2	8+0	8+5
16	7+3	8+1	8+6
17	7+4	8+2	9+0
18	7+5	8+3	9+1
19	7+6	8+4	9+1
20	8+0	8+5	9+2
21	8+1	8+6	9+4
22	8+1	8+6	9+4
23	8+2	8+0	9+5
24	8+4	9+1	9+6
25	8+4	9+2	10+0
26	8+5	9+3	10+1
27	8+6	9+4	10+1
28	8+6	9+4	10+2
29	9+0	9+5	10+3
30	9+1	9+6	10+4
31	9+2	10+0	10+4
32	9+3	10+1	10+6
33	9+4	10+1	10+6
34	9+4	10+2	11+0
35	9+5	10+3	11+1
36	9+6	10+4	11+1
37	9+6	10+4	11+2
38	10+0	10+5	11+3
39	10+1	10+6	11+4
40	10+1	10+6	11+4
41	10+2	11+0	11+5

CRL(mm)	2.5%	GA(w+d) 50%	97.5%
42	10+3	11+1	11+6
43	10+4	11+1	11+6
44	10+4	11+1	11+6
45	10+4	11+2	12+0
46	10+5	11+3	12+1
47	10+6	11+4	12+1
48	10+6	11+4	12+2
49	11+0	11+5	12+3
50	11+0	11+5	12+3
51	11+1	11+6	12+4
52	11+1	11+6	12+4
53	11+1	12+0	12+5
54	11+2	12+0	12+5
55	11+3	12+1	12+6
56	11+4	12+1	12+6
57	11+4	12+1	12+6
58	11+4	12+2	13+0
59	11+4	12+3	13+1
60	11+5	12+3	13+1
61	11+6	12+4	13+1
62	11+6	12+4	13+2
63	11+6	12+4	13+2
64	11+6	12+5	13+3
65	12+0	12+5	13+3
66	12+0	12+6	13+4
67	12+1	12+6	13+4
68	12+1	12+6	13+4
69	12+1	12+6	13+4
70	12+1	13+0	13+5
71	12+2	13+0	13+5
72	12+2	13+1	13+6
73	12+2	13+1	13+6
74	12+3	13+1	13+6
75	12+3	13+1	13+6
76	12+3	13+1	13+6
77	12+4	13+1	14+0
78	12+4	13+2	14+0
79	12+4	13+2	14+0
80	12+4	13+2	14+0

2.6.24 GA(CRL) Hadlock92

GA(CRL) Hadlock92
CRL - Crown Rump Length

Equation:
GA = exp (1.684969 + 0.315646*CRL - 0.049306*pow(CRL,2) + 0.004057*pow(CRL,3) - 0.000120456*pow(CRL,4)).
Equation input: CRL (cm).
Equation output: GA (weeks).

Reference:

Hadlock F., Shah Y.P, Kanon D.J., Math B., Lindsey J.V., "Fetal Crown-Rump Length: Reevaluation of Relation to Menstrual Age (5-18 weeks) with High-Resolution Real-Time Ultrasound". Radiology, 182:501-502, 1992.

CRL(mm)	GA(w+d)	SD(d)
2	5+5	3
3	5+6	3
4	6+1	3
5	6+2	3
6	6+3	3
7	6+4	3
8	6+5	3
9	6+6	3
10	7+1	3
11	7+2	3
12	7+3	3
13	7+4	3
14	7+5	3
15	7+6	3
16	8+0	3
17	8+1	3
18	8+2	3
19	8+3	3
20	8+4	4
21	8+5	4
22	8+6	4
23	9+0	4
24	9+1	4
25	9+2	4
26	9+3	4
27	9+4	4
28	9+4	4
29	9+5	4
30	9+6	4
31	10+0	5
32	10+1	5
33	10+1	5
34	10+2	5
35	10+3	5
36	10+4	5
37	10+4	5
38	10+5	5
39	10+6	5

CRL(mm)	GA(w+d)	SD(d)
40	10+6	5
41	11+0	5
42	11+1	5
43	11+1	5
44	11+1	5
45	11+2	5
46	11+3	5
47	11+3	6
48	11+4	6
49	11+5	6
50	11+5	6
51	11+6	6
52	11+6	6
53	12+0	6
54	12+0	6
55	12+1	6
56	12+1	6
57	12+2	6
58	12+2	6
59	12+3	6
60	12+3	6
61	12+4	6
62	12+4	6
63	12+5	6
64	12+6	6
65	12+6	6
66	12+6	6
67	13+0	6
68	13+1	6
69	13+1	6
70	13+1	6
71	13+2	6
72	13+3	6
73	13+3	6
74	13+3	6
75	13+4	6

(Continuation on next page)

GA(CRL) Hadlock92 (Continued)

CRL(mm)	GA(w+d)	SD(d)
76	13+5	6
77	13+6	6
78	13+6	6
79	13+6	6
80	14+0	6
81	14+1	6
82	14+1	6
83	14+1	6
84	14+2	6
85	14+3	6
86	14+3	6
87	14+4	7
88	14+5	7
89	14+6	7
90	14+6	7
91	15+0	7
92	15+1	7
93	15+1	7
94	15+2	7
95	15+2	7
96	15+3	7
97	15+3	7
98	15+4	7
99	15+5	7
100	15+6	7
101	16+0	7
102	16+1	8
103	16+1	8
104	16+2	8
105	16+3	8
106	16+3	8
107	16+4	8
108	16+5	8
109	16+6	8
110	16+6	8
111	17+0	8
112	18+0	8
113	17+1	8
114	17+2	8
115	17+3	8
116	17+3	8
117	17+4	8
118	17+5	8
119	17+6	8
120	17+6	8
121	18+0	8

2.6.25 GA(CRL) Hansmann85

GA(CRL) Hansmann85
CRL - Crown Rump Length

Reference:
Hansmann, B.-J. Hackeloer, A. Staudach. Ultraschalldiagnostik in Geburtshilfe und Gynakologie. Lehrbuch und Atlas. Springer Verlag, 413-443, 1985.

CRL(mm)	5%	GA(w+d) 50%	95%	CRL(mm)	5%	GA(w+d) 50%	95%
6	6+1	7+1	8+0	52	12+0	13+2	14+4
7	6+3	7+2	8+2	54	12+0	13+3	14+5
8	6+4	7+4	8+3	56	12+1	13+4	14+6
9	6+6	7+6	8+6	58	12+1	13+5	15+0
10	7+1	8+0	9+0	60	12+3	13+6	15+1
11	7+2	8+2	9+1	63	12+4	14+0	15+3
12	7+3	8+3	9+3	66	12+5	14+2	15+5
13	7+5	8+4	9+4	70	13+0	14+3	16+0
14	7+6	8+6	9+6	73	13+1	14+5	16+1
15	8+0	9+0	10+0	76	13+2	14+6	16+3
16	8+2	9+2	10+1	80	13+4	15+1	16+5
17	8+3	9+3	10+2	83	13+5	15+2	17+0
18	8+4	9+4	10+4	86	13+6	15+4	17+2
19	8+5	9+5	10+5	90	14+1	15+6	17+4
20	8+6	9+6	10+6	93	14+3	16+1	17+6
21	9+0	10+0	11+0	96	14+4	16+3	18+1
22	9+1	10+1	11+1	100	14+6	16+5	18+3
23	9+2	10+2	11+2	103	15+1	17+0	18+6
24	9+3	10+3	11+3	106	15+3	17+2	19+1
26	9+5	10+5	11+5	110	15+5	17+4	19+4
28	9+6	11+0	12+1	113	16+0	18+0	20+0
30	10+1	11+2	12+2	116	16+2	18+2	20+2
32	10+2	11+3	12+4	120	16+4	18+4	20+4
34	10+4	11+5	12+5	123	17+0	19+0	21+0
36	10+5	11+6	13+0	126	17+2	19+2	21+3
38	10+6	12+1	13+2	130	17+5	19+6	21+6
40	11+1	12+2	13+3	133	18+0	20+1	22+2
42	11+2	12+3	13+4	136	18+3	20+4	22+6
44	11+3	12+4	13+6	140	18+6	21+0	23+2
46	11+5	12+6	14+0	143	19+1	21+3	23+5
48	11+6	13+0	14+2	146	19+4	21+6	24+1
50	11+6	13+1	14+3	150	20+0	22+3	24+5

2.6.26 GA(CRL) Jeanty83

GA(CRL) Jeanty83
CRL - Crown Rump Length

Reference:

Jeanty, Philippe. Obstetrical Ultrasound. McGraw Hill, 1983, p. 56.

CRL(mm)	GA(w+d)
5	6+2
6	6+4
7	6+5
8	6+6
9	7+1
10	7+2
11	7+3
12	7+4
13	7+6
14	7+6
15	8+1
16	8+1
17	8+3
18	8+4
19	8+4
20	8+6
21	8+6
22	9+0
23	9+1
24	9+1
25	9+3
26	9+4
27	9+4
28	9+5
29	9+6
30	9+6

CRL(mm)	GA(w+d)
31	10+0
32	10+1
33	10+1
34	10+2
35	10+3
36	10+5
37	10+5
38	10+5
39	10+6
40	10+6
41	11+0
42	11+1
43	11+1
44	11+1
45	11+2
46	11+3
47	11+4
48	11+4
49	11+5
50	11+6
51	11+6
52	11+6
53	12+0
54	12+1

2.6.27 GA(CRL) Nelson81

GA(CRL) Nelson81
CRL - Crown Rump Length

Equation:	GA = (51.008 + 6*CRL) / 7.
Equation input:	CRL (cm).
Equation output:	GA (weeks).

Reference:

Nelson L.H., "Comparison of Methods for Determining Crown-Rump Measurement by Real-Time Ultrasound". Journal of clinical ultrasound 9: 67-70; February 1981.

CRL(mm)	GA(w+d)
10	8+1
12	8+2
14	8+4
16	8+4
18	8+6
20	9+0
22	9+1
24	9+2
26	9+4
28	9+5
30	9+6
32	10+0
34	10+1
36	10+3
38	10+4
40	10+5
42	10+6
44	11+0
46	11+1
48	11+3
50	11+4
52	11+5
54	11+6
56	12+1
58	12+2
60	12+3
62	12+4
64	12+6
66	12+6
68	13+1
70	13+2
72	13+4
74	13+4
76	13+6
78	14+0
80	14+1

2.6.28 GA(CRL) Osaka89

GA(CRL) Osaka89
CRL - Crown Rump Length

Reference:
Osaka University Method 3 by Univ. Osaka, 1989.

CRL(mm)	GA(w+d)
9	7+1
10	7+3
11	7+4
12	7+6
13	8+0
14	8+1
15	8+2
16	8+3
17	8+4
18	8+5
19	8+6
20	9+0
21	9+0
22	9+1
23	9+2
24	9+3
25	9+3
26	9+4
27	9+5
28	9+6
29	9+6
30	10+0
31	10+1
32	10+1
33	10+2
34	10+3
35	10+3
36	10+4
37	10+4
38	10+5
39	10+6
40	10+6

CRL(mm)	GA(w+d)
41	11+0
42	11+0
43	11+1
44	11+2
45	11+2
46	11+3
47	11+3
48	11+4
49	11+4
50	11+6
51	11+6
52	11+6
53	12+0
54	12+1
55	12+1
56	12+2
57	12+2
58	12+3
59	12+3
60	12+4
61	12+5
62	12+5
63	12+6

2.6.29 GA(CRL) Rempen91

GA(CRL) Rempen91
CRL - Crown Rump Length

Reference:

A. Rempen, UFK Wurzburg. Biometrie in der Fruhgraviditat (I Trimenon). Der Frauenarzt, 32, 1991.

CRL(mm)	5%	GA(w+d) 50%	95%
2	5+1	6+0	6+6
3	5+2	6+1	7+0
4	5+3	6+2	7+1
5	5+4	6+3	7+2
6	5+5	6+4	7+3
7	5+6	6+5	7+4
8	6+0	6+6	7+5
9	6+1	7+0	7+6
10	6+2	7+1	8+0
11	6+3	7+2	8+1
12	6+4	7+3	8+2
13	6+5	7+4	8+3
14	6+6	7+5	8+4
15	7+0	7+6	8+5
16	7+0	7+6	8+5
17	7+1	8+0	8+6
18	7+2	8+1	9+0
19	7+3	8+2	9+1
20	7+4	8+3	9+2
21	7+5	8+4	9+3
22	7+6	8+5	9+4
23	7+6	8+5	9+4
24	8+0	8+6	9+5
25	8+1	9+0	9+6
26	8+2	9+1	10+0
27	8+3	9+2	10+1
28	8+4	9+3	10+2
29	8+4	9+3	10+2
30	8+5	9+4	10+3
31	8+6	9+5	10+4
32	9+0	9+6	10+5
33	9+0	9+6	10+5
34	9+1	10+0	10+6
35	9+2	10+1	11+0
36	9+3	10+2	11+1
37	9+3	10+2	11+1
38	9+4	10+3	11+2
39	9+5	10+4	11+3
40	9+6	10+5	11+4
41	9+6	10+5	11+4
42	10+0	10+6	11+5
43	10+1	11+0	11+6
44	10+1	11+0	11+6
45	10+2	11+1	12+0

CRL(mm)	5%	GA(w+d) 50%	95%
46	10+3	11+2	12+1
47	10+3	11+2	12+1
48	10+4	11+3	12+2
49	10+5	11+4	12+3
50	10+5	11+4	12+3
51	10+6	11+5	12+4
52	10+6	11+5	12+4
53	11+0	11+6	12+5
54	11+1	12+0	12+6
55	11+1	12+0	12+6
56	11+2	12+1	13+0
57	11+2	12+1	13+0
58	11+3	12+2	13+1
59	11+4	12+3	13+2
60	11+4	12+3	13+2
61	11+5	12+4	13+3
62	11+5	12+4	13+3
63	11+6	12+5	13+4
64	11+6	12+5	13+4
65	12+0	12+6	13+5
66	12+0	12+6	13+5
67	12+1	13+0	13+6
68	12+1	13+0	13+6
69	12+2	13+1	14+0
70	12+2	13+1	14+0
71	12+3	13+2	14+1
72	12+3	13+2	14+1
73	12+4	13+3	14+2
74	12+4	13+3	14+2
75	12+5	13+4	14+3
76	12+5	13+4	14+3
77	12+5	13+4	14+3
78	12+6	13+5	14+4

2.6.30 GA(CRL) Robinson75

GA(CRL) Robinson75
CRL - Crown Rump Length

Reference:
Robinson H.P., Flemming J.E. A critical evaluation of sonar Crown-Rump Length measurements. British Journal of Obstetrics and Gynecology, 82:702-710, September 1975.

CRL(mm)	GA(w+d)	SD(d)
5.5	6+2	5
6.1	6+3	7
6.8	6+4	7
7.5	6+5	7
8.1	6+6	7
8.9	7+0	7
9.6	7+1	7
10.4	7+2	7
11.2	7+3	7
12	7+4	7
12.9	7+5	7
13.8	7+6	7
14.7	8+0	7
15.7	8+1	7
16.6	8+2	7
17.6	8+3	7
18.7	8+4	7
19.7	8+5	7
20.8	8+6	7
21.9	9+0	7
23.1	9+1	7
24.2	9+2	7
25.4	9+3	7
26.7	9+4	7
27.9	9+5	7
29.2	9+6	7
30.5	10+0	7
31.8	10+1	7
33.2	10+2	7
34.6	10+3	7
36	10+4	7

CRL(mm)	GA(w+d)	SD(d)
37.4	10+5	7
38.9	10+6	7
40.4	11+0	7
41.9	11+1	7
43.5	11+2	7
45.1	11+3	7
46.7	11+4	7
48.3	11+5	7
50	11+6	7
51.7	12+0	7
53.4	12+1	7
55.2	12+2	7
57	12+3	7
58.8	12+4	7
60.6	12+5	7
62.5	12+6	7
64.3	13+0	7
66.3	13+1	7
68.2	13+2	8
70.2	13+3	8
72.2	13+4	8
74.2	13+5	14
76.3	13+6	14
78.3	14+0	14

2.6.31 GA(CRL) Tokyo86

GA(CRL) Tokyo86
CRL - Crown Rump Length

Reference:
Tokyo University Method 6 by Univ. of Tokyo, 1986.

CRL(mm)	GA(w+d)	SD(d)
13	7+6	8
14	8+0	9
15	8+1	10
16	8+2	8
17	8+3	9
18	8+4	10
19	8+5	8
20	8+6	9
21	9+0	7
22	9+1	7
23	9+2	7
24	9+3	7
25	9+4	7
26	9+5	7
27	9+5	7
28	9+6	7
29	10+0	7
30	10+1	7
31	10+2	7
32	10+3	7
33	10+4	7
34	10+4	7
35	10+5	7
36	10+6	7
37	11+0	7
38	11+1	7
39	11+1	7
40	11+2	7
41	11+3	7
42	11+4	7
43	11+4	7
44	11+5	7
45	11+6	7
46	12+0	7
47	12+0	7
48	12+1	7
49	12+2	7
50	12+3	7

2.6.32 GA(CRL) Tokyo89

GA(CRL) Tokyo89
CRL - Crown Rump Length

Reference:
Masahiko Mizuno, Takashi Okai, and Norio Shinozuka. Assessment of Fetal Growth using Ultrasound Measurements. Nichidoku Iho (Japanisch-Deutsche Medizinische Berichte) (in Japanese), 1989; 34(3): 537-544.

CRL(mm)	GA(w+d)	SD(d)
14	8+0	7
21	9+0	7
29	10+0	7
37	11+0	7
46	12+0	7
57	13+0	7
71	14+0	7
88	15+0	14

2.6.33 GA(CRL) Tokyo96

GA(CRL) Tokyo96
CRL - Crown Rump Length

Reference:
Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

CRL(mm)	GA(w+d)	SD(d)
5	6+3	3
10	7+3	4
15	8+1	5
20	8+6	6
25	9+4	6
30	10+2	7
35	10+6	8
40	11+3	8
45	11+6	9
50	12+2	10

2.6.34 GA(FL) Chitty97

GA(FL) Chitty97
FL - Femur Length

Reference:
Altmann D.G.; Chitty L.S. "New charts for ultrasound dating of pregnancy". Ultrasound in Obstetrics and Gynecology Vol. 10: 174-191, 1997.

FL(mm)	5%	GA(w+d) 50%	95%
10	12+1	13+0	13+6
11	12+3	13+2	14+1
12	12+5	13+4	14+4
13	13+0	13+6	14+6
14	13+1	14+1	15+1
15	13+3	14+3	15+3
16	13+5	14+5	15+6
17	14+0	15+0	16+1
18	14+2	15+2	16+3
19	14+4	15+5	16+6
20	14+6	16+0	17+1
21	15+1	16+2	17+3
22	15+3	16+4	17+6
23	15+5	16+6	18+1
24	16+0	17+2	18+4
25	16+2	17+4	18+6
26	16+4	17+6	19+2
27	16+6	18+2	19+5
28	17+1	18+4	20+0
29	17+4	18+6	20+3
30	17+6	19+2	20+5
31	18+1	19+4	21+1
32	18+3	20+0	21+4
33	18+5	20+2	22+0
34	19+1	20+5	22+2
35	19+3	21+0	22+5
36	19+5	21+3	23+1
37	20+1	21+5	23+4
38	20+3	22+1	24+0
39	20+5	22+4	24+3

FL(mm)	5%	GA(w+d) 50%	95%
40	21+1	22+6	24+6
41	21+3	23+2	25+2
42	21+6	23+5	25+5
43	22+1	24+1	26+1
44	22+4	24+3	26+4
45	22+6	24+6	27+1
46	23+2	25+2	27+4
47	23+4	25+5	28+0
48	24+0	26+1	28+3
49	24+3	26+4	29+0
50	24+5	27+0	29+3
51	25+1	27+3	30+0
52	25+4	27+6	30+3
53	26+0	28+2	31+0
54	26+2	28+5	31+3
55	26+5	29+2	32+0
56	27+1	29+5	32+3
57	27+4	30+1	33+0
58	28+0	30+4	33+4
59	28+3	31+1	34+1
60	28+6	31+4	34+4
61	29+2	32+1	35+1
62	29+5	32+4	35+5
63	30+1	33+1	36+2
64	30+4	33+4	36+6
65	31+0	34+1	37+3
66	31+3	34+4	38+0
67	32+0	35+1	38+5

2.6.35 GA(FL) Hadlock82

GA(FL) Hadlock82
FL - Femur Length

Reference:

Hadlock FP, Deter RL, Harrist RB, Park SK. Fetal Femur Length as a Predictor of Menstrual Age: Sonographically Measured. American Journal of Roentgenology, 138:875-878, May 1982.

FL(mm)	GA(w+d)	SD(d)
10	12+6	10
11	13+1	10
12	13+3	10
13	13+4	10
14	13+6	10
15	14+1	10
16	14+4	10
17	14+6	10
18	15+1	10
19	15+3	10
20	15+5	10
21	16+0	10
22	16+2	10
23	16+4	10
24	16+6	10
25	17+1	10
26	17+4	10
27	17+6	10
28	18+1	10
29	18+4	10
30	18+6	10
31	19+1	10
32	19+4	10
33	19+6	10
34	20+2	10
35	20+5	10
36	21+0	10
37	21+3	10
38	21+6	10
39	22+1	10
40	22+4	10
41	22+6	10
42	23+2	22
43	23+5	22
44	24+1	22
45	24+4	22
46	24+6	22
47	25+2	22
48	25+5	22
49	26+1	22
50	26+4	22

FL(mm)	GA(w+d)	SD(d)
51	27+0	22
52	27+3	22
53	27+6	22
54	28+1	22
55	28+5	22
56	29+1	22
57	29+4	22
58	30+0	22
59	30+4	22
60	30+6	22
61	31+3	22
62	31+6	22
63	32+2	22
64	32+6	22
65	33+2	22
66	33+6	22
67	34+1	22
68	34+5	22
69	35+1	22
70	35+5	22
71	36+1	22
72	36+5	22
73	37+1	22
74	37+5	22
75	38+2	22
76	38+6	22
77	39+2	22
78	39+6	22
79	40+3	22

2.6.36 GA(FL) Hadlock84

GA(FL) Hadlock84
FL - Femur Length

References:

Hadlock FP, Deter RL, Harrist RB, et al. Estimating fetal age: Computer-assisted analysis of multiple fetal growth parameters. Radiology 152 (2): 497-501, 1984.

FL(mm)	GA(w+d)	SD(d)
10	13+0	10
11	13+2	10
12	13+4	10
13	13+6	10
14	14+1	10
15	14+3	10
16	14+5	10
17	15+0	10
18	15+2	10
19	15+4	10
20	16+0	10
21	16+2	10
22	16+4	10
23	16+6	10
24	17+2	10
25	17+4	10
26	17+6	10
27	18+2	10
28	18+4	14
29	18+6	14
30	19+2	14
31	19+4	14
32	20+0	14
33	20+2	14
34	20+5	14
35	21+0	14
36	21+3	14
37	21+5	14
38	22+1	14
39	22+4	14
40	22+6	14
41	23+2	14
42	23+5	14
43	24+0	14
44	24+3	15
45	24+6	15
46	25+2	15
47	25+5	15
48	26+1	15
49	26+3	15
50	26+6	15

FL(mm)	GA(w+d)	SD(d)
51	27+2	15
52	27+5	15
53	28+1	15
54	28+4	15
55	29+0	15
56	29+3	15
57	29+6	15
58	30+2	21
59	30+5	21
60	31+2	21
61	31+5	21
62	32+1	21
63	32+4	21
64	33+0	21
65	33+4	21
66	34+0	21
67	34+3	21
68	35+0	21
69	35+3	21
70	35+6	21
71	36+3	21
72	36+6	22
73	37+3	22
74	37+6	22
75	38+3	22
76	38+6	22
77	39+3	22
78	39+6	22
79	40+3	22

2.6.37 GA(FL) Hadlock90

GA(FL) Hadlock90
FL - Femur Length

Equation: GA = 10.4 + 2.26*FL + 0.195*pow(FL,2).
Equation input: FL (cm).
Equation output: GA (weeks).

Reference:

Hadlock, F. "Sonographic Estimation of Fetal Age and Weight". Radiologic Clinics of North America. Vol.28, No. 1, January 1990.

FL(mm)	GA(w+d)	SD(d)
12	13+3	8
14	13+6	8
16	14+4	8
18	15+1	8
20	15+5	8
22	16+3	8
24	16+6	8
26	17+4	8
28	18+1	8
30	18+6	8
32	19+4	8
34	20+2	8
36	21+0	8
38	21+6	8
40	22+4	8
42	23+2	8
44	24+1	8
46	24+6	8
48	25+5	8
50	26+4	8
52	27+3	8
54	28+1	8
56	29+1	8
58	30+0	8
60	30+6	8
62	31+6	8
64	32+6	8
66	33+6	8
68	34+5	8
70	35+5	8
72	36+5	8
74	37+5	8
76	38+6	8
78	39+6	8
80	40+6	8
82	41+6	8

2.6.38 GA(FL) Hansmann85

GA(FL) Hansmann85
FL - Femur Length

Reference:
Hansmann, M. Ultrasound Diagnosis in Obstetrics and Gynecology. New York: Springer Verlag, 1985.

FL(mm)	GA(w+d)	2SD(d)
10	13+2	0
12	13+4	0
13	13+6	0
14	14+1	0
15	14+3	0
16	14+5	35
17	15+1	35
18	15+2	28
19	15+5	28
20	16+0	28
21	16+2	28
22	16+4	28
23	16+6	28
24	17+2	28
25	17+4	28
26	17+6	28
27	18+2	28
28	18+4	28
29	18+6	28
30	19+2	28
31	19+4	28
32	20+0	28
33	20+3	28
34	20+5	28
35	21+1	35
36	21+3	35
37	21+6	35
38	22+1	35
39	22+4	35
40	22+6	35
41	23+2	35
42	23+5	35
43	24+0	35
44	24+3	35
45	24+6	35

FL(mm)	GA(w+d)	2SD(d)
46	25+2	35
47	25+4	35
48	26+0	35
49	26+3	35
50	26+6	35
51	27+3	35
52	27+5	35
53	28+1	35
54	28+4	35
55	29+0	35
56	29+3	42
57	29+6	42
58	30+2	42
59	30+5	35
60	31+2	35
61	31+5	35
62	32+1	35
63	32+5	35
64	33+1	42
65	33+5	42
66	34+1	42
67	34+5	42
68	35+1	42
69	35+5	42
70	36+1	42
71	36+5	42
72	37+2	42
73	37+6	42
74	38+3	49
75	39+0	49

2.6.39 GA(FL) Hohler82

GA(FL) Hohler82
FL - Femur Length

Equation: GA = 9.18 + 0.267*FL + 0.0016*pow(FL,2).
Equation input: FL (mm).
Equation output: GA (weeks).

Reference:

Hohler C.W., Quetel T.A. "Fetal Femur Length: Equations for Computer Calculation of Gestational Age from Ultrasound Measurements". American Journal of Obstetrics and Gynecology, Vol. 143, No. 4: 479-481, June 15, 1982.

FL(mm)	GA(w+d)	2SD(d)
10	12+0	7
11	12+2	7
12	12+4	7
13	12+6	7
14	13+1	7
15	13+4	7
16	13+6	7
17	14+1	7
18	14+4	7
19	14+6	7
20	15+1	7
21	15+4	7
22	15+6	7
23	16+1	7
24	16+4	7
25	16+6	7
26	17+1	7
27	17+4	7
28	17+6	7
29	18+2	7
30	18+4	7
31	19+0	7
32	19+3	7
33	19+5	7
34	20+1	7
35	20+4	7
36	20+6	7
37	21+2	7
38	21+5	7
39	22+0	7
40	22+3	7
41	22+6	7
42	23+1	20
43	23+4	20
44	24+0	20
45	24+4	20

FL(mm)	GA(w+d)	2SD(d)
46	24+6	20
47	25+2	20
48	25+5	20
49	26+1	20
50	26+4	20
51	27+0	20
52	27+3	20
53	27+6	20
54	28+2	20
55	28+5	20
56	29+1	20
57	29+4	20
58	30+0	20
59	30+4	20
60	31+0	20
61	31+4	20
62	31+6	20
63	32+3	20
64	32+6	20
65	33+2	20
66	33+6	20
67	34+2	20
68	34+6	20
69	35+2	20
70	35+6	20
71	36+2	20
72	36+6	20
73	37+2	20
74	37+6	20
75	38+2	20
76	38+6	20
77	39+2	20
78	39+6	20
79	40+2	20
80	40+6	20

2.6.40 GA(FL) Jeanty84

GA(FL) Jeanty84
FL - Femur Length

Equation:	GA = 9.54 + 2.977*FL + 0.10389*pow(FL,2).
Equation input:	FL (cm).
Equation output:	GA (weeks).

Reference:

Jeanty, Philippe et al. Estimation of Gestational Age from Measurements of Fetal Long Bones. J. Ultrasound Med. February 1984; 3:75-79.

FL(mm)	5%	GA(w+d) 50%	95%
10	10+3	12+4	14+6
11	10+5	12+6	15+1
12	11+1	13+2	15+3
13	11+3	13+3	15+6
14	11+5	13+6	16+1
15	12+0	14+1	16+3
16	12+3	14+4	16+6
17	12+5	14+6	17+1
18	13+0	15+1	17+3
19	13+3	15+3	17+6
20	13+5	15+6	18+1
21	14+1	16+2	18+4
22	14+3	16+4	18+6
23	14+5	16+6	19+1
24	15+1	17+2	19+3
25	15+3	17+3	19+6
26	15+6	18+0	20+1
27	16+1	18+2	20+4
28	16+4	18+5	20+6
29	16+6	19+0	21+1
30	17+1	19+3	21+3
31	17+3	19+6	22+0
32	17+4	20+1	22+2
33	18+2	20+4	22+5
34	18+5	20+6	23+1
35	19+0	21+1	23+1
36	19+3	21+3	23+6
37	19+6	22+0	24+1
38	20+1	22+3	24+4
39	20+4	22+5	24+6
40	20+6	23+1	25+2
41	21+2	23+3	25+5
42	21+5	23+6	26+1
43	22+1	24+2	26+4
44	22+4	24+5	26+6
45	22+6	25+0	27+1

FL(mm)	5%	GA(w+d) 50%	95%
46	23+1	25+3	27+3
47	23+3	25+6	28+0
48	24+0	26+1	28+3
49	24+3	26+4	28+6
50	24+6	27+0	29+1
51	25+1	27+3	29+3
52	25+3	27+6	30+0
53	26+0	28+1	30+3
54	26+3	28+4	30+6
55	26+6	29+1	31+2
56	27+2	29+3	31+5
57	27+5	29+6	32+1
58	28+1	30+2	32+4
59	28+4	30+5	32+6
60	28+6	31+1	33+2
61	29+3	31+3	33+6
62	29+6	32+0	34+1
63	30+1	32+3	34+4
64	30+5	32+6	35+1
65	31+1	33+2	35+3
66	31+3	33+5	35+6
67	32+0	34+1	36+3
68	32+3	34+4	36+6
69	32+6	35+0	37+1
70	33+2	35+3	37+5
71	33+5	35+6	38+1
72	34+1	36+3	38+4
73	34+4	36+6	39+0
74	35+1	37+2	39+3
75	35+3	37+5	39+6
76	36+0	38+1	40+3
77	36+3	38+4	40+6
78	36+6	39+1	41+2
79	37+2	39+3	41+2
80	37+6	40+0	42+1

2.6.41 GA(FL) Merz91

GA(FL) Merz91
FL - Femur Length

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 308-338, 1991.

FL(mm)	5%	GA(w+d) 50%	95%
10	11+1	12+2	13+4
11	11+4	12+5	13+6
12	11+6	13+0	14+1
13	12+1	13+2	14+4
14	12+3	13+5	15+0
15	12+5	14+0	15+2
16	13+1	14+3	15+5
17	13+3	14+5	16+0
18	13+6	15+1	16+3
19	14+1	15+3	16+5
20	14+4	15+6	17+1
21	14+6	16+1	17+3
22	15+1	16+4	17+6
23	15+3	16+6	18+1
24	15+6	17+1	18+4
25	16+1	17+4	19+1
26	16+3	17+6	19+3
27	16+6	18+2	19+6
28	17+1	18+4	20+1
29	17+4	19+0	20+4
30	17+6	19+3	20+6
31	18+1	19+5	21+1
32	18+4	20+1	21+4
33	18+6	20+4	22+1
34	19+1	20+6	22+3
35	19+4	21+1	22+6
36	20+0	21+4	23+1
37	20+2	21+6	23+4
38	20+5	22+2	23+6
39	21+0	22+5	24+3
40	21+3	23+1	24+6
41	21+5	23+3	25+1
42	22+1	23+6	25+4
43	22+4	24+1	25+6
44	22+6	24+4	26+3
45	23+1	25+0	26+6
46	23+4	25+3	27+1
47	24+0	25+6	27+4
48	24+3	26+1	28+0
49	24+5	26+4	28+2
50	25+1	26+6	28+5
51	25+4	27+2	29+1
52	25+6	27+5	29+4
53	26+1	28+1	30+0
54	26+4	28+4	30+4
55	27+0	29+0	31+0
56	27+3	29+3	31+3
57	27+6	29+6	31+6
58	28+1	30+1	32+1
59	28+4	30+4	32+4
60	29+0	31+0	33+0
61	29+4	31+4	33+4
62	29+6	31+6	33+6
63	30+2	32+2	34+2
64	30+6	32+6	34+6
65	31+1	33+1	35+1
66	31+4	33+4	35+4
67	32+0	34+1	36+1
68	32+3	34+4	36+4
69	32+6	35+0	37+1
70	33+2	35+3	37+4
71	33+6	35+6	38+0
72	34+1	36+2	38+3
73	34+4	36+6	39+0
74	35+1	37+2	39+4
75	35+4	37+5	39+6
76	36+0	38+1	40+3
77	36+4	38+5	40+6
78	37+0	39+1	41+3
79	37+3	39+4	41+6
80	37+6	40+1	42+2

2.6.42 GA(FL) Osaka89

GA(FL) Osaka89
FL - Femur Length

Reference:
Osaka University Method 3 by Univ. Osaka, 1989.

FL(mm)	GA(w+d)
9	13+0
10	13+2
11	13+4
12	13+6
13	14+1
14	14+4
15	14+6
16	15+1
17	15+3
18	15+5
19	16+1
20	16+3
21	16+6
22	17+1
23	17+3
24	17+6
25	18+1
26	18+4
27	18+6
28	19+2
29	19+4
30	20+0
31	20+2
32	20+5
33	21+0
34	21+3
35	21+5
36	22+1
37	22+4
38	23+1
39	23+2
40	23+5
41	24+1
42	24+4
43	25+0
44	25+3
45	25+6

FL(mm)	GA(w+d)
46	26+2
47	26+4
48	27+1
49	27+4
50	28+0
51	28+3
52	28+6
53	29+2
54	29+6
55	30+2
56	30+6
57	31+3
58	31+6
59	32+3
60	32+6
61	33+4
62	34+1
63	34+4
64	35+2
65	35+5
66	36+3
67	36+6
68	37+1
69	38+3
70	39+1
71	39+6

2.6.43 GA(FL) Tokyo86

GA(FL) Tokyo86
FL - Femur Length

Reference:
Tokyo University Method 6 by Univ. of Tokyo, 1986.

FL(mm)	GA(w+d)	SD(d)
8	12+3	10
10	13+0	10
12	13+4	10
14	14+1	10
16	14+5	10
18	15+2	10
20	16+0	10
22	16+4	10
24	17+1	10
26	17+6	10
28	18+4	14
30	19+2	17
32	20+5	17
34	21+5	18
36	22+3	19
38	23+0	21
40	24+0	22
42	24+5	24
44	25+2	25
46	26+0	25
48	27+0	25
50	28+0	25
52	29+0	30
54	29+5	30
56	30+2	30
58	31+3	32
60	33+0	38
62	34+0	42
64	35+0	46
66	36+5	50
68	38+0	57
70	40+0	64
72	40+2	64

2.6.44 GA(FL) Tokyo89

GA(FL) Tokyo89
FL - Femur Length

Reference:
asahiko Mizuno, Takashi Okai, and Norio Shinozuka. Assessment of Fetal Growth using Ultrasound Measurements. Nichidoku Iho (Japanisch-Deutsche Medizinische Berichte) (in Japanese), 1989; 34(3): 537-554.

FL(mm)	GA(w+d)	SD(d)
32.3	20+0	17
34.4	21+0	18
36.5	22+0	19
38.7	23+0	21
40.9	24+0	22
43.1	25+0	24
46.4	26+0	25
47.6	27+0	25
49.8	28+0	25
51.9	29+0	25
54.1	30+0	30
56.1	31+0	30
58.2	32+0	32
60.1	33+0	38
61.9	34+0	38
63.7	35+0	42
65.3	36+0	46
66.8	37+0	50
68.2	38+0	57
69.3	39+0	57
70.4	40+0	64

2.6.45 GA(FL) Tokyo96

GA(FL) Tokyo96
FL - Femur Length

Reference:
Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

FL(mm)	GA(w+d)	SD(d)	FL(mm)	GA(w+d)	SD(d)
20	16+1	6	46	26+2	10
21	16+3	6	47	26+5	10
22	16+6	6	48	27+2	10
23	17+1	7	49	27+5	10
24	17+3	7	50	28+2	10
25	17+6	7	51	28+5	10
26	18+1	7	52	29+2	11
27	18+3	7	53	29+5	11
28	18+6	7	54	30+2	11
29	19+1	7	55	30+5	11
30	19+4	8	56	31+2	11
31	20+0	8	57	31+6	11
32	20+2	8	58	32+3	11
33	20+5	8	59	33+0	12
34	21+1	8	60	33+3	12
35	21+3	8	61	34+0	12
36	21+6	8	62	34+4	12
37	22+2	9	63	35+1	12
38	22+5	9	64	35+5	12
39	23+1	9	65	36+2	12
40	23+4	9	66	37+0	12
41	24+0	9	67	37+4	13
42	24+3	9	68	38+1	13
43	24+6	9	69	38+5	13
44	25+3	9	70	39+3	13
45	25+6	10	--		

2.6.46 GA(FL) Warda85

GA(FL) Warda85
FL - Femur Length

Equation: GA = exp (2.35301 + 0.231815*FL - 0.007804*pow(FL,2)).
Equation input: FL (cm).
Equation output: GA (weeks).

Reference:

Warda A.H., Deter R.L.; Rossavik I.K., Carpenter R.J., Hadlock F.P. "Fetal Femur Length: A Critical Reevaluation of the Relationship to Menstrual Age". Ultrasound in Obstetrics and Gynecology Vol. 66: 69-75, 1985.

FL(mm)	5%	GA(w+d) 50%	95%
10	11+6	13+1	14+4
12	12+3	13+5	15+1
14	12+6	14+3	15+6
16	13+4	14+6	16+4
18	14+0	15+4	17+2
20	14+4	16+1	18+0
22	15+1	16+6	18+5
24	15+6	17+4	19+3
26	16+3	18+1	20+1
28	17+1	18+6	21+0
30	17+5	19+5	21+6
32	18+3	20+3	22+4
34	19+1	21+1	23+3
36	19+6	21+6	24+2
38	20+4	22+5	25+1
40	21+1	23+4	26+0
42	21+6	24+2	26+6
44	22+4	25+1	27+6
46	23+3	25+6	28+5
48	24+1	26+5	29+4
50	24+6	27+4	30+4
52	25+5	28+3	31+4
54	26+3	29+2	32+4
56	27+1	30+1	33+3
58	28+0	31+0	34+3
60	28+6	31+6	35+3
62	29+4	32+6	36+3
64	30+3	33+5	37+2
66	31+1	34+4	38+3
68	32+0	35+4	39+2
70	32+6	36+3	40+2
72	33+4	37+2	41+2
74	34+3	38+1	42+2
76	35+1	39+0	43+2
78	36+0	39+6	44+1
80	36+6	40+6	45+1

2.6.47 GA(GS) Hansmann79

GA(GS) Hansmann79
GS (GSD) - Gestational Sac Diameter

Reference:
M. Hansmann, A. Geburtsh. Frauenheilk 39: 656, 1979.

GS(mm)	GA(w+d)
10	4+5
11	4+6
12	5+0
13	5+1
14	5+2
15	5+3
16	5+4
17	5+5
18	5+6
19	6+0
20	6+1
21	6+2
22	6+3
23	6+4
24	6+5
25	6+6
26	7+0
27	7+1
28	7+2
29	7+3
30	7+4
31	7+5
32	7+6
33	8+0
34	8+1
35	8+2
36	8+2
37	8+3
38	8+4
39	8+5
40	8+6
41	9+0
42	9+1
43	9+2
44	9+3
45	9+4

GS(mm)	GA(w+d)
46	9+5
47	9+6
48	10+0
49	10+1
50	10+2
51	10+3
52	10+4
53	10+5
54	10+6
55	10+1
56	11+1
57	11+2
58	11+3
59	11+4
60	11+5
61	11+6
62	12+0
63	12+1
64	12+2
65	12+3

2.6.48 GA(GS) Hansmann85

GA(GS) Hansmann85
GS (GSD) - Gestational Sac Diameter

Reference:

Hansmann M., Hackeloer BJ, Staudach A. "Ultraschalldiagnostik in Geburtshilfe und GynΓ¤kologie".Springer- Verlag, 1985, pp.39.

GS(mm)	GA(w+d)
7	4+6
9	5+5
10	6+0
13	6+2
15	6+5
24	7+3
28	8+2
34	9+0

2.6.49 GA(GS) Hellman69

GA(GS) Hellman69
GS - Gestational Sac

Equation:	GA = (GS + 2.543) / 0.702.
Equation input:	GS (cm).
Equation output:	GA (weeks).

Reference:

Hellman LM, Kobayashi M, Fillisti L., et al. "Growth and development of the human fetus prior to the 20th week of gestation". American Journal of Obstetrics and Gynecology; March 15; 1969; 789-800.

Nobuaki Mitsuda, Yoshiro Ohtsuki, Nagatoshi Sugita, Tetsu Takagi, and Osamu Tanizawa. Image Diagnosis of Fetal Growth. Obstetrical and Gynecological Practice, (in Japanese), 1988; 37 (10): 1459-1470.

GS(mm)	GA(w+d)	SD(d)
2	3+6	7
4	4+1	7
5	4+2	7
6	4+3	7
7	4+4	7
8	4+5	7
9	4+6	7
10	5+0	7
11	5+1	7
12	5+2	7
13	5+3	7
14	5+4	7
15	5+5	8
16	5+6	8
17	6+0	8
18	6+1	8
19	6+2	8
20	6+3	8
21	6+4	11
22	6+5	11
23	6+6	11
24	7+0	11
25	7+1	11
26	7+2	11
27	7+3	12
28	7+4	12
29	7+5	12
30	7+6	12
31	8+0	12
32	8+1	12
33	8+2	13
34	8+3	13
35	8+4	13
36	8+5	13
37	8+6	13
38	9+0	13
39	9+1	13
40	9+2	13
41	9+3	14
42	9+4	14
43	9+5	14
44	9+6	14
45	10+0	14
46	10+1	14
48	10+4	14
50	10+6	14
52	11+1	14

2.6.50 GA(GS) Hollander72

GA(GS) Hollander72
GS (GSD) - Gestational Sac Diameter

Equation:	GA = 1.384*GS + 4.452.
Equation input:	GS (cm).
Equation output:	GA (weeks).

Reference:

Hollander H.J. "Die Ultraschalldiagnostik in der Schwangerschaft". Urban & Schwarzenberger, Munchen 1972.

GS(mm)	GA(w+d)
8	5+4
9	5+5
10	5+6
11	6+0
12	6+1
13	6+2
14	6+3
15	6+4
16	6+5
17	6+6
18	7+0
19	7+1
20	7+2
21	7+3
22	7+3
23	7+4
24	7+5
25	7+6
26	8+0
27	8+1
28	8+2
29	8+3
30	8+4
31	8+5
32	8+6
33	9+0
34	9+1
35	9+2
36	9+3
37	9+4
38	9+5
39	9+6
40	10+0
41	10+1
42	10+2

2.6.51 GA(GS) Merz91

GA(GS) Merz91 (Hollander)
GS (GSD) - Gestational Sac Diameter

Reference:

Hollander, E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 309, 1991.

GS(mm)	GA(w+d)
8	5+4
9	5+5
10	5+6
11	6+0
12	6+1
13	6+2
14	6+3
15	6+4
16	6+5
17	6+6
18	7+0
19	7+1
20	7+2
21	7+3
22	7+3
23	7+4
24	7+5
25	7+6
26	8+0
27	8+1
28	8+2
29	8+3
30	8+4
31	8+5
32	8+6
33	9+0
34	9+1
35	9+2
36	9+3
37	9+4
38	9+5
39	9+6
40	10+0
41	10+1
42	10+2

2.6.52 GA(GS) Rempen91

GA(GS) Rempen91
GS (GSD) - Gestational Sac Diameter

Reference:

Rempen A. .Biometrie in der Frühgravidität (I. Trimenon). Der Frauenarzt; 32:4. 1991.
German Society for Gynecology and Obstetrics, March 1991, Issue 15, Vol. 1, pp. 23-28.

GS(mm)	GA(w+d)	SD90%(d)
2	4+6	10
3	5+0	10
4	5+1	10
6	5+2	10
7	5+3	10
8	5+4	10
10	5+5	10
11	5+6	10
12	6+0	10
13	6+1	10
14	6+2	10
16	6+3	10
17	6+4	10
18	6+5	10
20	6+6	10
21	7+0	10
22	7+1	10
23	7+2	10
24	7+3	10
26	7+4	10
27	7+5	10
28	7+6	10
29	8+0	10
30	8+1	10
31	8+2	10
33	8+3	10
34	8+4	10
35	8+5	10
36	8+6	10
37	9+0	10
38	9+1	10
39	9+3	10
40	9+3	10

GS(mm)	GA(w+d)	SD(d)
41	9+4	10
42	9+5	10
44	9+6	10
45	10+0	10
47	10+2	10
48	10+3	10
49	10+4	10
50	10+5	10
51	10+6	10
52	11+0	10
54	11+2	10
55	11+3	10
56	11+4	10
58	11+6	10
59	12+0	10
60	12+1	10
62	12+3	10
63	12+4	10
64	12+5	10
65	12+6	10
66	13+0	10
68	13+2	10
69	13+3	10
70	13+3	10
71	13+5	10
72	14+0	10
73	14+1	10

2.6.53 GA(GS) Tokyo86

GA(GS) Tokyo86
GS (GSD) - Gestational Sac Diameter

Reference:
Tokyo University Method 6 by Univ. of Tokyo, 1986.

GS(mm)	GA(w+d)	SD(d)
10	4+0	7
12	4+1	7
14	4+4	7
16	5+0	8
18	5+1	8
20	5+4	8
22	6+0	11
24	6+1	11
26	6+6	12
28	7+1	12
30	7+3	12
32	7+4	12
34	8+0	13
36	8+1	13
38	8+3	13
40	8+6	13
42	9+1	14
44	9+3	14
46	9+4	14
48	10+0	15
50	10+1	15
52	10+3	15
54	10+4	15
56	10+6	15
58	11+1	16
60	11+3	16
62	11+4	16
64	11+6	16
66	12+1	16
68	12+1	17

2.6.54 GA(HC) Hadlock84

GA(HC) Hadlock84
HC - Head Circumference

Reference:
Hadlock FP, Deter RL, Harrist RB, Park SK. Estimating Fetal Age: Computer - Assisted Analysis of Multiple Fetal Growth Parameters. Radiology, 152: 497-501, 1984.

HC(mm)	GA(w+d)	SD(d)
55	12+0	9
62	12+2	9
69	12+6	9
76	13+1	9
83	13+4	9
90	14+0	9
97	14+3	9
104	15+0	9
111	15+2	9
118	15+6	9
125	16+2	9
132	16+5	9
139	17+2	9
146	17+5	9
153	18+2	11
160	18+6	11
167	19+2	11
174	20+0	11
181	20+3	11
188	21+1	11
195	21+6	11
202	22+2	11
209	23+0	11
216	23+4	11
223	24+2	16
230	25+0	16
237	25+5	16
244	26+3	16
251	27+2	16
258	28+0	16
265	28+6	16
272	29+4	16
279	30+4	19
286	31+3	19
293	32+2	19
300	33+2	19
307	34+1	19
314	35+1	19
321	36+1	24
328	37+2	24
335	38+2	24
342	39+3	24
349	40+4	24
356	41+5	24

2.6.55 GA(HC) Hadlock90

GA(HC) Hadlock90
HC - Head Circumference

Equation:	GA = 8.8 + 0.55*HC + 0.00028*pow(HC,3).
Equation input:	HC (cm).
Equation output:	GA (weeks).

Reference:

Hadlock F., "Sonographic Estimation of Fetal Age and Weight". Radiologic Clinics of North America. Vol.28, No. 1, January 1990.

HC(mm)	GA(w+d)	SD(d)
85	13+5	8
90	14+0	8
95	14+2	8
100	14+4	8
105	15+0	8
110	15+2	8
115	15+4	8
120	15+6	8
125	16+2	8
130	16+4	8
135	17+0	8
140	17+2	8
145	17+5	8
150	18+1	8
155	18+3	8
160	18+6	8
165	19+1	8
170	19+4	8
175	20+0	8
180	20+3	8
185	20+6	8
190	21+1	8
195	21+4	8
200	22+1	8
205	22+4	8
210	23+0	8
215	23+3	8
220	23+6	8
225	24+3	8

HC(mm)	GA(w+d)	SD(d)
230	24+6	8
235	25+3	8
240	25+6	8
245	26+3	8
250	26+6	8
255	27+4	8
260	28+0	8
265	28+1	8
270	29+1	8
275	29+6	8
280	30+2	8
285	31+0	8
290	31+4	8
295	32+1	8
300	32+6	8
305	33+4	8
310	34+1	8
315	34+6	8
320	35+4	8
325	36+2	8
330	37+0	8
335	37+5	8
340	38+4	8
345	39+1	8
350	40+0	8
355	40+6	8
360	41+4	8

2.6.56 GA(HC) Hansmann86

GA(HC) Hansmann86
HC - Head Circumference

Reference:
Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p.431.

HC(mm)	GA(w+d)
106	14+0
115	15+0
127	16+0
140	17+0
152	18+0
164	19+0
176	20+0
190	21+0
203	22+0
215	23+0
226	24+0
240	25+0
251	26+0
263	27+0
274	28+0
284	29+0
293	30+0
303	31+0
311	32+0
318	33+0
325	34+0
332	35+0
337	36+0
340	37+0
344	38+0
347	39+0
349	40+0

2.6.57 GA(HC) Merz91

GA(HC) Merz91
HC - Head Circumference

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 308-338, 1991.

HC(mm)	5%	GA(w+d) 50%	95%
72	11+0	12+1	13+1
74	11+1	12+2	13+4
76	11+1	12+3	13+4
78	11+2	12+4	13+5
80	11+4	12+5	13+6
82	11+4	12+6	14+0
84	11+5	12+6	14+1
86	11+6	13+1	14+2
88	12+0	13+1	14+3
90	12+1	13+2	14+4
92	12+2	13+4	14+5
94	12+3	13+4	14+6
96	12+4	13+5	14+6
98	12+5	13+6	15+1
100	12+6	14+0	15+1
102	12+6	14+1	15+4
104	13+0	14+2	15+4
106	13+1	14+3	15+5
108	13+2	14+4	15+6
110	13+3	14+5	16+0
112	13+4	14+6	16+1
114	13+5	15+0	16+2
116	13+6	15+1	16+3
118	14+0	15+2	16+4
120	14+1	15+3	16+5
122	14+1	15+4	17+0
124	14+2	15+5	17+1
126	14+3	15+6	17+1
128	14+4	16+0	17+3
130	14+5	16+1	17+4
132	14+6	16+2	17+5
134	15+0	16+3	17+6
136	15+1	16+4	18+0
138	15+2	16+5	18+1
140	15+4	16+6	18+2
142	15+4	17+0	18+3
144	15+6	17+1	18+4
146	15+6	17+2	18+5
148	16+0	17+4	19+0
150	16+1	17+4	19+1

HC(mm)	5%	GA(w+d) 50%	95%
152	16+2	17+6	19+2
154	16+3	17+6	19+3
156	16+4	18+1	19+4
158	16+5	18+1	19+5
160	16+6	18+3	19+6
162	17+0	18+4	20+0
164	17+1	18+5	20+1
166	17+2	18+6	20+2
170	17+4	19+1	20+4
172	17+6	19+2	20+6
174	17+6	19+3	20+6
176	18+0	19+4	21+1
178	18+1	19+6	21+3
180	18+2	19+6	21+4
182	18+4	20+1	21+5
184	18+4	20+1	21+6
186	18+6	20+3	22+0
188	19+0	20+4	22+1
190	19+1	20+5	22+2
192	19+2	20+6	22+4
194	19+4	21+1	22+5
196	19+4	21+1	22+6
198	19+5	21+3	23+0
200	19+6	21+4	23+2
202	20+0	21+5	23+3
204	20+1	21+6	23+4
206	20+3	22+1	23+6
208	20+4	22+1	23+6
210	20+5	22+3	24+1
212	20+6	22+4	24+2
214	21+0	22+5	24+3
216	21+1	22+6	24+4
218	21+3	23+1	24+6
220	21+4	23+2	25+0
222	21+6	23+4	25+1
224	21+6	23+4	25+2
226	22+1	23+6	25+4
228	22+1	24+0	25+6
230	22+3	24+1	26+0

(Continuation on next page)

GA(HC) Merz91 (Continued)

HC(mm)	5%	GA(w+d) 50%	95%
232	22+4	24+3	26+1
234	22+5	24+4	26+2
236	22+6	24+5	26+4
238	23+1	24+6	26+5
240	23+2	25+1	26+6
242	23+4	25+2	27+1
244	23+5	25+4	27+2
246	23+6	25+5	27+4
248	24+1	25+6	27+5
250	24+1	26+0	27+6
252	24+3	26+1	28+0
254	24+4	26+3	28+1
256	24+6	26+4	28+3
258	25+0	26+6	28+4
260	25+1	27+0	28+6
262	25+3	27+1	29+0
264	25+4	27+3	29+1
268	26+0	27+6	29+4
270	26+1	28+1	30+0
272	26+3	28+2	30+1
274	26+4	28+4	30+3
276	26+6	28+5	30+4
278	27+0	28+6	30+6
280	27+1	29+1	31+0
282	27+3	29+2	31+1
284	27+5	29+4	31+4
286	27+6	29+6	31+5
288	28+1	30+0	31+6
290	28+2	30+1	32+1
292	28+4	30+4	32+3
294	28+6	30+5	32+4
296	29+0	30+6	32+6
298	29+1	31+1	33+0
300	29+3	31+3	33+3

HC(mm)	5%	GA(w+d) 50%	95%
302	29+4	31+4	33+4
304	29+6	31+6	33+6
306	30+1	32+1	34+1
308	30+2	32+2	34+2
310	30+4	32+4	34+4
312	30+6	32+6	34+6
314	31+1	33+1	35+1
316	31+3	33+3	35+3
318	31+4	33+4	35+4
320	31+6	33+6	36+0
322	32+0	34+1	36+1
324	32+2	34+3	36+4
326	32+4	34+5	36+6
328	32+6	34+6	37+0
330	33+1	35+1	37+2
332	33+2	35+4	37+5
334	33+4	35+6	38+0
336	33+6	36+1	38+2
338	34+1	36+3	38+4
340	34+3	36+4	38+6
342	34+5	36+6	39+1
344	35+0	37+1	39+3
346	35+2	37+4	39+5
348	35+4	37+6	40+1
350	35+6	38+1	40+4
352	36+1	38+4	40+6
354	36+4	38+6	41+4
356	36+6	39+1	41+3
358	37+1	39+4	41+6
360	37+4	39+6	42+1
362	37+6	40+1	42+3
364	38+1	40+4	42+6

2.6.58 GA(HL) Jeanty84

GA(HL) Jeanty84
HL - Humerus Length

Reference:

Jeanty, Philippe et al. estimation of Gestational Age from Measurements of Fetal Long Bones. J. Ultrasound Med. February 1984; 3:75-79.

HL(mm)	5%	GA(w+d) 50%	95%
10	9+6	12+4	15+2
11	10+1	12+6	15+3
12	10+3	13+1	15+6
13	10+6	13+3	16+1
14	11+1	13+6	16+4
15	11+3	14+1	16+6
1,6	11+6	14+4	17+2
17	12+1	14+6	17+3
18	12+4	15+1	18+0
19	12+6	15+3	18+2
20	13+1	15+6	18+5
21	13+3	16+2	19+1
22	13+6	16+5	19+3
23	14+2	17+1	19+6
24	14+5	17+3	20+1
25	15+1	17+6	20+4
26	15+3	18+1	21+0
27	15+6	18+4	21+3
28	16+2	19+0	21+6
29	16+5	19+3	22+1
30	17+1	19+6	22+4
31	17+3	20+2	23+0
32	18+0	20+5	23+3
33	18+3	21+1	23+6
34	18+6	21+3	24+2
35	19+2	22+0	24+6
36	19+5	22+4	25+1
37	20+1	22+6	25+5
38	20+4	23+3	26+1
39	21+1	23+6	26+4
40	21+3	24+2	27+1

HL(mm)	5%	GA(w+d) 50%	95%
41	22+0	24+6	27+3
42	22+4	25+2	28+0
43	23+0	25+5	28+4
44	23+3	26+1	29+0
45	24+0	26+5	29+3
46	24+4	27+1	30+0
47	25+0	27+5	30+4
48	25+3	28+1	31+0
49	26+0	28+6	31+3
50	26+4	29+2	32+0
51	27+1	29+6	32+4
52	27+3	30+2	33+1
53	28+1	30+6	33+3
54	28+5	31+3	34+1
55	29+1	32+0	34+5
56	29+6	32+4	35+2
57	30+2	33+1	35+6
58	30+6	33+3	36+4
59	31+3	34+1	36+6
60	32+0	34+6	37+3
61	32+4	35+2	38+1
62	33+1	35+6	38+5
63	33+6	36+4	39+2
64	34+3	37+1	39+6
65	35+0	37+5	40+4
66	35+3	38+2	41+1
67	36+1	38+6	41+5
68	36+6	39+3	42+2
69	37+3	40+1	42+6

2.6.59 GA(HL) Merz91

GA(HL) Merz91
HL - Humerus Length

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 1991.

HL(mm)	GA(w+d)
8	12+0
11	13+0
14	14+0
16	15+0
19	16+0
22	17+0
25	18+0
27	19+0
30	20+0
32	21+0
35	22+0
37	23+0
40	24+0
42	25+0
44	26+0
46	27+0
48	28+0
50	29+0
52	30+0
54	31+0
55	32+0
57	33+0
59	34+0
60	35+0
61	36+0
63	37+0
64	38+0
65	39+0
66	40+0

2.6.60 GA(HL) Osaka89

GA(HL) Osaka89
HL - Humerus Length

Reference:
Osaka University Method 3 by Univ. Osaka, 1989.

HL(mm)	GA(w+d)
10	13+0
11	13+2
12	13+5
13	14+0
14	14+2
15	14+5
16	15+0
17	15+3
18	15+5
19	16+1
20	16+3
21	16+5
22	17+2
23	17+4
24	18+0
25	18+3
26	18+6
27	19+1
28	19+4
29	20+0
30	20+3
31	20+5
32	21+2
33	21+4
34	22+1
35	22+4
36	23+0
37	23+3
38	23+6
39	24+2
40	24+6

HL(mm)	GA(w+d)
41	25+3
42	26+0
43	26+3
44	26+6
45	27+3
46	28+0
47	28+4
48	29+1
49	29+5
50	30+3
51	31+0
52	31+5
53	32+3
54	33+1
55	33+6
56	34+4
57	35+3
58	36+2
59	37+1
60	38+1
61	39+2
62	40+0

2.6.61 GA(OFD) Hansmann86

GA(OFD) Hansmann86
OFD - Occipitofrontal Diameter

Reference:
Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p. 431.

OFD(mm)	GA(w+d)
31	14+0
38	15+0
41	16+0
46	17+0
50	18+0
54	19+0
58	20+0
63	21+0
67	22+0
72	23+0
76	24+0
80	25+0
84	26+0
88	27+0
91	28+0
95	29+0
98	30+0
100	31+0
103	32+0
105	33+0
107	34+0
109	35+0
111	36+0
112	37+0
113	38+0
114	39+0
115	40+0

2.6.62 GA(TL) Jeanty84

GA(TL) Jeanty84
TL - Tibia Length

Reference:
Jeanty, Philippe et al. estimation of Gestational Age from Measurements of Fetal Long Bones. J. Ultrasound Med. February 1984; 3:75-79.

TL(mm)	5%	GA(w+d) 50%	95%
10	10+4	13+3	16+2
11	10+6	13+5	16+4
12	11+1	14+1	17+0
13	11+3	14+3	17+2
14	11+6	14+6	17+5
15	12+1	15+1	18+0
16	12+4	15+3	18+3
17	13+0	15+6	18+6
18	13+1	16+1	19+1
19	13+5	16+4	19+3
20	14+1	17+0	19+6
21	14+4	17+3	20+2
22	14+6	17+6	20+5
23	15+1	18+1	21+1
24	15+3	18+4	21+3
25	16+0	18+6	21+6
26	16+3	19+2	22+1
27	16+6	19+5	22+4
28	17+1	20+1	23+0
29	17+3	20+4	23+3
30	18+1	21+0	23+6
31	18+4	21+3	24+2
32	18+6	21+6	24+5
33	19+2	22+1	25+1
34	19+5	22+4	25+3
35	20+1	23+1	26+0
36	20+4	23+3	26+3
37	21+0	23+6	26+6
38	21+3	24+3	27+2
39	21+6	24+6	27+5
40	22+3	25+2	28+1

TL(mm)	5%	GA(w+d) 50%	95%
41	22+6	25+5	28+4
42	23+2	26+1	29+1
43	23+5	26+4	29+3
44	24+1	27+1	30+0
45	24+4	27+3	30+4
46	25+1	28+0	30+4
47	25+3	28+4	31+3
48	26+1	29+0	31+6
49	26+4	29+3	32+2
50	27+0	29+6	32+6
51	27+3	30+3	33+2
52	28+0	30+6	33+6
53	28+4	31+3	34+2
54	29+0	31+6	34+6
55	29+3	32+3	35+2
56	30+0	32+6	35+6
57	30+4	33+3	36+2
58	31+0	33+6	36+6
59	31+3	34+3	37+2
60	32+0	34+6	37+6
61	32+4	35+3	38+2
62	33+0	35+6	38+6
63	33+3	36+4	39+3
64	34+1	37+0	39+6
65	34+2	37+3	40+3
66	35+1	38+0	41+0
67	35+5	38+4	41+3
68	36+1	39+1	42+0
69	36+6	39+5	42+4

2.6.63 GA(TL) Merz91

GA(TL) Merz91
TL - Tibia Length

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 1991.

TL(mm)	GA(w+d)
7	12+0
10	13+0
12	14+0
15	15+0
18	16+0
21	17+0
23	18+0
26	19+0
28	20+0
31	21+0
33	22+0
36	23+0
38	24+0
40	25+0
42	26+0
45	27+0
47	28+0
49	29+0
50	30+0
52	31+0
54	32+0
56	33+0
57	34+0
59	35+0
60	36+0
62	37+0
63	38+0
64	39+0
66	40+0

2.6.64 GA(UL) Jeanty84

GA(UL) Jeanty84
UL - Ulna Length

Reference:
Jeanty, Philippe et al. estimation of Gestational Age from Measurements of Fetal Long Bones. J. Ultrasound Med. February 1984; 3:75-79.

UL(mm)	5%	GA(w+d) 50%	95%
10	10+1	13+1	16+1
11	10+4	13+3	16+4
12	10+6	13+6	16+6
13	11+1	14+1	17+2
14	11+3	14+4	17+5
15	11+6	15+0	18+0
16	12+2	15+3	18+3
17	12+5	15+5	18+6
18	13+1	16+1	19+1
19	13+3	16+4	19+3
20	13+6	16+6	20+0
21	14+2	17+2	20+3
22	14+5	17+5	20+6
23	15+1	18+1	21+1
24	15+3	18+4	21+3
25	16+0	19+0	22+1
26	16+3	19+3	22+4
27	16+6	19+6	22+6
28	17+2	20+2	23+3
29	17+5	20+6	23+6
30	18+1	21+1	24+2
31	18+4	21+5	24+6
32	19+1	22+1	25+1
33	19+3	22+5	25+5
34	20+1	23+1	26+1
35	20+4	23+4	26+5
36	21+1	24+1	27+1
37	21+3	24+4	27+5
38	22+1	25+1	28+1
39	22+4	25+3	28+5
40	23+1	26+1	29+1

UL(mm)	5%	GA(w+d) 50%	95%
41	23+3	26+5	29+5
42	24+1	27+1	30+2
43	24+5	27+5	30+6
44	25+1	28+2	31+2
45	25+6	28+6	31+6
46	26+2	29+3	32+3
47	26+6	29+6	33+0
48	27+3	30+4	33+3
49	28+0	31+1	34+1
50	28+4	31+3	34+5
51	29+1	32+1	35+2
52	29+5	32+6	35+6
53	30+2	33+3	36+3
54	30+6	34+0	37+0
55	31+3	34+4	37+5
56	32+1	35+1	38+2
57	32+6	35+6	38+6
58	33+3	36+3	39+3
59	34+0	37+1	40+1
60	34+4	37+5	40+6
61	35+2	38+2	41+3
62	35+6	39+0	42+0
63	36+4	39+3	42+5
64	37+1	40+2	43+2

2.6.65 GA(UL) Merz91

GA(UL) Merz91
UL - Ulna Length

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 1991.

UL(mm)	GA(w+d)
6	12+0
9	13+0
12	14+0
14	15+0
17	16+0
20	17+0
23	18+0
25	19+0
28	20+0
30	21+0
33	22+0
35	23+0
37	24+0
39	25+0
41	26+0
43	27+0
45	28+0
47	29+0
48	30+0
50	31+0
51	32+0
53	33+0
54	34+0
55	35+0
56	36+0
57	37+0
58	38+0
59	39+0
60	40+0

2.6.66 GA(HC/AC) Hadlock82

GA(HC/AC) Hadlock82
HC - Head Circumference
AC - Abdominal Circumference

References:

Deter RL, Hadlock FP, and Harrist RB. Evaluation of fetal growth and the detection of intrauterine growth retadation. In Callen Pw (ed.), Ultrasonography in Obstetrics and Gynecology. W.B. Saunders Co., Philadelphia, 1983, pp. 113-140.

Hadlock FP et al. Perinatol. Neonatal 7 (9): 21, 1983.

Hadlock FP. Evaluation of fetal dating studies. In deter RL et al. (eds.). Quantitative Obstetrical Ultrasonography. John wiley & Sons, New York, 1982, pp. 33-45.

HC/AC	GA(w+d)	SD(d)
1.22	12+0	8
1.21	13+0	8
1.2	14+0	8
1.19	15+0	8
1.18	16+0	8
1.17	18+0	8
1.16	19+0	10
1.15	20+0	10
1.14	21+0	10
1.13	22+0	10
1.12	23+0	10
1.1	26+0	14
1.09	27+0	14
1.08	28+0	14
1.07	29+0	14
1.06	31+0	19
1.05	32+0	19
1.04	33+0	19
1.03	34+0	19
1.02	35+0	19
1.01	37+0	18
1	38+0	18
0.99	39+0	18
0.98	40+0	18

2.6.67 GA(FTA) Osaka88

GA(FTA) Osaka88
FTA - Fetal Trunk Area

Reference:

Nobuaki Mitsuda, Yoshiro Ohtsuki, Nagatoshi Sugita, Tetsu Takagi, and Osamu Tanizawa. Image Diagnosis of Fetal Growth. Obstetrical and Gynecological Practice, (in Japaneese), 1988, 37(10):1459-1470.

FTA(cm2)	GA(w+d)
5.6	14+0
7.3	15+0
9.2	16+0
11.3	17+0
13.5	18+0
15.8	19+0
18.4	20+0
21	21+0
23.8	22+0
26.8	23+0
29.9	24+0
33.1	25+0
36.5	26+0
39.9	27+0
43.4	28+0
47.1	29+0
50.8	30+0
54.5	31+0
58.3	32+0
62.1	33+0
65.8	34+0
69.5	35+0
73.2	36+0
76.8	37+0
80.2	38+0
83.5	39+0
86.6	40+0

2.6.68 GA(ATD) Hansmann79

GA(ATD) Hansmann79
ATD - Abdominal Transverse Diameter

Reference:

M. Hansmann, A. Geburtsh. Frauenheilk 39: 656, 1979.

ATD(mm)	GA(w+d)
20	12+3
21	12+5
22	13+0
23	13+2
24	13+4
25	13+6
26	14+1
27	14+3
28	14+5
29	15+0
30	15+2
31	15+4
32	15+6
33	16+1
34	16+3
35	16+5
36	17+0
37	17+3
38	17+5
39	18+0
40	18+2
41	18+4
42	18+6
43	19+3
44	19+4
45	19+6
46	20+1
47	20+3
48	20+6
49	21+1
50	21+3
51	21+5
52	22+1
53	22+3
54	22+5
55	23+0
56	23+3
57	23+5
58	24+0
59	24+2
60	24+5
61	25+0
62	25+2

ATD(mm)	GA(w+d)
63	25+4
64	26+0
65	26+2
66	26+4
67	26+6
68	27+2
69	27+4
70	27+6
71	28+2
72	28+4
73	29+0
74	29+2
75	29+5
76	30+0
77	30+2
78	30+5
79	31+0
80	31+3
81	31+5
82	32+1
83	32+3
84	32+6
85	33+1
86	33+4
87	33+6
88	34+2
89	34+4
90	35+0
91	35+2
92	35+5
93	36+0
94	36+3
95	36+6
96	37+2
97	37+5
98	38+1
99	38+4
100	39+0
101	39+3
102	39+6
103	40+2

2.6.69 GA(ATD) Merz91

GA(ATD) Merz91
ATD - Abdominal Transverse Diameter

Reference:
E. Merz, W. Goldhofer, E. Timor-Tritsch. Ultrasound in Gynecology and Obstetrics. Textbook and Atlas. Georg Thieme Verlag, 1991.

ATD(mm)	GA(w+d)
19	12+0
23	13+0
26	14+0
29	15+0
32	16+0
36	17+0
39	18+0
42	19+0
45	20+0
49	21+0
52	22+0
55	23+0
58	24+0
62	25+0
65	26+0
68	27+0
72	28+0
75	29+0
78	30+0
81	31+0
85	32+0
88	33+0
91	34+0
94	35+0
98	36+0
101	37+0
104	38+0
108	39+0
111	40+0

2.6.70 GA(TTD) Hansmann85

GA(TTD) Hansmann85
TTD - Thorax Transverse Diameter

Reference:
M.Hansmann, B.-J. Hackeloer, A. Staudach. Ultraschalldiagnostik in Geburtshilfe und Gynakologie. Lehrbuch und Atlas, Springer Verlag, 413-443, 1985.

TTD(mm)	5%	GA(w+d) 50%	95%
20	10+6	12+0	13+2
22	11+5	13+0	14+3
26	12+5	14+0	15+3
29	13+5	15+0	16+3
32	14+5	16+0	17+3
36	15+4	17+0	18+4
39	16+3	18+0	19+5
42	17+3	19+0	20+5
46	18+2	20+0	21+6
49	19+0	21+0	23+0
52	19+6	22+0	24+1
55	20+6	23+0	25+2
58	21+5	24+0	26+3
61	22+4	25+0	27+4
64	23+3	26+0	28+5
67	24+2	27+0	29+6
70	25+0	28+0	31+0
73	26+0	29+0	32+1
76	26+6	30+0	33+2
79	27+5	31+0	34+3
82	28+4	32+0	35+4
85	29+3	33+0	36+5
88	30+2	34+0	37+6
90	31+4	35+0	38+3
93	32+6	36+0	39+2
96	33+6	37+0	40+2
98	34+5	38+0	41+3
101	35+3	39+0	42+5
103	36+6	40+0	43+1
105	38+2	41+0	43+5

2.6.71 GA(TTD) Hansmann86

GA(TTD) Hansmann86
TTD - Thorax Transverse Diameter

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer-Verlag, New York, 1986; pp.431.

TTD(mm)	GA(w+d)
17	12+0
20	13+0
24	14+0
27	15+0
31	16+0
34	17+0
37	18+0
40	19+0
44	20+0
47	21+0
50	22+0
53	23+0
56	24+0
59	25+0
62	26+0
65	27+0
69	28+0
72	29+0
74	30+0
78	31+0
81	32+0
83	33+0
86	34+0
89	35+0
92	36+0
94	37+0
97	38+0
99	39+0
101	40+0
102	41+0

2.6.72 GA(TAPD) Hansmann76

GA(TAPD) Hansmann76
TAPD - Thorax Anterior Posterior Diameter

Reference:

Hansmann M. "Ultraschallbiometrie im II. und III. Trimester der Schwangerschaft". Gynakologe 9 (1976) 133.

TAPD(mm)	GA(w+d)
22,5	14+0
25,8	15+0
28,5	16+0
31,1	17+0
34,6	18+0
37,5	19+0
40	20+0
43,4	21+0
46,5	22+0
49	23+0
51,5	24+0
54,8	25+0
58	26+0
61,5	27+0
63,9	28+0
67	29+0
70,1	30+0
72,5	31+0
76,2	32+0
79,3	33+0
81,5	34+0
84	35+0
87,5	36+0
90,2	37+0
93	38+0
95,3	39+0
96,8	40+0
98,4	41+0
99,1	42+0

2.6.73 GA(BOD) Jeanty84

GA(BOD) Jeanty84
BOD - Binocular Distance

Reference:

Jeanty P., Cantraine F., Cousaert E., Romero R., Hobbins J.C. "The binocular distance: a new way to estimate fetal age". Journal of Ultrasound in Medicine; 1984; Jun; 3(6): 241-243.

BOD(mm)	5%	GA(w+d) 50%	95%
15	7+1	10+3	13+6
16	7+5	11+0	14+3
17	8+2	11+4	15+0
18	8+6	12+1	15+4
19	9+4	12+6	16+1
20	10+1	13+3	16+5
21	10+5	14+0	17+2
22	11+2	14+4	17+6
23	11+6	15+1	18+4
24	12+4	15+6	19+1
25	13+1	16+3	19+5
26	13+5	17+0	20+2
27	14+2	17+4	20+6
28	14+6	18+1	21+4
29	15+4	18+6	22+1
30	16+1	19+3	22+5
31	16+4	20+0	23+2
32	17+1	20+4	23+6
33	17+6	21+1	24+4
34	18+3	21+5	25+1
35	19+0	22+2	25+5
36	19+4	22+6	26+2
37	20+1	23+4	26+6
38	20+6	24+1	27+3
39	21+3	24+5	28+0
40	22+0	25+2	28+4

BOD(mm)	5%	GA(w+d) 50%	95%
41	22+4	25+6	29+1
42	23+1	26+4	29+6
43	23+6	27+1	30+3
44	24+3	27+5	31+0
45	25+0	28+2	31+4
46	25+4	28+6	32+1
47	26+1	29+4	32+6
48	26+6	30+1	33+3
49	27+2	30+5	34+0
50	27+6	31+2	34+4
51	28+4	31+6	35+1
52	29+1	32+4	35+6
53	29+5	33+0	36+3
54	30+2	33+4	37+0
55	30+6	34+1	37+4
56	31+4	34+6	38+1
57	32+1	35+3	38+5
58	32+5	36+0	39+2
59	33+2	36+4	39+6
60	33+6	37+1	40+4
61	34+4	37+6	41+1
62	35+1	38+3	41+5
63	35+5	39+0	42+2
64	36+2	39+4	42+6
65	36+6	40+1	43+4

2.6.74 GA(Cereb) Chitty97

GA(Cereb) Chitty97
Cereb - Cerebellum

Reference:
Altmann D.G.; Chitty L.S. "New charts for ultrasound dating of pregnancy". Ultrasound in Obstetrics and Gynecology. Vol. 10: 174-191, 1997.

Cereb(mm)	5%	GA(w+d) 50%	95%
13	13+1	14+3	16+0
14	14+0	15+2	16+6
15	14+6	16+2	17+5
16	15+4	17+0	18+4
17	16+3	17+6	19+3
18	17+2	18+5	20+2
19	18+0	19+4	21+1
20	18+6	20+3	22+0
21	19+4	21+1	22+6
22	20+2	22+0	23+5
23	21+0	22+5	24+4
24	21+5	23+4	25+4
25	22+2	24+2	26+3
26	23+0	25+0	27+3
27	23+4	25+6	28+2
28	24+1	26+4	29+2
29	24+5	27+2	30+2
30	25+1	28+0	31+2
31	25+5	28+6	32+2
32	26+1	29+4	33+3
33	26+4	30+2	34+4
34	26+6	31+0	35+5
35	27+2	31+5	36+6
36	27+4	32+3	38+1

2.6.75 GA(Cereb) Goldstein87

GA(Cereb) Goldstein87
Cereb - Cerebellum

Equation:	GA = 6.329 + 4.807*Cereb + 1.484*pow(Cereb,2) - 0.2474* pow(Cereb,3).
Equation input:	Cereb (1.0 - 5.5 cm).
Equation output:	GA (weeks).

Reference:

Goldstein I.; Reece A.; Pilu G.; Bovicelli L.; Hobbins J.C. "Cerebellar measurement with ultrasonography in the evaluation of fetal growth and development". Am J Obstet Gynecol; May 1987; 1065-1069.

Cereb(mm)	GA(w+d)
10	12+3
11	13+1
12	13+6
13	14+4
14	15+2
15	16+0
16	16+6
17	17+4
18	18+2
19	19+1
20	19+6
21	20+5
22	21+3
23	22+1
24	23+0
25	23+6
26	24+4
27	25+2
28	26+0
29	26+5
30	27+3
31	28+1
32	28+6
33	29+3

Cereb(mm)	GA(w+d)
34	30+1
35	30+5
36	31+2
37	31+6
38	32+3
39	33+0
40	33+3
41	33+6
42	34+3
43	34+6
44	35+1
45	35+3
46	35+6
47	36+0
48	36+1
49	36+3
50	36+4
51	36+4
52	36+5
53	36+5
54	36+4
55	36+4

2.6.76 GA(Cereb) Hill90

GA(Cereb) Hill90
Cereb - Cerebellum

Equation: GA = 6.37 + 5.4*Cereb + 0.78*pow(Cereb,2) - 0.13* pow(Cereb,3).
Equation input: Cereb (1.4 - 5.6 cm).
Equation output: GA (weeks).

Reference:

Hill L.M., Guzick D., Fries J., Hixson J., Rivello D., "The Transverse Cerebellar Diameter in Estimation Gestational Age in the Large for Gestational Age-Fetus". Obstetrics and Gynecology. Vol.75, No.6, June 1990, pages 981-985.

Cereb(mm)	GA(w+d)	SD(d)
14	15+1	4
15	15+6	4
16	16+4	4
17	17+1	4
18	17+6	4
19	18+4	6
20	19+2	6
21	20+0	6
22	20+5	6
23	21+3	6
24	22+1	6
25	22+6	6
26	23+4	6
27	24+1	7
28	24+6	7
29	25+4	7
30	26+1	7
31	26+6	7
32	27+4	7
33	28+1	7
34	28+6	7
35	29+3	7
36	30+0	8
37	30+4	8
38	31+1	8
39	31+6	8
40	32+2	8
41	32+6	8
42	33+3	8
43	33+6	8
44	34+3	8
45	34+6	8
46	35+2	8
47	35+5	8
48	36+1	11
49	36+4	11
50	36+6	11
51	37+1	11
52	37+4	11
54	38+0	11
55	38+2	11
56	38+4	11

2.6.77 GA(Clav) Yarkoni85

GA(Clav) Yarkoni85
Clav - Clavicle

Equation:	GA = 3.717731 + 8.272778*Clav.
Equation input:	Clav (1.1 - 4.5 cm).
Equation output:	GA (weeks).

Reference:
Yarkoni S., Schmidt W., Jeanty P., Reece A., Hobbins J.C. "Clavicular Measurement: A New Biometric Parameter for Fetal Evaluation". Journal of Ultrasound in Medicine. 4:467-470, September, 1985.

Clav(mm)	5%	GA(w+d) 50%	95%
11	8+3	13+6	17+2
12	9+1	14+4	18+1
13	10+0	14+3	19+6
14	11+6	15+2	20+5
15	12+5	16+1	21+4
16	12+3	18+0	21+3
17	13+2	18+5	22+2
18	14+1	19+4	23+0
19	16+0	19+3	24+6
20	16+6	20+2	25+5
21	17+4	21+1	26+4
22	17+3	22+6	26+2
23	18+2	23+5	27+1
24	19+1	24+4	28+0
25	21+0	24+3	29+6
26	21+5	25+1	30+5
27	22+4	26+0	30+3
28	22+3	27+6	31+2
29	23+2	28+5	32+1
30	24+0	29+4	34+0
31	25+6	29+2	34+6
32	26+5	30+1	35+4
33	27+4	31+0	35+3
34	27+3	32+6	36+2
35	28+1	33+5	37+1
36	29+0	33+3	39+0
37	30+6	34+2	39+5
38	31+5	35+1	40+4
39	32+4	37+0	40+3
40	32+2	37+6	41+2
41	33+1	38+4	42+0
42	35+0	38+3	43+6
43	35+6	39+2	44+5
44	36+5	40+1	45+4
45	36+3	41+6	45+3

2.7 Human OB Average Estimated Fetal Weight (AvgEFW)

Average Estimated Fetal Weight (AvgEFW) is calculated by averaging selected EFW values:

$AvgEFW = (EFW_1 + EFW_2 + EFW_3 + ... + EFW_N) / N.$

For averaging are used only EFW<>0 values.

2.8 Human OB Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

2.9 Human OB Estimated Delivery Date (EDD)

Human gestational period is assumed to be 280 days (40 weeks).

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 280 days - GA;

EDD (AUA) = Exam date + 280 days - AUA;

EDD (LMP) = LMP date + 280 days.

2.10 Human OB Fetal Growth B mode tables

For Fetal Growth analysis are used look-up tables that are presented in this chapter or any other user-defined tables. Software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB results View dialog. Intermediate values inside tables are calculated using linear interpolation.

2.10.1 AC(GA) Hadlock84

AC(GA) Hadlock84
AC - Abdominal Circumference
Fetal Growth

Equation:	AC = -13.3 + 1.61*GA - 0.00998*pow(GA,2).
Equation input:	GA (12-40 weeks).
Equation output:	AC (cm).

Reference:

Hadlock F.P., Deter R.L., Harrist R.B., Park S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters". Radiology 1984; 152: 497-501.

GA(w+d)	AC(mm)
12+0	46
12+4	53
13+0	60
13+3	67
14+0	73
14+4	80
15+0	86
15+3	93
16+0	99
16+4	106
17+0	112
17+3	119
18+0	125
18+4	131
19+0	137
19+3	144
20+0	150
20+4	156
21+0	162
21+3	168
22+0	174
22+4	179
23+0	185
23+3	191
24+0	197
24+4	202
25+0	208
25+3	213
26+0	219

GA(w+d)	AC(mm)
26+4	224
27+0	230
27+3	235
28+0	240
28+4	246
29+0	251
29+3	256
30+0	261
30+4	266
31+0	271
31+3	276
32+0	281
32+4	286
33+0	291
33+3	295
34+0	300
34+4	305
35+0	309
35+3	314
36+0	318
36+4	323
37+0	327
37+3	332
38+0	336
38+4	340
39+0	344
39+3	348
40+0	353

2.10.2 AC(GA) Hansmann86

AC(GA) Hansmann86
AC - Abdominal Circumference
Fetal Growth

Reference:
Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p.431.

GA(w+d)	AC(mm)
12+0	53
13+0	63
14+0	75
15+0	85
16+0	97
17+0	107
18+0	116
19+0	126
20+0	135
21+0	145
22+0	155
23+0	165
24+0	173
25+0	183
26+0	191
27+0	202
28+0	211
29+0	222
30+0	230
31+0	240
32+0	249
33+0	258
34+0	268
35+0	277
36+0	287
37+0	296
38+0	306
39+0	315
40+0	320

2.10.3 AC(GA) Jeanty84

AC(GA) Jeanty84
AC - Abdominal Circumference
Fetal Growth

Equation: AC = -2.9005 + 0.39388*GA + 0.033897*pow(GA,2) - 0.00055459*pow(GA,3).
Equation input: GA (12-40 weeks).
Equation output: AC (cm).

Reference:

Jeanty P., Cousaert E., Cantraine F. "Normal Growth of the Abdominal Perimeter". American Journal of Perinatology; Volume1; Number 2; January 1984; pages 129-135.

GA(w+d)	5%	AC(mm)	95%
12+0	35	57	80
13+0	45	67	90
14+0	55	77	100
15+0	65	88	110
16+0	76	98	120
17+0	86	109	131
18+0	97	119	142
19+0	108	130	152
20+0	119	141	163
21+0	129	152	174
22+0	140	163	185
23+0	151	173	196
24+0	162	184	206
25+0	172	195	217
26+0	183	205	227
27+0	193	215	238
28+0	203	225	248
29+0	213	235	257
30+0	222	244	267
31+0	231	254	277
32+0	240	262	285
33+0	248	271	293
34+0	256	279	301
35+0	264	286	309
36+0	271	293	316
37+0	278	300	322
38+0	283	306	328
39+0	289	311	333
40+0	294	316	338

2.10.4 AC(GA) Merz96

AC(GA) Merz96
AC - Abdominal Circumference
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones. Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	AC(mm)	95%
12+4	50	62	74
13+0	55	67	80
13+3	60	73	85
14+0	65	78	91
14+4	71	83	96
15+0	76	89	102
15+3	81	94	108
16+0	86	100	114
16+4	91	105	119
17+0	96	111	125
17+3	102	116	131
18+0	107	122	136
18+4	112	127	142
19+0	117	132	148
19+3	122	138	153
20+0	127	143	159
20+4	133	149	165
21+0	138	154	170
21+3	143	159	176
22+0	148	165	181
22+4	153	170	187
23+0	158	175	193
23+3	163	181	198
24+0	168	186	204
24+4	173	191	209
25+0	178	196	215
25+3	183	202	220
26+0	188	207	226
26+4	193	212	231
27+0	198	217	236
27+3	202	222	242
28+0	207	227	247
28+4	212	232	252
29+0	217	237	257
29+3	221	242	263
30+0	226	247	268
30+4	231	252	273
31+0	235	257	278
31+3	240	262	283
32+0	244	266	288
32+4	249	271	293
33+0	253	276	298
33+3	258	280	303
34+0	262	285	308
34+4	266	289	313
35+0	270	294	317
35+3	275	298	322
36+0	279	303	327
36+4	283	307	331
37+0	287	311	336
37+3	290	315	340
38+0	294	319	344
38+4	298	323	348
39+0	301	327	352
39+3	305	331	356
40+0	308	334	360
40+4	311	338	364
41+0	314	341	367
41+3	317	343	370

2.10.5 AC(GA) Tokyo96

AC(GA) Tokyo96
AC - Abdominal Circumference
Fetal Growth

Reference:
Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

GA(w+d)	5%	AC(mm)	95%
16+0	93	109	125
17+0	103	120	136
18+0	112	130	147
19+0	122	140	158
20+0	131	151	169
21+0	140	161	180
22+0	150	171	191
23+0	159	181	202
24+0	168	191	212
25+0	177	201	223
26+0	186	210	233
27+0	195	220	244
28+0	203	229	254
29+0	211	238	264
30+0	220	247	273
31+0	228	256	283
32+0	235	265	292
33+0	243	273	301
34+0	250	281	310
35+0	257	289	319
36+0	264	297	327
37+0	270	304	335
38+0	276	311	343
39+0	282	318	350
40+0	288	324	357
41+0	293	330	364
42+0	297	336	370

2.10.6 BPD(GA) Campbell85

BPD(GA) Campbell85
BPD - Biparietal Diameter
Fetal Growth

Reference:
Campbell S., Warsof S.L., Little D., Cooper D.J. "Routine Ultrasound Screening for the Prediction of Gestational Age". Obstetrics & Gynecology; Vol. 65; No. 5; May 1985; pages 613-620.

GA(w+d)	BPD(mm)	SD
12+0	21,2	3
13+0	21,7	2,8
14+0	27,8	3,2
15+0	31,4	2,8
16+0	35,3	2,9
17+0	38,7	2,4
18+0	41,5	2,9
19+0	46	3,1
20+0	48,2	3,2
21+0	51,2	3,1
22+0	54,2	3,4
23+0	58,2	2,3
24+0	61,6	3,9
25+0	64,2	5,8
26+0	65,9	5
27+0	70,9	5,2
28+0	75,8	3,2
29+0	78,7	3,4
30+0	80,3	4,3
31+0	82,2	3,9
32+0	85,7	3,5
33+0	86,7	2,8
34+0	89,4	3,6
35+0	91,6	3
36+0	91,4	4,2
37+0	93,5	3,9
38+0	93,5	4,4
39+0	96,2	3,9
40+0	95,9	3,3

2.10.7 BPD(GA) Hadlock84

BPD(GA) Hadlock84
BPD - Biparietal Diameter
Fetal Growth

Equation: BPD = -3.08 + 0.41*GA - 0.000061*pow(GA,3).
Equation input: GA (12-40 weeks).
Equation output: BPD (cm).

Reference:

Hadlock F.P., Deter R.L.; Harrist R.B., Park S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters". Radiology 1984; 152: 497-501.

GA(w+d)	BPD(mm)	SD
12+0	17	3
12+4	19	3
13+0	21	3
13+3	23	3
14+0	25	3
14+4	27	3
15+0	29	3
15+3	31	3
16+0	32	3
16+4	34	3
17+0	36	3
17+3	38	3
18+0	39	3
18+4	41	3
19+0	43	3
19+3	45	3
20+0	46	3
20+4	48	3
21+0	50	3
21+3	51	3
22+0	53	3
22+4	55	3
23+0	56	3
23+3	58	3
24+0	59	3
24+4	61	3
25+0	62	3
25+3	64	3
26+0	65	3

GA(w+d)	BPD(mm)	SD
26+4	67	3
27+0	68	3
27+3	69	3
28+0	71	3
28+4	72	3
29+0	73	3
29+3	75	3
30+0	76	3
30+4	77	3
31+0	78	3
31+3	79	3
32+0	81	3
32+4	82	3
33+0	83	3
33+3	84	3
34+0	85	3
34+4	86	3
35+0	87	3
35+3	88	3
36+0	89	3
36+4	89	3
37+0	90	3
37+3	91	3
38+0	92	3
38+4	92	3
39+0	93	3
39+3	94	3
40+0	94	3

2.10.8 BPD(GA) Hansmann86

BPD(GA) Hansmann86
BPD - Biparietal Diameter
Fetal Growth

Reference:
Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer-Verlag, New York, 1986. p.432.

GA(w+d)	Min	BPD(mm)	Max
12+0	15	20	25
13+0	19	24	29
14+0	23	28	32
15+0	27	32	35
16+0	31	35	39
17+0	34	38	42
18+0	38	42	46
19+0	41	46	50
20+0	44	49	53
21+0	48	52	57
22+0	51	56	60
23+0	54	59	64
24+0	57	62	67
25+0	60	65	71
26+0	63	68	74
27+0	66	71	77
28+0	68	74	80
29+0	71	77	83
30+0	73	80	86
31+0	75	82	88
32+0	78	85	91
33+0	80	87	93
34+0	82	89	95
35+0	84	91	97
36+0	86	93	99
37+0	88	95	101
38+0	89	96	102
39+0	90	98	104
40+0	92	99	105
41+0	93	100	106

2.10.9 BPD(GA) Jeanty84

BPD(GA) Jeanty84
BPD - Biparietal Diameter
Fetal Growth

Equation:	BPD = -19.634 + 3.0209*GA + 0.042134*pow(GA,2) - 0.0011756*pow(GA,3).
Equation input:	GA (10-40 weeks).
Equation output:	BPD (mm).

Reference:

Jeanty P., Cousaert E., Hobbins J.C., Tack B., Bracken M., Cantraine F. "A longitudinal Study of fetal head biometry". American Journal of Perinatology; Volume1; Number; January 1984; pages 118-128.

GA(w+d)	5%	BPD(mm)	95%
10+0	9	14	18
11+0	13	17	22
12+0	16	21	25
13+0	20	24	29
14+0	23	28	32
15+0	27	31	36
16+0	30	35	39
17+0	34	38	43
18+0	37	42	46
19+0	40	45	49
20+0	44	48	53
21+0	47	51	56
22+0	50	55	59
23+0	53	58	62
24+0	56	61	65
25+0	59	64	68
26+0	62	67	71
27+0	65	70	74
28+0	68	72	77
29+0	70	75	79
30+0	73	77	82
31+0	75	79	84
32+0	77	82	86
33+0	79	84	88
34+0	81	86	90
35+0	83	87	92
36+0	84	89	93
37+0	86	90	95
38+0	87	91	96
39+0	88	93	97
40+0	89	93	98

2.10.10 BPD(GA) Merz96

BPD(GA) Merz96
BPD - Biparietal Diameter
Fetal Growth

Reference:
Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	BPD(mm)	95%
12+4	21	25	29
13+0	23	26	30
13+3	24	28	31
14+0	25	29	33
14+4	27	31	35
15+0	28	32	36
15+3	30	34	38
16+0	31	35	39
16+4	33	37	41
17+0	35	39	43
17+3	36	40	45
18+0	38	42	46
18+4	40	44	48
19+0	41	46	50
19+3	43	47	52
20+0	45	49	53
20+4	46	51	55
21+0	48	52	57
21+3	49	54	59
22+0	51	56	60
22+4	53	57	62
23+0	54	59	64
23+3	56	61	65
24+0	57	62	67
24+4	59	64	69
25+0	61	65	70
25+3	62	67	72
26+0	64	68	73
26+4	65	70	75
27+0	66	71	77

GA(w+d)	5%	BPD(mm)	95%
27+3	68	73	78
28+0	69	74	79
28+4	71	76	81
29+0	72	77	82
29+3	73	78	84
30+0	74	80	85
30+4	76	81	86
31+0	77	82	88
31+3	78	83	89
32+0	79	85	90
32+4	80	86	91
33+0	81	87	92
33+3	82	88	93
34+0	83	89	95
34+4	84	90	96
35+0	85	91	97
35+3	86	92	97
36+0	87	92	98
36+4	87	93	99
37+0	88	94	100
37+3	89	95	101
38+0	89	95	101
38+4	90	96	102
39+0	90	96	103
39+3	91	97	103
40+0	91	97	103
40+4	91	97	104
41+0	91	98	104
41+3	92	98	104

2.10.11 BPD(GA) Rempen91

BPD(GA) Rempen91
BPD - Biparietal Diameter
Fetal Growth

Reference:
Der Frauenarzt 32, 4 (1991) 425-30.

GA(w+d)	BPD(mm)	2SD
6+2	2	3,7
6+3	2,5	3,7
6+4	3	3,7
6+5	3,4	3,7
6+6	3,9	3,7
7+0	4,3	3,7
7+1	4,8	3,7
7+2	5,3	3,7
7+3	5,7	3,7
7+4	6,2	3,7
7+5	6,7	3,7
7+6	7,1	3,7
8+0	7,6	3,7
8+1	8	3,7
8+2	8,5	3,7
8+3	8,9	3,7
8+4	9,4	3,7
8+5	9,8	3,7
8+6	10,3	3,7
9+0	10,7	3,7
9+1	11,2	3,7
9+2	11,6	3,7
9+3	12,1	3,7
9+4	12,5	3,7
9+5	13	3,7
9+6	13,4	3,7

GA(w+d)	BPD(mm)	2SD
10+0	13,9	3,7
10+1	14,3	3,7
10+2	14,8	3,7
10+3	15,2	3,7
10+4	15,7	3,7
10+5	16,1	3,7
10+6	16,5	3,7
11+0	17	3,7
11+1	17,4	3,7
11+2	17,9	3,7
11+3	18,3	3,7
11+4	18,7	3,7
11+5	19,2	3,7
11+6	19,6	3,7
12+0	20	3,7
12+1	20,5	3,7
12+2	20,9	3,7
12+3	21,3	3,7
12+4	21,8	3,7
12+5	22,2	3,7
12+6	22,6	3,7
13+0	23,1	3,7
13+1	23,5	3,7
13+2	23,9	3,7

2.10.12 BPD(GA) Sabbagha76

BPD(GA) Sabbagha76
BPD - Biparietal Diameter
Fetal Growth

Reference:
Sabbagha R.E., Barton B.A., Barton F.B., Kingas E., Orgill J., Turner J.H. "Sonar biparietal diameter II. Predictive of three fetal growth patterns leading to a closer assessment of gestational age and neonatal weight". American Journal of Obstetrics and Gynecology; October 15; 1976; pp.485-490.

GA(w+d)	5%	BPD(mm)	95%
16+0	31	37	45
17+0	34	40	47
18+0	37	43	49
19+0	39	45	51
20+0	42	47	53
21+0	45	50	55
22+0	49	53	58
23+0	52	56	62
24+0	55	59	66
25+0	58	62	70
26+0	61	66	73
27+0	64	69	76
28+0	66	72	79
29+0	68	75	83
30+0	71	78	86
31+0	73	80	88
32+0	75	83	90
33+0	77	85	91
34+0	79	87	93
35+0	82	88	96
36+0	83	90	97
37+0	84	92	98
38+0	85	93	99
39+0	87	94	100
40+0	89	95	101

2.10.13 BPD(GA) Tokyo96

BPD(GA) Tokyo96
BPD - Biparietal Diameter
Fetal Growth

Reference:

Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

GA(w+d)	-1.64SD	BPD(mm)	1.64SD
10+0	10,5	14,3	18,1
11+0	13,7	17,6	21,5
12+0	17	21	25
13+0	20,4	24,4	28,5
14+0	23,7	27,8	32
15+0	27	31,2	35,5
16+0	30,3	34,6	39
17+0	33,5	38	42,4
18+0	36,8	41,3	45,8
19+0	40	44,6	49,2
20+0	43,2	47,9	52,6
21+0	46,3	51,1	55,9
22+0	49,3	54,2	59,1
23+0	52,3	57,3	62,3
24+0	55,2	60,3	65,3
25+0	58	63,2	68,4
26+0	60,8	66	71,3
27+0	63,4	68,7	74,1
28+0	65,9	71,4	76,8
29+0	68,3	73,9	79,4
30+0	70,6	76,3	81,9
31+0	72,8	78,5	84,2
32+0	74,8	80,6	86,5
33+0	76,7	82,6	88,5
34+0	78,5	84,5	90,4
35+0	80,1	86,1	92,2
36+0	81,5	87,6	93,8
37+0	82,7	89	95,2
38+0	83,8	90,1	96,5
39+0	84,6	91,1	97,5
40+0	85,3	91,8	98,4
41+0	85,8	92,4	99
42+0	86	92,8	99,5

2.10.14 CRL(GA) Hadlock92

CRL(GA) Hadlock92
CRL - Crown Rump Length
Fetal Growth

Equation:	CRL = exp(-6.983 + 1.4498*GA - 0.078345*pow(GA,2) + 0.001501*pow(GA,3)).
Equation input:	GA (5-18 weeks).
Equation output:	CRL (cm).

Reference:

Hadlock F., Shah Y.P, Kanon D.J., Math B., Lindsey J.V. "Fetal Crown-Rump Length: Reevaluation of Relation to Menstrual Age (5-18 weeks) with High-Resolution Real-Time Ultrasound". Radiology, 182:501-502, 1992.

GA(w+d)	2.5%	CRL(mm)	97.5%
5+0	2	2,2	2,4
5+1	2,3	2,5	2,7
5+2	2,5	2,8	3
5+3	2,8	3,1	3,3
5+4	3,1	3,4	3,7
5+5	3,5	3,8	4,1
5+6	3,8	4,2	4,5
6+0	4,2	4,6	4,9
6+1	4,6	5	5,4
6+2	5,1	5,5	6
6+3	5,6	6,1	6,5
6+4	6,1	6,6	7,1
6+5	6,6	7,2	7,8
6+6	7,2	7,9	8,5
7+0	7,9	8,5	9,2
7+1	8,5	9,3	10
7+2	9,2	10	10,8
7+3	10	10,8	11,7
7+4	10,7	11,7	12,6
7+5	11,6	12,6	13,6
7+6	12,4	13,5	14,6
8+0	13,3	14,5	15,6
8+1	14,3	15,5	16,7
8+2	15,2	16,6	17,9
8+3	16,3	17,7	19,1
8+4	17,3	18,8	20,3
8+5	18,4	20	21,6
8+6	19,6	21,3	23
9+0	20,8	22,6	24,4
9+1	22	23,9	25,8
9+2	23,2	25,2	27,3
9+3	24,5	26,6	28,8
9+4	25,8	28,1	30,3
9+5	27,2	29,6	31,9
9+6	28,6	31,1	33,5
10+0	30	32,6	35,2
10+1	31,4	34,2	36,9
10+2	32,9	35,8	38,6
10+3	34,4	37,4	40,4
10+4	35,9	39	42,1
10+5	37,4	40,7	43,9
10+6	39	42,4	45,7
11+0	40,5	44,1	47,6
11+1	42,1	45,8	49,4
11+2	43,7	47,5	51,3
11+3	45,3	49,2	53,2
11+4	46,9	51	55

GA(w+d)	2.5%	CRL(mm)	97.5%
11+5	48,5	52,7	56,9
11+6	50,1	54,5	58,8
12+0	51,7	56,2	60,7
12+1	53,3	58	62,6
12+2	54,9	59,7	64,5
12+3	56,5	61,5	66,4
12+4	58,1	63,2	68,2
12+5	59,7	64,9	70,1
12+6	61,3	66,6	72
13+0	62,9	68,3	73,8
13+1	64,4	70	75,6
13+2	66	71,7	77,4
13+3	67,5	73,4	79,2
13+4	69	75	81
13+5	70,5	76,6	82,8
13+6	72	78,2	84,5
14+0	73,4	79,8	86,2
14+1	74,9	81,4	87,9
14+2	76,3	83	89,6
14+3	77,7	84,5	91,3
14+4	79,1	86	92,9
14+5	80,5	87,5	94,5
14+6	81,9	89	96,1
15+0	83,2	90,5	97,7
15+1	84,5	91,9	99,3
15+2	85,9	93,3	100,8
15+3	87,2	94,7	102,3
15+4	88,5	96,2	103,8
15+5	89,7	97,5	105,3
15+6	91	98,9	106,8
16+0	92,3	100,3	108,3
16+1	93,5	101,7	109,8
16+2	94,8	103	111,3
16+3	96	104,4	112,7
16+4	97,3	105,7	114,2
16+5	98,5	107,1	115,7
16+6	99,8	108,5	117,1
17+0	101	109,8	118,6
17+1	102,3	111,2	120,1
17+2	103,6	112,6	121,6
17+3	104,9	114	123,1
17+4	106,2	115,4	124,7
17+5	107,5	116,9	126,2
17+6	108,9	118,3	127,8
18+0	110,2	119,8	129,4

2.10.15 CRL(GA) Hansmann86

CRL(GA) Hansmann86
CRL - Crown Rump Length
Fetal Growth

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer-Verlag, New York, 1986.

GA(w+d)	-2SD	CRL(mm)	2SD
6+1	2,3	6,9	11,5
6+2	2,8	7,6	12,5
6+3	3,2	8,3	13,4
6+4	3,6	9	14,3
6+5	3,9	9,6	15,2
6+6	4,3	10,2	16,1
7+0	4,7	10,8	16,9
7+1	5	11,4	17,8
7+2	5,4	12,1	18,7
7+3	5,8	12,7	19,6
7+4	6,2	13,3	20,5
7+5	6,6	14	21,4
7+6	7	14,7	22,4
8+0	7,5	15,4	23,4
8+1	8	16,2	24,4
8+3	9,1	17,8	26,5
8+5	10,3	19,6	28,8
9+0	11,7	21,5	31,2
9+2	13,3	23,6	33,9
9+4	15,1	25,9	36,6
9+6	17	28,3	39,6
10+2	20,3	32,4	44,4
10+4	22,7	35,3	47,9
10+6	25,2	38,3	51,4
11+2	29,3	43,2	57,1
11+4	32,2	46,6	61,3
11+6	35,3	50,2	65,1
12+2	40	55,6	71,3

GA(w+d)	-2SD	CRL(mm)	2SD
12+4	43,2	59,4	75,5
12+6	46,4	63,1	79,8
13+2	51,3	68,8	86,3
13+4	55,6	72,6	90,6
13+6	57,8	76,3	94,8
14+2	62,5	81,8	101,1
14+4	65,6	85,4	105,2
14+6	68,6	88,9	109,2
15+2	72,8	93,9	115
15+4	75,5	97,1	118,7
15+6	78	100,1	122,2
16+2	81,5	104,4	127,3
16+4	83,6	107	130,4
16+6	85,6	109,5	133,4
17+2	88,3	113	137,7
17+4	89,9	115,1	140,4
17+6	91,5	117,2	142,9
18+2	93,5	120	146,5
18+4	94,8	121,9	148,9
18+6	96,2	123,7	151,2
19+1	97,5	125,5	153,6
19+3	98,9	127,4	156
19+5	100,3	129,4	158,5
20+0	102	131,6	161,2
20+1	102,9	132,8	162,6
20+2	104	134	164,1

2.10.16 CRL(GA) Rempen91

CRL(GA) Rempen91
CRL - Crown Rump Length
Fetal Growth

Reference:
Der Frauenarzt 32, 4 (1991) 425-30.

GA(w+d)	CRL(mm)	2SD
5+5	1,2	7,8
5+6	2,1	7,8
6+0	3	7,8
6+1	3,8	7,8
6+2	4,7	7,8
6+3	5,7	7,8
6+4	6,6	7,8
6+5	7,5	7,8
6+6	8,5	7,8
7+0	9,5	7,8
7+1	10,5	7,8
7+2	11,5	7,8
7+3	12,5	7,8
7+4	13,5	7,8
7+5	14,6	7,8
7+6	15,6	7,8
8+0	16,7	7,8
8+1	17,8	7,8
8+2	18,9	7,8
8+3	20	7,8
8+4	21,1	7,8
8+5	22,3	7,8
8+6	23,5	7,8
9+0	24,6	7,8
9+1	25,8	7,8
9+2	27	7,8
9+3	28,3	7,8
9+4	29,5	7,8

GA(w+d)	CRL(mm)	2SD
9+5	30,7	7,8
9+6	32	7,8
10+0	33,3	7,8
10+1	34,6	7,8
10+2	35,9	7,8
10+3	37,2	7,8
10+4	38,5	7,8
10+5	39,9	7,8
10+6	41,3	7,8
11+0	42,6	7,8
11+1	44	7,8
11+2	45,4	7,8
11+3	46,9	7,8
11+4	48,3	7,8
11+5	49,8	7,8
11+6	51,2	7,8
12+0	52,7	7,8
12+1	54,2	7,8
12+2	55,7	7,8
12+3	57,3	7,8
12+4	58,8	7,8
12+5	60,3	7,8
12+6	61,9	7,8
13+0	63,5	7,8
13+1	65,1	7,8
13+2	66,7	7,8

2.10.17 CRL(GA) Robinson75

CRL(GA) Robinson75
CRL - Crown Rump Length
Fetal Growth

Reference:

Robinson H.P., Fleming J.E.E. A critical evaluation of Sonar Crown-Rump Length measurements. British Journal of Obstetrics and Gynecology; Volume 82:702-710, September 1975.

GA(w+d)	CRL(mm)	2SD
6+2	6,7	2,9
6+3	7,4	3,1
6+4	8	3,2
6+5	8,7	3,4
6+6	9,5	3,5
7+0	10,2	3,7
7+1	11	3,8
7+2	11,8	3,9
7+3	12,6	4,1
7+4	13,5	4,2
7+5	14,4	4,4
7+6	15,3	4,5
8+0	16,3	4,6
8+1	17,3	4,8
8+2	18,3	4,9
8+3	19,3	5,1
8+4	20,4	5,2
8+5	21,5	5,3
8+6	22,6	5,5
9+0	23,8	5,6
9+1	25	5,8
9+2	26,2	5,9
9+3	27,4	6
9+4	28,7	6,2
9+5	30	6,3
9+6	31,3	6,5
10+0	32,7	6,6
10+1	34	6,7

GA(w+d)	CRL(mm)	2SD
10+2	35,5	6,9
10+3	36,9	7
10+4	38,4	7,2
10+5	39,9	7,3
10+6	41,4	7,4
11+0	43	7,6
11+1	44,6	7,7
11+2	46,2	7,9
11+3	47,8	8
11+4	49,5	8,1
11+5	51,2	8,3
11+6	52,9	8,4
12+0	54,7	8,6
12+1	56,5	8,7
12+2	58,3	8,8
12+3	60,1	9
12+4	62	9,1
12+5	63,9	9,3
12+6	65,9	9,4
13+0	67,8	9,5
13+1	69,8	9,7
13+2	71,8	9,8
13+3	73,9	10
13+4	76	10,1
13+5	78,1	10,2
13+6	80,2	10,4
14+0	82,4	10,5

2.10.18 CRL(GA) Tokyo96

CRL(GA) Tokyo96
CRL - Crown Rump Length
Fetal Growth

Reference:

Shinozuka; Jpn. J. Med. Ultrasonics 23: 12 1996.

GA(w+d)	CRL(mm)	1.64SD
7+0	7,9	1,7
7+1	8,6	1,9
7+2	9,3	2
7+3	10,1	2,2
7+4	10,9	2,3
7+5	11,7	2,5
7+6	12,5	2,6
8+0	13,4	2,8
8+1	14,3	2,9
8+2	15,2	3,1
8+3	16,1	3,3
8+4	17,1	3,4
8+5	18,1	3,6
8+6	19,1	3,7
9+0	20,1	3,9
9+1	21,2	4
9+2	22,3	4,2
9+3	23,4	4,3
9+4	24,5	4,5
9+5	25,7	4,6
9+6	26,8	4,8
10+0	28	4,9
10+1	29,3	5,1
10+2	30,5	5,2
10+3	31,8	5,4
10+4	33,1	5,5
10+5	34,4	5,7
10+6	35,8	5,9
11+0	37,1	6
11+1	38,5	6,2
11+2	40	6,3
11+3	41,4	6,5
11+4	42,9	6,6
11+5	44,4	6,8
11+6	45,9	6,9
12+0	47,4	7,1
12+1	49	7,2
12+2	50,6	7,4
12+3	52,2	7,5
12+4	53,9	7,7
12+5	55,5	7,8
12+6	57,2	8
13+0	58,9	8,2

2.10.19 CRL(GA) Tokyo96

CRL(GA) Tokyo96
CRL - Crown Rump Length
Fetal Growth

Reference:

Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

GA(w+d)	5%	CRL(mm)	95%
7+0	5,1	7,9	10,7
7+1	5,5	8,6	11,7
7+2	6	9,3	12,7
7+3	6,5	10,1	13,7
7+4	7,1	10,9	14,7
7+5	7,6	11,7	15,8
7+6	8,2	12,5	16,9
8+0	8,8	13,4	18
8+1	9,5	14,3	19,1
8+2	10,1	15,2	20,3
8+3	10,8	16,1	21,5
8+4	11,5	17,1	22,7
8+5	12,2	18,1	23,9
8+6	13	19,1	25,2
9+0	13,8	20,1	26,5
9+1	14,6	21,2	27,8
9+2	15,4	22,3	29,1
9+3	16,3	23,4	30,5
9+4	17,2	24,5	31,8
9+5	18,1	25,7	33,2
9+6	19	26,8	34,7
10+0	19,9	28	36,1
10+1	20,9	29,3	37,6
10+2	21,9	30,5	39,1
10+3	22,9	31,8	40,6
10+4	24	33,1	42,2
10+5	25,1	34,4	43,8
10+6	26,2	35,8	45,4
11+0	27,3	37,1	47
11+1	28,4	38,5	48,6
11+2	29,6	40	50,3
11+3	30,8	41,4	52
11+4	32	42,9	53,7
11+5	33,3	44,4	55,5
11+6	34,5	45,9	57,3
12+0	35,8	47,4	59,1
12+1	37,2	49	60,9
12+2	38,5	50,6	62,7
12+3	39,9	52,2	64,6
12+4	41,3	53,9	66,5
12+5	42,7	55,5	68,4
12+6	44,1	57,2	70,3
13+0	45,6	58,9	72,3

2.10.20 FL(GA) Chitty84

FL(GA) Chitty84
FL - Femur Length
Fetal Growth

Reference:

Chitty L.S., Altmann D.G., Henderson A., Campbell S. "Charts of fetal size: 4. Femur length". British Journal of Obstetrics and Gynecology; February 1984; Vol.101; pp. 132-135.

GA(w+d)	10%	FL(mm)	90%
12+0	5,5	7,7	10
13+0	8,6	10,9	13,3
14+0	11,7	14,1	16,5
15+0	14,7	17,2	19,7
16+0	17,7	20,3	22,8
17+0	20,7	23,3	25,9
18+0	23,6	26,3	29
19+0	26,4	29,2	32
20+0	29,2	32,1	34,9
21+0	32	34,9	37,8
22+0	34,6	37,6	40,6
23+0	37,2	40,3	43,4
24+0	39,8	42,9	46,1
25+0	42,3	45,5	48,7
26+0	44,7	48	51,3
27+0	47	50,4	53,8
28+0	49,3	52,7	56,2
29+0	51,4	55	58,5
30+0	53,5	57,1	60,7
31+0	55,5	59,2	62,9
32+0	57,4	61,2	64,9
33+0	59,3	63,1	66,9
34+0	61	64,9	68,8
35+0	62,6	66,6	70,6
36+0	64,2	68,2	72,3
37+0	65,6	69,7	73,8
38+0	66,9	71,1	75,3
39+0	68,1	72,4	76,7
40+0	69,2	73,6	77,9
41+0	70,2	74,6	79
42+0	71,1	75,6	80,1

2.10.21 FL(GA) Hadlock84

FL(GA) Hadlock84
FL - Femur Length
Fetal Growth

Equation: FL = -3.91 + 0.427*GA - 0.0034*pow(GA,2).
Equation input: GA (12-40 weeks).
Equation output: FL (cm).

Reference:

Hadlock F.P., Deter R.L.; Harrist R.B., Park S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters". Radiology 1984; 152: 497-501.

GA(w+d)	FL(mm)	SD
12+0	7	3
12+4	9	3
13+0	11	3
13+3	12	3
14+0	14	3
14+4	16	3
15+0	17	3
15+3	19	3
16+0	20	3
16+4	22	3
17+0	24	3
17+3	25	3
18+0	27	3
18+4	28	3
19+0	30	3
19+3	31	3
20+0	33	3
20+4	34	3
21+0	35	3
21+3	37	3
22+0	38	3
22+4	40	3
23+0	41	3
23+3	42	3
24+0	44	3
24+4	45	3
25+0	46	3
25+3	47	3
26+0	49	3
26+4	50	3
27+0	51	3
27+3	52	3
28+0	54	3
28+4	55	3
29+0	56	3
29+3	57	3
30+0	58	3
30+4	59	3
31+0	60	3
31+3	61	3
32+0	62	3
32+4	63	3
33+0	64	3
33+3	65	3
34+0	66	3
34+4	67	3
35+0	68	3
35+3	69	3
36+0	70	3
36+4	71	3
37+0	72	3
37+3	73	3
38+0	74	3
38+4	74	3
39+0	75	3
39+3	76	3
40+0	77	3

2.10.22 FL(GA) Hansmann86

FL(GA) Hansmann86
FL - Femur Length
Fetal Growth

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p.431.

GA(w+d)	5%	FL(mm)	95%
13+0	8	10	15
14+0	10	12	17
15+0	13	16	21
16+0	15	18	23
17+0	18	22	26
18+0	21	25	29
19+0	24	28	32
20+0	27	31	35
21+0	29	34	38
22+0	32	36	41
23+0	34	39	44
24+0	37	41	47
25+0	39	44	49
26+0	42	47	52
27+0	44	49	55
28+0	46	51	57
29+0	49	54	59
30+0	51	56	62
31+0	53	59	64
32+0	55	61	66
33+0	57	63	68
34+0	59	65	70
35+0	61	67	72
36+0	63	69	74
37+0	65	71	77
38+0	67	73	79
39+0	68	74	81
40+0	70	75	84

2.10.23 FL(GA) Jeanty84

FL(GA) Jeanty84
FL - Femur Length
Fetal Growth

Equation: FL = -2.5252 + 0.2555*GA + 0.0027566*pow(GA,2) - 7.3286* pow(GA,3)* pow(10,-5).
Equation input: GA (12-40 weeks).
Equation output: FL (cm).

Reference:

Jeanty P., Cousaert E., Cantraine F., Hobbins J.C., Tack B., Struyven J. " A longitudinal Study of fetal limb growth". American Journal of Perinatology; Volume 1; Number 2; January 1984; 136-141.

GA(w+d)	5%	FL(mm)	95%
12+0	4	8	13
13+0	6	11	16
14+0	9	14	18
15+0	12	17	21
16+0	15	20	24
17+0	18	23	27
18+0	21	25	30
19+0	24	28	33
20+0	26	31	36
21+0	29	34	38
22+0	32	36	41
23+0	35	39	44
24+0	37	42	46
25+0	40	44	49
26+0	42	47	51
27+0	45	49	54
28+0	47	52	56
29+0	50	54	59
30+0	52	56	61
31+0	54	59	63
32+0	56	61	65
33+0	58	63	67
34+0	60	65	69
35+0	62	67	71
36+0	64	68	73
37+0	65	70	74
38+0	67	71	76
39+0	68	73	77
40+0	70	74	79

2.10.24 FL(GA) Merz96

FL(GA) Merz96
FL - Femur Length
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	FL(mm)	95%
12+4	6	9	12
13+0	8	11	14
13+3	10	13	16
14+0	11	15	18
14+4	13	16	20
15+0	15	18	21
15+3	16	20	23
16+0	18	21	25
16+4	19	23	26
17+0	21	24	28
17+3	22	26	29
18+0	24	27	31
18+4	25	29	32
19+0	27	30	34
19+3	28	32	35
20+0	29	33	37
20+4	31	35	38
21+0	32	36	40
21+3	33	37	41
22+0	35	39	42
22+4	36	40	44
23+0	37	41	45
23+3	39	43	46
24+0	40	44	48
24+4	41	45	49
25+0	42	46	50
25+3	43	48	52
26+0	45	49	53
26+4	46	50	54
27+0	47	51	55

GA(w+d)	5%	FL(mm)	95%
27+3	48	52	57
28+0	49	53	58
28+4	50	55	59
29+0	51	56	60
29+3	52	57	61
30+0	53	58	62
30+4	54	59	63
31+0	55	60	64
31+3	56	61	66
32+0	57	62	67
32+4	58	63	68
33+0	59	64	69
33+3	60	65	70
34+0	61	66	71
34+4	62	67	72
35+0	63	68	73
35+3	64	69	74
36+0	65	70	74
36+4	66	70	75
37+0	66	71	76
37+3	67	72	77
38+0	68	73	78
38+4	69	74	79
39+0	69	74	79
39+3	70	75	80
40+0	71	76	81
40+4	71	76	81
41+0	72	77	82
41+3	72	77	83

2.10.25 FL(GA) O'Brien81

FL(GA) O'Brien81
FL - Femur Length
Fetal Growth

Reference:

O'Brien G.D., Queenan J.T. "Growth of the ultrasound fetal femur length during normal pregnancy. Part I". American Journal in Obstetrics and Gynecology; December 1981; 141(7); pp. 833-887.

GA(w+d)	-2SD	FL(mm)	2SD
14+0	14	17	19
15+0	18	20	22
16+0	19	22	25
17+0	22	25	28
18+0	27	30	33
19+0	29	32	36
20+0	32	35	37
21+0	33	38	42
22+0	37	41	45
23+0	40	44	47
24+0	43	46	50
25+0	43	48	53
26+0	46	51	56
27+0	50	53	56
28+0	50	54	59
29+0	53	57	62
30+0	55	59	63
31+0	57	62	66
32+0	59	63	67
33+0	60	65	70
34+0	61	66	70
35+0	63	68	73
36+0	65	70	74
37+0	67	71	75
38+0	66	72	77
39+0	69	74	79
40+0	70	75	81

2.10.26 FL(GA) Tokyo96

FL(GA) Tokyo96
FL - Femur Length
Fetal Growth

Reference:

Shinozuka N., Masuda H., Kagawa H., Taketani Y. Department of Obstetrics and Gynecology, Faculty of Medicine, University of Tokyo. "Standard Values of Ultrasonographic Fetal Biometry". Jpn J Med Ultrasonics 23 (12) 877-888; 1996.

GA(w+d)	5%	FL(mm)	95%
16+0	17,1	21,4	25,8
17+0	19,6	24	28,4
18+0	22,1	26,5	31
19+0	24,6	29,1	33,6
20+0	27,1	31,6	36,2
21+0	29,5	34,1	38,8
22+0	31,9	36,6	41,3
23+0	34,3	39,1	43,8
24+0	36,7	41,5	46,3
25+0	39	43,9	48,7
26+0	41,3	46,2	51,1
27+0	43,5	48,4	53,4
28+0	45,6	50,6	55,7
29+0	47,7	52,8	57,9
30+0	49,7	54,8	60
31+0	51,6	56,8	62
32+0	53,5	58,7	64
33+0	55,2	60,5	65,8
34+0	56,9	62,2	67,6
35+0	58,4	63,8	69,2
36+0	59,9	65,3	70,8
37+0	61,2	66,7	72,2
38+0	62,4	68	73,6
39+0	63,5	69,1	74,7
40+0	64,4	70,1	75,8
41+0	65,3	71	76,7
42+0	65,9	71,7	77,5

2.10.27 FL(GA) Warda85

FL(GA) Warda85
FL - Femur Length
Fetal Growth

Equation: FL = -3.8929 + 0.42062*GA - 0.0034513*pow(GA,2).
Equation input: GA (12-40 weeks).
Equation output: FL (cm).

Reference:

Warda A.H.; Deter R.L.; Rossavik I.K.; Carpenter R.J.; Hadlock F.P. "Fetal Femur Length: A Critical Reevaluation of the Relationship to Menstrual Age". Ultrasound in Obstetrics and Gynecology Vol. 66: 69-75, 1985.

GA(w+d)	Min	FL(mm)	Max
12+0	6	7	8
13+0	9	10	11
14+0	11	13	15
15+0	14	16	18
16+0	17	20	23
17+0	20	23	26
18+0	22	26	30
19+0	25	29	33
20+0	27	31	35
21+0	29	34	39
22+0	32	37	42
23+0	34	40	46
24+0	36	42	48
25+0	39	45	51
26+0	40	47	54
27+0	42	49	56
28+0	45	52	59
29+0	46	54	62
30+0	48	56	64
31+0	50	58	66
32+0	52	60	68
33+0	53	62	71
34+0	55	64	73
35+0	57	66	75
36+0	58	68	78
37+0	59	69	79
38+0	61	71	81
39+0	63	73	83
40+0	64	74	84

2.10.28 GS(GA) Hellman69

GS(GA) Hellman69
GS - Gestational Sac Diameter
Fetal Growth

Equation:	GS = 0.702*GA - 2.543.
Equation input:	GA (4-11 weeks).
Equation output:	GS (cm).

Reference:

Hellman LM, Kobayashi M, Fillisti L., et al. "Growth and development of the human fetus prior to the 20th week of gestation". American Journal of Obstetrics and Gynecology; March 15; 1969; 789-800.

GA(w+d)	GS(mm)
4+0	2,7
4+4	6,2
5+0	9,7
5+3	13,2
6+0	16,7
6+4	20,2
7+0	23,7
7+3	27,2
8+0	30,7
8+4	34,2
9+0	37,8
9+3	41,3
10+0	44,8
10+4	48,3
11+0	51,8

2.10.29 GS(GA) Rempen91

GS(GA) Rempen91
GS - Gestational Sac Diameter
Fetal Growth

Reference:

Rempen A. Biometrie in der FrГjhgraviditГ¤t (I. Trimenon). Der Frauenarzt; 32:4 (1991) 425-30.

GA(w+d)	5%	GS(mm)	95%
4+4	0	0,5	11
4+5	0	1,8	12,3
4+6	0	3,2	13,7
5+0	0	4,5	15
5+1	0	5,8	16,3
5+2	0	7,1	17,6
5+3	0	8,4	18,9
5+4	0	9,7	20,2
5+5	0,4	10,9	21,4
5+6	1,7	12,2	22,7
6+0	2,9	13,4	23,9
6+1	4,1	14,6	25,1
6+2	5,4	15,9	26,4
6+3	6,6	17,1	27,6
6+4	7,8	18,3	28,8
6+5	8,9	19,4	29,9
6+6	10,1	20,6	31,1
7+0	11,2	21,7	32,2
7+1	12,4	22,9	33,4
7+2	13,5	24	34,5
7+3	14,6	25,1	35,6
7+4	15,7	26,2	36,7
7+5	16,8	27,3	37,8
7+6	17,9	28,4	38,9
8+0	19	29,5	40
8+1	20	30,5	41
8+2	21,1	31,6	42,1
8+3	22,1	32,6	43,1
8+4	23,1	33,6	44,1
8+5	24,1	34,6	45,1
8+6	25,1	35,6	46,1
9+0	26,1	36,6	47,1
9+1	27,1	37,6	48,1
9+2	28	38,5	49
9+3	29	39,5	50
9+4	29,9	40,4	50,9
9+5	30,8	41,3	51,8
9+6	31,7	42,2	52,7
10+0	32,6	43,1	53,6
10+1	33,5	44	54,5
10+2	34,4	44,9	55,4
10+3	35,2	45,7	56,2
10+4	36,1	46,6	57,1
10+5	36,9	47,4	57,9
10+6	37,7	48,2	58,7
11+0	38,5	49	59,5
11+1	39,3	49,8	60,3
11+2	40,1	50,6	61,1
11+3	40,9	51,4	61,9
11+4	41,6	52,1	62,6
11+5	42,4	52,9	63,4
11+6	43,1	53,6	64,1
12+0	43,8	54,3	64,8
12+1	44,6	55,1	65,6
12+2	45,3	55,8	66,3
12+3	45,9	56,4	66,9
12+4	46,6	57,1	67,6
12+5	47,3	57,8	68,3
12+6	47,9	58,4	68,9
13+0	48,6	59,1	69,6
13+1	49,2	59,7	70,2
13+2	49,8	60,3	70,8

2.10.30 HC(GA) Hadlock84

HC(GA) Hadlock84
HC - Head Circumference
Fetal Growth

Equation: HC = -11.48 + 1.56*GA - 0.0002548* pow(GA,3).
Equation input: GA (12-40 weeks).
Equation output: HC (cm).

Reference:

Hadlock F.P., Deter R.L.; Harrist R.B., Park S.K. "Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters". Radiology 1984; 152: 497-501.

GA(w+d)	HC(mm)	SD
12+0	68	10
12+4	75	10
13+0	82	10
13+3	89	10
14+0	97	10
14+4	104	10
15+0	110	10
15+3	117	10
16+0	124	10
16+4	131	10
17+0	138	10
17+3	144	10
18+0	151	10
18+4	158	10
19+0	164	10
19+3	170	10
20+0	177	10
20+4	183	10
21+0	189	10
21+3	195	10
22+0	201	10
22+4	207	10
23+0	213	10
23+3	219	10
24+0	224	10
24+4	230	10
25+0	235	10
25+3	241	10
26+0	246	10

GA(w+d)	HC(mm)	SD
26+4	251	10
27+0	256	10
27+3	261	10
28+0	266	10
28+4	271	10
29+0	275	10
29+3	280	10
30+0	284	10
30+4	288	10
31+0	293	10
31+3	297	10
32+0	301	10
32+4	304	10
33+0	308	10
33+3	312	10
34+0	315	10
34+4	318	10
35+0	322	10
35+3	325	10
36+0	328	10
36+4	330	10
37+0	333	10
37+3	335	10
38+0	338	10
38+4	340	10
39+0	342	10
39+3	344	10
40+0	346	10

2.10.31 HC(GA) Hansmann86

HC(GA) Hansmann86
HC - Head Circumference
Fetal Growth

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p.434.

GA(w+d)	5%	HC(mm)	95%
14+0	94	106	120
15+0	103	115	129
16+0	114	127	141
17+0	125	140	153
18+0	138	152	166
19+0	149	164	180
20+0	161	176	193
21+0	173	190	206
22+0	185	203	219
23+0	198	215	232
24+0	210	226	244
25+0	223	240	257
26+0	234	251	268
27+0	244	263	280
28+0	254	274	290
29+0	263	284	301
30+0	273	293	310
31+0	282	303	320
32+0	290	311	328
33+0	297	318	335
34+0	303	325	343
35+0	310	332	349
36+0	315	337	355
37+0	321	340	360
38+0	325	344	364
39+0	329	347	369
40+0	333	349	372

2.10.32 HC(GA) Jeanty82

HC(GA) Jeanty82
HC - Head Circumference
Fetal Growth

Reference:
Jeanty; Radiology 143: 513; 1982.

GA(w+d)	5%	HC(mm)	95%
12+0	51	75	100
13+0	64	88	112
14+0	76	101	125
15+0	89	113	138
16+0	101	126	150
17+0	114	138	163
18+0	126	151	175
19+0	138	163	187
20+0	150	175	199
21+0	162	187	211
22+0	174	198	223
23+0	185	210	234
24+0	196	221	245
25+0	207	232	256
26+0	218	242	266
27+0	228	252	277
28+0	238	262	286
29+0	247	271	296
30+0	256	281	305
31+0	265	289	313
32+0	273	297	322
33+0	281	305	329
34+0	288	312	336
35+0	294	319	343
36+0	300	325	349
37+0	306	330	355
38+0	311	335	359
39+0	315	339	364
40+0	319	343	367

2.10.33 HC(GA) Merz96

HC(GA) Merz96
HC - Head Circumference
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	HC(mm)	95%
12+4	80	92	104
13+0	84	96	108
13+3	89	101	113
14+0	94	106	119
14+4	100	112	124
15+0	105	118	130
15+3	111	124	137
16+0	117	130	143
16+4	123	136	149
17+0	130	143	156
17+3	136	149	162
18+0	142	155	168
18+4	148	162	175
19+0	155	168	181
19+3	161	174	188
20+0	167	181	194
20+4	173	187	201
21+0	180	193	207
21+3	186	200	214
22+0	192	206	220
22+4	198	212	226
23+0	204	218	232
23+3	210	224	238
24+0	216	230	244
24+4	221	236	250
25+0	227	241	256
25+3	232	247	262
26+0	238	253	267
26+4	243	258	273
27+0	248	263	278

GA(w+d)	5%	HC(mm)	95%
27+3	253	268	284
28+0	258	273	289
28+4	263	278	294
29+0	268	283	299
29+3	272	288	303
30+0	277	292	308
30+4	281	297	313
31+0	285	301	317
31+3	289	305	321
32+0	293	309	325
32+4	297	313	329
33+0	300	316	333
33+3	303	320	336
34+0	307	323	340
34+4	310	326	343
35+0	313	329	346
35+3	315	332	349
36+0	318	335	352
36+4	320	337	354
37+0	322	339	356
37+3	324	341	359
38+0	326	343	361
38+4	327	345	362
39+0	329	346	364
39+3	330	348	365
40+0	331	349	366
40+4	332	349	367
41+0	332	350	368
41+3	332	350	369

2.10.34 HL(GA) Jeanty84

HL(GA) Jeanty84
HL - Humerus Length
Fetal Growth

Equation:
HL = -1.624 + 0.076315*GA + 0.01683*pow(GA,2) - 0.00056212*pow(GA,3) + 5.5666*pow(GA,4)*pow(10,-6).
Equation input: GA (12-40 weeks).
Equation output: HL (cm).

Reference:
Jeanty P., Cousaert E., Cantraine F., Hobbins J.C., Tack B., Struyven J. "A longitudinal Study of fetal limb growth". American Journal of Perinatology; Volume 1; Number 2; January 1984; 136-141.

GA(w+d)	5%	HL(mm)	95%
12+0	4	9	13
13+0	7	11	15
14+0	10	14	18
15+0	13	17	21
16+0	16	20	24
17+0	18	22	27
18+0	21	25	29
19+0	24	28	32
20+0	26	30	34
21+0	29	33	37
22+0	31	35	39
23+0	33	38	42
24+0	36	40	44
25+0	38	42	46
26+0	40	44	48
27+0	42	46	50
28+0	44	48	52
29+0	46	50	54
30+0	47	51	56
31+0	49	53	57
32+0	51	55	59
33+0	52	56	60
34+0	54	58	62
35+0	55	59	63
36+0	56	61	65
37+0	58	62	66
38+0	59	63	67
39+0	61	65	69
40+0	62	66	70

2.10.35 HL(GA) Merz96

HL(GA) Merz96
HL - Humerus Length
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	HL(mm)	95%
12+4	5	8	11
13+0	7	10	13
13+3	9	12	15
14+0	10	13	17
14+4	12	15	18
15+0	14	17	20
15+3	15	18	22
16+0	17	20	23
16+4	18	21	25
17+0	20	23	26
17+3	21	24	28
18+0	22	26	29
18+4	24	27	30
19+0	25	28	32
19+3	26	30	33
20+0	27	31	34
20+4	29	32	36
21+0	30	33	37
21+3	31	35	38
22+0	32	36	39
22+4	33	37	40
23+0	34	38	42
23+3	36	39	43
24+0	37	40	44
24+4	38	41	45
25+0	39	42	46
25+3	40	43	47
26+0	41	45	48
26+4	42	46	49
27+0	43	47	50

GA(w+d)	5%	HL(mm)	95%
27+3	44	47	51
28+0	45	48	52
28+4	45	49	53
29+0	46	50	54
29+3	47	51	55
30+0	48	52	56
30+4	49	53	57
31+0	50	54	58
31+3	51	55	59
32+0	51	55	60
32+4	52	56	60
33+0	53	57	61
33+3	54	58	62
34+0	54	59	63
34+4	55	59	63
35+0	56	60	64
35+3	56	61	65
36+0	57	61	66
36+4	58	62	66
37+0	58	63	67
37+3	59	63	68
38+0	59	64	68
38+4	60	64	69
39+0	60	65	69
39+3	61	65	70
40+0	61	66	70
40+4	61	66	71
41+0	62	66	71
41+3	62	67	71

2.10.36 OFD(GA) Hansmann86

OFD(GA) Hansmann86
OFD - Occipito Frontal Diameter
Fetal Growth

Reference:

Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986.

GA(w+d)	5%	OFD(mm)	95%
14+0	25	31	35
15+0	32	38	42
16+0	36	41	46
17+0	41	46	51
18+0	45	50	55
19+0	49	54	60
20+0	53	58	64
21+0	57	63	69
22+0	61	67	73
23+0	65	72	78
24+0	69	76	82
25+0	73	80	87
26+0	76	84	91
27+0	80	88	95
28+0	83	91	98
29+0	87	95	101
30+0	89	98	105
31+0	92	100	107
32+0	95	103	110
33+0	97	105	112
34+0	99	107	115
35+0	101	109	117
36+0	103	111	118
37+0	104	112	120
38+0	105	113	121
39+0	106	114	123
40+0	107	115	124

2.10.37 OFD(GA) Jeanty84

OFD(GA) Jeanty84
OFD - Occipito Frontal Diameter
Fetal Growth

Equation:	OFD = -2.6934 + 0.37701*GA + 0.0046395*pow(GA,2) - 0.00012939*pow(GA,3).
Equation input:	GA (10-40 weeks).
Equation output:	OFD (cm).

Reference:

Jeanty P., Cousaert E., Hobbins J.C., Tack B., Bracken M., Cantraine F. "A longitudinal study of fetal head biometry". American Journal of Perinatology; Volume 1; Number 2; January 1984.

GA(w+d)	5%	OFD(mm)	95%
10+0	7	14	21
11+0	11	18	25
12+0	16	23	30
13+0	20	27	34
14+0	24	31	38
15+0	29	36	43
16+0	33	40	47
17+0	37	44	51
18+0	41	48	55
19+0	46	53	60
20+0	50	57	64
21+0	54	61	68
22+0	58	65	72
23+0	62	69	76
24+0	65	72	79
25+0	69	76	83
26+0	73	80	87
27+0	76	83	90
28+0	80	87	94
29+0	83	90	97
30+0	86	93	100
31+0	89	96	103
32+0	92	99	106
33+0	95	102	108
34+0	97	104	111
35+0	99	106	113
36+0	102	109	116
37+0	104	111	118
38+0	105	112	119
39+0	107	114	121
40+0	108	115	122

2.10.38 OFD(GA) Merz96

OFD(GA) Merz96
OFD - Occipito Frontal Diameter
Fetal Growth

Reference:
Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	OFD(mm)	95%
12+4	26	30	34
13+0	28	32	36
13+3	29	34	38
14+0	31	35	40
14+4	33	37	41
15+0	35	39	43
15+3	37	41	46
16+0	39	43	48
16+4	41	45	50
17+0	43	47	52
17+3	45	50	54
18+0	47	52	56
18+4	49	54	59
19+0	51	56	61
19+3	54	58	63
20+0	56	60	65
20+4	58	63	67
21+0	60	65	69
21+3	62	67	72
22+0	64	69	74
22+4	66	71	76
23+0	68	73	78
23+3	70	75	80
24+0	72	77	82
24+4	74	79	84
25+0	75	81	86
25+3	77	82	88
26+0	79	84	90
26+4	81	86	91
27+0	82	88	93

GA(w+d)	5%	OFD(mm)	95%
27+3	84	90	95
28+0	86	91	97
28+4	87	93	98
29+0	89	94	100
29+3	90	96	101
30+0	92	97	103
30+4	93	99	104
31+0	94	100	106
31+3	96	101	107
32+0	97	102	108
32+4	98	104	110
33+0	99	105	111
33+3	100	106	112
34+0	101	107	113
34+4	102	108	114
35+0	103	109	115
35+3	103	110	116
36+0	104	110	116
36+4	105	111	117
37+0	105	112	118
37+3	106	112	119
38+0	106	113	119
38+4	107	113	120
39+0	107	114	120
39+3	108	114	120
40+0	108	114	121
40+4	108	114	121
41+0	108	115	121
41+3	108	115	121

2.10.39 TL(GA) Jeanty84

TL(GA) Jeanty84
TL - Tibia Length
Fetal Growth

Equation:
TL = -0.5555 - 0.091554*GA + 0.023359*pow(GA,2) - 6.387*pow(GA,3)* pow(10,-4) + 5.5801*pow(GA,4)* pow(10,-6).
Equation input: GA (12-40 weeks).
Equation output: TL (cm).

Reference:

Jeanty P., Cousaert E., Cantraine F., Hobbins J.C., Tack B., Struyven J. "A longitudinal Study of fetal limb growth". American Journal of Perinatology; Volume 1; Number 2; January 1984; 136-141.

GA(w+d)	5%	TL(mm)	95%
12+0	3	7	12
13+0	5	10	14
14+0	8	12	16
15+0	10	15	19
16+0	13	17	21
17+0	15	20	24
18+0	18	22	27
19+0	21	25	29
20+0	23	27	32
21+0	26	30	34
22+0	28	32	37
23+0	31	35	39
24+0	33	37	42
25+0	35	40	44
26+0	37	42	46
27+0	40	44	48
28+0	42	46	50
29+0	44	48	52
30+0	46	50	54
31+0	47	52	56
32+0	49	54	58
33+0	51	55	60
34+0	53	57	61
35+0	54	58	63
36+0	56	60	64
37+0	57	61	66
38+0	59	63	67
39+0	60	64	69
40+0	61	66	70

2.10.40 TL(GA) Merz96

TL(GA) Merz96
TL - Tibia Length
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones. Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	TL(mm)	95%
12+4	4	7	10
13+0	6	9	12
13+3	7	10	13
14+0	9	12	15
14+4	11	14	17
15+0	12	15	18
15+3	14	17	20
16+0	15	18	21
16+4	16	20	23
17+0	18	21	24
17+3	19	22	26
18+0	21	24	27
18+4	22	25	29
19+0	23	26	30
19+3	24	28	31
20+0	26	29	32
20+4	27	30	34
21+0	28	31	35
21+3	29	33	36
22+0	30	34	37
22+4	31	35	39
23+0	33	36	40
23+3	34	37	41
24+0	35	38	42
24+4	36	40	43
25+0	37	41	44
25+3	38	42	45
26+0	39	43	47
26+4	40	44	48
27+0	41	45	49
27+3	42	46	50

GA(w+d)	5%	TL(mm)	95%
28+0	43	47	51
28+4	44	48	52
29+0	45	49	53
29+3	46	50	54
30+0	46	51	55
30+4	47	51	56
31+0	48	52	56
31+3	49	53	57
32+0	50	54	58
32+4	51	55	59
33+0	51	56	60
33+3	52	56	61
34+0	53	57	62
34+4	54	58	62
35+0	54	59	63
35+3	55	59	64
36+0	56	60	65
36+4	56	61	65
37+0	57	62	66
37+3	58	62	67
38+0	58	63	67
38+4	59	63	68
39+0	59	64	69
39+3	60	64	69
40+0	60	65	70
40+4	61	65	70
41+0	61	66	71
41+3	61	66	71

2.10.41 UL(GA) Jeanty84

UL(GA) Jeanty84
UL - Ulna Length
Fetal Growth

Equation: UL = -3.4313 + 0.38685*GA - 0.0036949*pow(GA,2).
Equation input: GA (12-40 weeks).
Equation output: UL (cm).

Reference:

Jeanty P., Cousaert E., Cantraine F., Hobbins J.C., Tack B., Struyven J. "A longitudinal Study of fetal limb growth" American Journal of Perinatology; Volume 1; Number 2; January 1984; 136-141.

GA(w+d)	5%	UL(mm)	95%
12+0	3	7	11
13+0	5	10	14
14+0	8	13	17
15+0	11	15	20
16+0	14	18	22
17+0	16	21	25
18+0	19	23	28
19+0	22	26	30
20+0	24	28	33
21+0	26	31	35
22+0	29	33	37
23+0	31	35	39
24+0	33	37	42
25+0	35	39	44
26+0	37	41	46
27+0	39	43	47
28+0	41	45	49
29+0	43	47	51
30+0	44	48	53
31+0	46	50	54
32+0	47	52	56
33+0	49	53	57
34+0	50	55	59
35+0	52	56	60
36+0	53	57	61
37+0	54	58	63
38+0	55	59	64
39+0	56	60	65
40+0	57	61	66

2.10.42 UL(GA) Merz96

UL(GA) Merz96
UL - Ulna Length
Fetal Growth

Reference:
Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	UL(mm)	95%
12+4	3	5	8
13+0	5	8	11
13+3	7	10	13
14+0	8	11	14
14+4	10	13	16
15+0	12	15	18
15+3	13	16	19
16+0	15	18	21
16+4	16	19	22
17+0	17	21	24
17+3	19	22	25
18+0	20	23	27
18+4	21	25	28
19+0	23	26	29
19+3	24	27	31
20+0	25	28	32
20+4	26	30	33
21+0	27	31	34
21+3	29	32	35
22+0	30	33	37
22+4	31	34	38
23+0	32	35	39
23+3	33	36	40
24+0	34	37	41
24+4	35	38	42
25+0	36	39	43
25+3	37	40	44
26+0	38	41	45
26+4	39	42	46
27+0	40	43	47

GA(w+d)	5%	UL(mm)	95%
27+3	41	44	48
28+0	41	45	49
28+4	42	46	50
29+0	43	47	51
29+3	44	48	52
30+0	45	49	52
30+4	46	49	53
31+0	46	50	54
31+3	47	51	55
32+0	48	52	56
32+4	49	53	56
33+0	49	53	57
33+3	50	54	58
34+0	51	55	59
34+4	51	55	59
35+0	52	56	60
35+3	52	57	61
36+0	53	57	61
36+4	54	58	62
37+0	54	58	63
37+3	55	59	63
38+0	55	59	64
38+4	56	60	64
39+0	56	60	65
39+3	57	61	65
40+0	57	61	66
40+4	57	62	66
41+0	58	62	66
41+3	58	62	67

2.10.43 [FL/AC](GA) Hadlock84

[FL/HC](GA) Hadlock84
FL - Femur Length
HC - Head Circumference
Fetal Growth

Reference:
Hadlock; J. Ultrasound Med., 1984, 3: 439-442.

GA(w+d)	FL/AC Min	FL/AC Max
21+0	0,2	0,24
42+0	0,2	0,24

2.10.44 [FL/HC](GA) Hadlock84

[FL/HC](GA) Hadlock84
FL - Femur Length
HC - Head Circumference
Fetal Growth

Reference:

Hadlock; J. Ultrasound Med., 1984, 3: 439-442.

GA(w+d)	FL/HC Min	FL/HC Max
15+0	0,153	0,171
16+0	0,133	0,165
17+0	0,146	0,176
18+0	0,158	0,18
19+0	0,161	0,183
20+0	0,168	0,198
21+0	0,159	0,203
22+0	0,184	0,202
23+0	0,192	0,208
24+0	0,187	0,209
25+0	0,187	0,203
26+0	0,186	0,204
27+0	0,186	0,204
28+0	0,188	0,206
29+0	0,196	0,208
30+0	0,192	0,214
31+0	0,193	0,213
32+0	0,191	0,213
33+0	0,199	0,215
34+0	0,194	0,218
35+0	0,201	0,223
36+0	0,201	0,221
37+0	0,208	0,226
38+0	0,209	0,227
39+0	0,206	0,234
40+0	0,207	0,225
41+0	0,216	0,232
42+0	0,201	0,239

2.10.45 [HC/AC](GA) Campbell77

[HC/AC](GA) Campbell77
HC - Head Circumference
AC - Abdominal Circumference
Fetal Growth

Reference:

Campbell S., Thoms A., "Ultrasound Measurement of the fetal Head to Abdomen Circumference Ratio in the Assessment of Growth Retardation". British Journal of Obstetrics and Gynecology; March 1977, Vol. 84, pp. 165-174.

GA(w+d)	5%	HC/AC	95%
13+0	1,14	1,23	1,31
14+0	1,14	1,23	1,31
15+0	1,05	1,22	1,39
16+0	1,05	1,22	1,39
17+0	1,07	1,18	1,29
18+0	1,07	1,18	1,29
19+0	1,09	1,18	1,26
20+0	1,09	1,18	1,26
21+0	1,06	1,15	1,25
22+0	1,06	1,15	1,25
23+0	1,05	1,13	1,21
24+0	1,05	1,13	1,21
25+0	1,04	1,13	1,22
26+0	1,04	1,13	1,22
27+0	1,05	1,13	1,22
28+0	1,05	1,13	1,22
29+0	0,99	1,1	1,21
30+0	0,99	1,1	1,21
31+0	0,96	1,07	1,17
32+0	0,96	1,07	1,17
33+0	0,96	1,04	1,11
34+0	0,96	1,04	1,11
35+0	0,93	1,02	1,11
36+0	0,93	1,02	1,11
37+0	0,92	0,98	1,05
38+0	0,92	0,98	1,05
39+0	0,87	0,97	1,06
40+0	0,87	0,97	1,06
41+0	0,93	0,96	1
42+0	0,93	0,96	1

2.10.46 EFW(GA) Brenner76

EFW(GA) Brenner76
EFW - Estimated Fetal Weight
Fetal Growth

Reference:

Brenner W.E., Edelman D.A., Hendricks C.H. A standard of fetal growth for the United States of America. American Journal of Obstetrics and Gynecology; November 1; 1976; pp. 555-564.

GA(w+d)	10%	EFW(g)	90%
21+0	280	410	860
22+0	320	480	920
23+0	370	550	990
24+0	420	640	1080
25+0	490	740	1180
26+0	570	860	1320
27+0	660	990	1470
28+0	770	1150	1660
29+0	890	1310	1890
30+0	1030	1460	2100
31+0	1180	1630	2290
32+0	1310	1810	2500
33+0	1480	2010	2690
34+0	1670	2220	2880
35+0	1870	2430	3090
36+0	2190	2650	3290
37+0	2310	2870	3470
38+0	2510	3030	3610
39+0	2680	3170	3750
40+0	2750	3280	3870
41+0	2800	3360	3980
42+0	2830	3410	4060
43+0	2840	3420	4100
44+0	2790	3390	4110

2.10.47 EFW(GA) Hadlock91

EFW(GA) Hadlock91
EFW - Estimated Fetal Weight
Fetal Growth

Equation: EFW = exp(0.578 + 0.332*GA - 0.00354*pow(GA,2)).
Equation input: GA (10-40 weeks).
Equation output: EFW (g).

Reference:

Hadlock F.P., Harrist R.B., Martinez-Poyer J. In Utero Analysis of Fetal Growth: A Sonographic Weight Standard. Radiology.1991, 181: 129-133.

GA(w+d)	10%	EFW(g)	90%
10+0	29	35	41
11+0	37	45	53
12+0	48	58	68
13+0	61	73	85
14+0	77	93	109
15+0	97	117	137
16+0	121	146	171
17+0	150	181	212
18+0	185	223	261
19+0	227	273	319
20+0	275	331	387
21+0	331	399	467
22+0	398	478	559
23+0	471	568	665
24+0	556	670	784
25+0	652	785	918
26+0	758	913	1068
27+0	876	1055	1234
28+0	1004	1210	1416
29+0	1145	1379	1613
30+0	1294	1559	1824
31+0	1453	1751	2049
32+0	1621	1953	2285
33+0	1794	2162	2530
34+0	1973	2377	2781
35+0	2154	2595	3036
36+0	2335	2813	3291
37+0	2513	3028	3543
38+0	2686	3236	3786
39+0	2851	3435	4019
40+0	3004	3619	4234

2.10.48 EFW(GA) Hansmann86

EFW(GA) Hansmann86
EFW - Estimated Fetal Weight
Fetal Growth

Reference:

Hansmann, Hackeloer, Staudach, Wittmann "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer- Verlag, New York, 1986, p. 431.

GA(w+d)	EFW(g)
13+0	14
14+0	25
15+0	50
16+0	80
17+0	100
18+0	150
19+0	200
20+0	250
21+0	300
22+0	350
23+0	450
24+0	530
25+0	700
26+0	850
27+0	1000
28+0	1100
29+0	1250
30+0	1400
31+0	1600
32+0	1800
33+0	2000
34+0	2250
35+0	2550
36+0	2750
37+0	2950
38+0	3100
39+0	3250
40+0	3400

2.10.49 EFW(GA) Tokyo94

EFW(GA) Tokyo94
EFW - Estimated Fetal Weight
Fetal Growth

Reference:

Shinozuka N., Nakamura T., Hirayama M. Tokyo Metropolitan Government Maternal and Child Health Service Center, Tokyo Research Network of Perinatal Medicine. Standard Growth Curve of Japanese using Non-Linear Growth Model. Acta Neanatoligica Japonica 30 (3) 433-441; 1994.

GA(w+d)	5%	EFW(g)	95%
18+0	158	216	274
19+0	204	279	355
20+0	256	349	442
21+0	314	427	539
22+0	381	513	645
23+0	456	609	761
24+0	541	714	888
25+0	634	830	1026
26+0	737	956	1175
27+0	849	1092	1334
28+0	970	1237	1504
29+0	1099	1391	1683
30+0	1234	1552	1870
31+0	1375	1720	2064
32+0	1520	1892	2265
33+0	1667	2068	2469
34+0	1814	2244	2675
35+0	1960	2420	2880
36+0	2102	2592	3083
37+0	2236	2758	3280
38+0	2360	2915	3469
39+0	2471	3059	3647
40+0	2565	3187	3809
41+0	2639	3296	3952

2.10.50 EFW(GA) Williams

EFW(GA) Williams
EFW - Estimated Fetal Weight
Fetal Growth

Reference:

GA(w+d)	Min	EFW(g)	Max
22+0	320	513	746
23+0	365	589	861
24+0	417	675	989
25+0	477	773	1132
26+0	546	882	1289
27+0	627	1005	1463
28+0	720	1143	1653
29+0	829	1298	1859
30+0	955	1484	2136
31+0	1100	1695	2402
32+0	1284	1920	2673
33+0	1499	2155	2910
34+0	1728	2394	3132
35+0	1974	2628	3333
36+0	2224	2849	3521
37+0	2455	3052	3706
38+0	2642	3227	3867
39+0	2790	3364	3994
40+0	2881	3462	4080
41+0	2946	3524	4127
42+0	3011	3589	4185
43+0	3044	3626	4221
44+0	3043	3633	4233

2.10.51 ATD(GA) Merz96

ATD(GA) Merz96
ATD - Abdominal Transverse Diameter
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	ATD(mm)	95%
12+4	17	20	24
13+0	18	22	26
13+3	20	24	28
14+0	21	25	29
14+4	23	27	31
15+0	25	29	33
15+3	26	31	35
16+0	28	32	37
16+4	30	34	38
17+0	31	36	40
17+3	33	38	42
18+0	35	39	44
18+4	36	41	46
19+0	38	43	48
19+3	39	44	49
20+0	41	46	51
20+4	43	48	53
21+0	44	50	55
21+3	46	51	57
22+0	48	53	58
22+4	49	55	60
23+0	51	56	62
23+3	52	58	64
24+0	54	60	65
24+4	56	61	67
25+0	57	63	69
25+3	59	65	71
26+0	60	66	72
26+4	62	68	74
27+0	63	70	76
27+3	65	71	78
28+0	67	73	79
28+4	68	75	81
29+0	70	76	83
29+3	71	78	84
30+0	73	79	86
30+4	74	81	88
31+0	76	82	89
31+3	77	84	91
32+0	78	85	92
32+4	80	87	94
33+0	81	88	96
33+3	83	90	97
34+0	84	91	99
34+4	85	93	100
35+0	87	94	102
35+3	88	96	103
36+0	89	97	105
36+4	91	98	106
37+0	92	100	108
37+3	93	101	109
38+0	94	102	110
38+4	95	104	112
39+0	97	105	113
39+3	98	106	114
40+0	99	107	116
40+4	100	108	117
41+0	101	109	118
41+3	102	110	119

2.10.52 AAPD(GA) Merz96

AAPD(GA) Merz96
AAPD - Abdominal Anterior Posterior Diameter
Fetal Growth

Reference:

Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	AAPD(mm)	95%
12+4	15	19	23
13+0	17	21	25
13+3	18	23	27
14+0	20	24	28
14+4	22	26	30
15+0	23	28	32
15+3	25	29	34
16+0	27	31	36
16+4	28	33	37
17+0	30	35	39
17+3	32	36	41
18+0	33	38	43
18+4	35	40	45
19+0	37	42	47
19+3	38	43	48
20+0	40	45	50
20+4	42	47	52
21+0	43	48	54
21+3	45	50	55
22+0	46	52	57
22+4	48	54	59
23+0	50	55	61
23+3	51	57	63
24+0	53	59	64
24+4	54	60	66
25+0	56	62	68
25+3	57	63	69
26+0	59	65	71
26+4	61	67	73
27+0	62	68	75

GA(w+d)	5%	AAPD(mm)	95%
27+3	64	70	76
28+0	65	72	78
28+4	67	73	80
29+0	68	75	81
29+3	70	76	83
30+0	71	78	85
30+4	73	79	86
31+0	74	81	88
31+3	76	82	89
32+0	77	84	91
32+4	78	85	93
33+0	80	87	94
33+3	81	88	96
34+0	83	90	97
34+4	84	91	99
35+0	85	93	100
35+3	87	94	102
36+0	88	96	103
36+4	89	97	105
37+0	90	98	106
37+3	92	100	107
38+0	93	101	109
38+4	94	102	110
39+0	95	103	111
39+3	96	105	113
40+0	97	106	114
40+4	98	107	115
41+0	99	108	116
41+3	100	109	117

2.10.53 TTD(GA) Hansmann86

TTD(GA) Hansmann86
TTD - Thorax Transverse Diameter
Fetal Growth

Reference:
Hansmann, Hackeloer, Staudach, Wittmann. "Ultrasound Diagnosis in Obstetrics and Gynecology". Springer-Verlag, New York, 1986; pp.435.

GA(w+d)	Min	TTD(mm)	Max
12+0	13	17	21
13+0	16	20	24
14+0	20	24	28
15+0	23	27	31
16+0	27	31	35
17+0	30	34	38
18+0	33	37	42
19+0	36	40	46
20+0	39	44	49
21+0	42	47	53
22+0	45	50	56
23+0	48	53	60
24+0	50	56	63
25+0	53	59	67
26+0	56	62	70
27+0	59	65	73
28+0	62	69	77
29+0	64	72	80
30+0	67	74	83
31+0	70	78	86
32+0	73	81	89
33+0	75	83	93
34+0	78	86	96
35+0	80	89	99
36+0	83	92	102
37+0	85	94	105
38+0	87	97	108
39+0	89	99	111
40+0	91	101	114
41+0	92	102	117

2.10.54 TAPD(GA) Hansmann76

TAPD(GA) Hansmann76
TAPD - Thorax Anterior Posterior Diameter
Fetal Growth

Reference:

Hansmann M. "Ultraschallbiometrie im II. und III. Trimester der Schwangerschaft". Gynakologe 9 (1976) 133.

GA(w+d)	2SD	TAPD(mm)	2SD
14+0	19,7	22,5	26,5
15+0	22,1	25,8	29,5
16+0	24,5	28,5	32,5
17+0	26,1	31,1	36,1
18+0	30,2	34,6	39
19+0	32,5	37,5	42,5
20+0	34	40	46
21+0	37,6	43,4	49,2
22+0	40,4	46,5	52,6
23+0	42	49	56
24+0	43,5	51,5	59,5
25+0	46,8	54,8	62,8
26+0	49,5	58	66,5
27+0	53	61,5	70
28+0	54,3	63,9	73,5
29+0	57	67	77
30+0	60,1	70,1	80,1
31+0	61	72,5	84
32+0	65,2	76,2	87,2
33+0	68,1	79,3	90,5
34+0	69	81,5	94
35+0	70,8	84	97,2
36+0	74	87,5	101
37+0	76,2	90,2	104,2
38+0	79	93	107
39+0	80,6	95,3	110
40+0	81,6	96,8	112
41+0	83,2	98,4	113,5
42+0	84,1	99,1	114

2.10.55 BOD(GA) Jeanty82

BOD(GA) Jeanty82
BOD - Binocular Distance
Fetal Growth

Reference:

Jeanty P., Dramaix-Wilmet M., Van Gansbeke D., Van Regemorter N., Rodesch F. "Fetal ocular biometry by ultrasound". Radiology 143(2): 513-516; May 1982.

GA(w+d)	5%	BOD(mm)	95%
12+0	11	16	20
13+0	14	18	23
14+0	16	20	25
15+0	18	23	27
16+0	20	25	29
17+0	22	27	31
18+0	24	29	33
19+0	26	31	35
20+0	28	33	37
21+0	30	35	39
22+0	32	36	41
23+0	34	38	43
24+0	35	40	44
25+0	37	42	46
26+0	39	43	47
27+0	40	45	49
28+0	42	46	51
29+0	43	48	52
30+0	45	49	53
31+0	46	50	55
32+0	47	52	56
33+0	49	53	57
34+0	50	54	58
35+0	51	55	60
36+0	52	56	61
37+0	53	57	62
38+0	54	58	63
39+0	55	59	64
40+0	56	60	64

2.10.56 Cereb(GA) Goldstein87

Cereb(GA) Goldstein87
Cereb - Cerebellum
Fetal Growth

Reference:
Goldstein I.; Reece A.; Pilu G.; Bovicelli L.; Hobbins J.C. "Cerebellar measurement with ultrasonography in the evaluation of fetal growth and development". Am J Obstet Gynecol; May 1987; 1065-1069.

GA(w+d)	10%	Cereb(mm)	90%
15+0	10	14	16
16+0	14	16	17
17+0	16	17	18
18+0	17	18	19
19+0	18	19	22
20+0	18	20	22
21+0	19	22	24
22+0	21	23	24
23+0	22	24	26
24+0	22	25	28
25+0	23	28	29
26+0	25	29	32
27+0	26	30	32
28+0	27	31	34
29+0	29	34	38
30+0	31	35	40
31+0	32	38	43
32+0	33	38	42
33+0	32	40	44
34+0	33	40	44
35+0	31	40,5	47
36+0	36	43	55
37+0	37	45	55
38+0	40	48,5	55
39+0	50	52	55

2.10.57 Cereb(GA) Hill90

Cereb(GA) Hill90
Cereb - Cerebellum
Fetal Growth

Reference:

Hill L M, Guzick D, Fries J, Hixson J, Rivello D., "The Transverse Cerebellar Diameter in Estimation Gestational Age in the Large-for-Gestational-Age-Fetus". Obstetrics and Gynecology. Vol. 75, No 6, June 1990, pages 981-985.

GA(w+d)	Cereb(mm)	2SD
15+0	15	3
16+0	16	2
17+0	17	2
18+0	18	2
19+0	20	2
20+0	20	3
21+0	22	3
22+0	23	3
23+0	24	3
24+0	26	4
25+0	28	4
26+0	30	4
27+0	30	4
28+0	33	4
29+0	34	4
30+0	37	4
31+0	39	4
32+0	41	5
33+0	43	5
34+0	46	9
35+0	47	7
36+0	49	9
37+0	51	11
38+0	51	12
39+0	52	10
40+0	52	8

2.10.58 Rad(GA) Jeanty82

Rad(GA) Jeanty82
Rad - Radius
Fetal Growth

Reference:
Jeanty P., Dramaix-Wilmet M., Van Kerkem J., Petroons P., Schwers J. "Ultrasonic evaluation of fetal limb growth: part II". Radiology; June 1982; 143(3): 751-754.

GA(w+d)	5%	Rad(mm)	95%
12+0	4	7	11
13+0	6	10	14
14+0	8	13	17
15+0	11	15	20
16+0	13	18	22
17+0	14	20	26
18+0	15	22	29
19+0	20	24	29
20+0	22	27	32
21+0	24	29	33
22+0	27	31	34
23+0	26	32	39
24+0	26	34	42
25+0	31	36	41
26+0	32	37	43
27+0	33	39	45
28+0	33	40	48
29+0	36	42	47
30+0	36	43	49
31+0	38	44	50
32+0	37	45	53
33+0	41	46	51
34+0	40	47	53
35+0	41	48	54
36+0	43	48	57
37+0	45	49	53
38+0	45	49	54
39+0	45	50	54
40+0	46	50	55

2.10.59 Rad(GA) Merz96

Rad(GA) Merz96
Rad - Radius
Fetal Growth

Reference:
Merz E., Wellek S. "Normal Fetal Development Profiles- A Model to obtain Standard Development Graphs for the Head and Abdominal Parameters and the Long Limb Bones". Ultraschall in der Medizin 17 (1996) 153-162.

GA(w+d)	5%	Rad(mm)	95%
12+4	1	4	7
13+0	3	6	9
13+3	5	8	11
14+0	6	10	13
14+4	8	11	14
15+0	10	13	16
15+3	11	14	17
16+0	12	16	19
16+4	14	17	20
17+0	15	18	22
17+3	16	20	23
18+0	17	21	24
18+4	19	22	25
19+0	20	23	26
19+3	21	24	28
20+0	22	25	29
20+4	23	26	30
21+0	24	28	31
21+3	25	29	32
22+0	26	30	33
22+4	27	31	34
23+0	28	32	35
23+3	29	32	36
24+0	30	33	37
24+4	31	34	38
25+0	32	35	39
25+3	32	36	40
26+0	32	37	41
26+4	34	38	41
27+0	35	39	42

GA(w+d)	5%	Rad(mm)	95%
27+3	36	39	43
28+0	36	40	44
28+4	37	41	45
29+0	38	42	45
29+3	39	42	46
30+0	39	43	47
30+4	40	44	48
31+0	41	44	48
31+3	41	45	49
32+0	42	46	50
32+4	43	46	50
33+0	43	47	51
33+3	44	48	52
34+0	44	48	52
34+4	45	49	53
35+0	45	49	53
35+3	46	50	54
36+0	46	50	54
36+4	47	51	55
37+0	47	51	55
37+3	48	52	56
38+0	48	52	56
38+4	48	52	57
39+0	49	53	57
39+3	49	53	57
40+0	49	53	58
40+4	49	54	58
41+0	50	54	58
41+3	50	54	58

2.10.60 Clav(GA) Yarkoni85

Clav(GA) Yarkoni85
Clav - Clavicle
Fetal Growth

Equation: Clav = 0.1118303 + 0.09788639*GA.
Equation input: GA (15-40 weeks).
Equation output: Clav (cm).

Reference:

Yarkoni S., Schmidt W., Jeanty P., Reece A., Hobbins J.C. "Clavicular Measurement: A New Biometric Parameter for Fetal Evaluation". Journal of Ultrasound in Medicine 4:467-470, September, 1985.

GA(w+d)	5%	Clav(mm)	95%
15+0	11	16	21
16+0	12	17	22
17+0	13	18	23
18+0	14	19	24
19+0	15	20	25
20+0	16	21	26
21+0	17	22	27
22+0	18	23	28
23+0	19	24	29
24+0	20	25	30
25+0	21	26	31
26+0	22	27	32
27+0	23	28	33
28+0	24	29	34
29+0	25	30	35
30+0	26	31	36
31+0	27	32	37
32+0	28	33	38
33+0	29	34	39
34+0	30	35	40
35+0	31	36	41
36+0	32	37	42
37+0	33	38	43
38+0	34	39	44
39+0	35	40	45
40+0	36	41	46

2.10.61 AFI(GA) Moore90

AFI(GA) Moore90
AFI - Amniotic Fluid Index
Fetal Growth

Reference:

Moore TR, Cayle JE. The amniotic fluid index in normal human pregnancy. Am J Obstet Gynecol 1990; 162(5):1168-73.

GA(w+d)	2.5%	5%	AFI(mm)	95%	97.5%
16+0	73	79	121	185	201
17+0	77	83	127	194	211
18+0	80	87	133	202	220
19+0	83	90	137	207	225
20+0	86	93	141	212	230
21+0	88	95	143	214	233
22+0	89	97	145	216	235
23+0	90	98	146	218	237
24+0	90	98	147	219	238
25+0	89	97	147	221	240
26+0	89	97	147	223	242
27+0	88	95	146	226	245
28+0	86	94	146	228	249
29+0	84	92	145	231	254
30+0	82	90	145	234	258
31+0	79	88	144	238	263
32+0	77	86	144	242	269
33+0	74	83	143	245	274
34+0	72	81	142	248	278
35+0	70	79	140	249	279
36+0	68	77	138	249	279
37+0	66	75	135	244	275
38+0	65	73	132	239	269
39+0	64	72	127	226	255
40+0	63	71	123	214	240
41+0	63	70	116	194	216
42+0	63	69	110	175	192

2.10.62 AFI(GA) Magann00

AFI(GA) Magann00
AFI - Amniotic Fluid Index
Fetal Growth

Reference:

Magann EF, Sanderson M, Martin JN Jr, et. al. The amniotic fluid index, single deepest pocket and two diameter pocket in normal pregnancy. Am J Obstet Gynecol 2000; 182:1581-1588.

GA(w+d)	5%	10%	AFI(mm)	90%	95%
14+0	28	31	54	80	86
15+0	32	36	57	82	91
16+0	36	41	61	85	96
17+0	41	45	66	90	103
18+0	46	51	71	97	111
19+0	51	56	77	104	120
20+0	55	61	83	113	129
21+0	59	66	89	122	139
22+0	63	71	96	132	149
23+0	67	75	103	142	159
24+0	70	79	110	152	169
25+0	73	82	117	161	178
26+0	75	84	123	170	187
27+0	76	86	128	178	194
28+0	76	86	133	184	199
29+0	76	86	136	188	204
30+0	75	85	138	189	206
31+0	73	84	138	189	206
32+0	71	81	137	187	204
33+0	68	78	134	182	200
34+0	64	74	130	177	194
35+0	60	70	125	169	187
36+0	56	65	118	162	179
37+0	51	60	111	153	169
38+0	47	55	103	144	159
39+0	42	50	94	137	149
40+0	37	45	86	129	139
41+0	33	40	77	123	129

2.10.63 FHR(GA) Rempen90

FHR(GA) Rempen90
FHR - Fetal Heart Rate (Embryonic Heart Rate) (calculated using measured two beats time interval)
Fetal Growth

Reference:

Rempen A. Diagnosis of viability in early pregnancy with vaginal sonography. J. Ultrasound Med. 1990; 9:711-716.

GA(w+d)	FHR(b/min)	SD
5+0	110	8
6+0	118	13
7+0	143	19
8+0	167	8
9+0	170	6
10+0	168	8
11+0	164	5
12+0	160	14
13+0	159	3

2.10.64 NT(CRL) Wright08

NT(CRL) Wright08
NT - Nuchal Translucency; CRL - Crown Rump Length
Fetal Growth

Reference:
D. Wright, K.O. Kagan, F.S. Molina, A. Gazzoni, K.H. Nicolaides. A mixture model of nuchal translucency thickness in screening for chromosomal defects. Ultrasound Obstet Gynecol 2008; 31: 376-383.
Note. Table values (5%, 50%, 95%) were derived from Fig. 2b.

CRL(mm)	5%	NT(mm)	95%
45	0.89	1.18	2.09
46	0.9	1.2	2.09
47	0.9	1.24	2.09
48	0.91	1.28	2.1
49	0.93	1.3	2.1
50	0.97	1.34	2.1
51	0.98	1.38	2.12
52	0.99	1.4	2.15
53	1	1.44	2.18
54	1.02	1.48	2.2
55	1.05	1.5	2.22
56	1.07	1.54	2.26
57	1.09	1.57	2.29
58	1.11	1.59	2.32
59	1.13	1.62	2.35
60	1.15	1.65	2.38
61	1.17	1.68	2.4
62	1.19	1.7	2.43
63	1.2	1.72	2.47
64	1.22	1.75	2.5
65	1.24	1.78	2.52
66	1.25	1.8	2.55
67	1.27	1.82	2.58
68	1.29	1.84	2.6
69	1.3	1.87	2.62
70	1.3	1.89	2.65
71	1.31	1.9	2.68
72	1.31	1.91	2.69
73	1.31	1.92	2.7
74	1.32	1.94	2.72
75	1.32	1.95	2.73
76	1.32	1.96	2.74
77	1.34	1.97	2.75
78	1.34	1.98	2.77
79	1.34	1.99	2.78
80	1.34	1.99	2.79
81	1.34	1.99	2.79
82	1.34	1.99	2.78
83	1.34	1.99	2.77
84	1.34	1.98	2.76
85	1.34	1.98	2.75

2.10.65 NT(CRL) Hsu03

NT(CRL) Hsu03
NT - Nuchal Translucency; CRL - Crown Rump Length
Fetal Growth

Reference:

J.J. Hsu, C.C. Hsieh, C.H. Chiang, L.M. Lo, T.T. Hsieh. Preliminary Normal Reference Values of Nuchal Translucency Thickness in Taiwanese Fetuses at 11-14 Weeks of Gestation. Chang Gung Med J Vol. 26 No. 1, 2003.

Note. Table values (5%, 50%, 95%) are from publication Table 3.

CRL(mm)	5%	NT(mm)	95%
45	0.6	1.1	2.05
50	0.6	1.1	2.05
55	0.8	1.3	2.1
60	0.9	1.4	2.1
65	1.1	1.5	2.2
70	1	1.6	2.25
75	1	1.7	2.3
80	1	1.75	2.56

2.10.66 NT(CRL) Mahale13

NT(CRL) Mahale13
NT - Nuchal Translucency; CRL - Crown Rump Length
Fetal Growth

Reference:

Nina Mahale, Ashwini Kumar, V.Ch. Mouli Rayapureddi, Ajit Mahale, Krishnapriya. Variaton of nuchal translucency with increasing crown rump length and gestational age in normal singleton pregnancies. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), Volume 6, Issue 3 (May.- Jun. 2013), pp. 16-19.

Note. Table values (5%, 50%, 95%) are from publication Table 1.

CRL(mm)	5%	NT(mm)	95%
40	0.3	1.2	2.1
45	0.4	1.3	2.2
50	0.5	1.4	2.3
55	0.6	1.5	2.4
60	0.7	1.6	2.5
65	0.8	1.7	2.6
70	0.9	1.8	2.7
75	0.9	1.9	2.8
80	1	2	2.9

2.10.67 NT(CRL) Chung04

NT(CRL) Chung04
NT - Nuchal Translucency; CRL - Crown Rump Length
Fetal Growth

Reference:

J.H. Chung, J.H. Yang, M.J. Song, J.Y. Cho, Y.H. Lee, S.Y. Park, M.J. Moon, H.J. Lim, J.S. Choi, J.O. Kim, J.S. Shin, H.K. Ahn, J.Y. Han, M.Y. Kim, K.H. Choi, H.M. Ryu. The Distribution of Fetal Nuchal Translucency Thickness in Normal Korean Fetuses. J Korean Med Sci 2004; 19: 32-6.

Note. Table values (5%, 50%, 95%) are from publication Table 1.

CRL(mm)	5%	NT(mm)	95%
40	0.31	1.22	2.14
45	0.4	1.32	2.24
50	0.5	1.42	2.34
55	0.6	1.52	2.44
60	0.7	1.62	2.54
65	0.8	1.72	2.64
70	0.9	1.82	2.73
75	0.99	1.91	2.83
80	1.09	2.01	2.93
85	1.1	2.11	3.03

2.11 Human OB Fetal Growth Doppler mode tables

For Fetal Growth analysis are used look-up tables that are presented in this chapter or any other user-defined tables. Software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB results View dialog. Intermediate values inside tables are calculated using linear interpolation.

2.11.1 UA_RI(GA) Merz05

UA_RI(GA) Merz05
UA_RI - Umbilical Artery Resistivity Index
Fetal Growth

References:

Uteroplacental circulation, vol. 1. In Merz E (ed). Ultrasonography in Obstetrics and Gynecology. Stuttgart, New York, Thieme, 2005, pp 469-480, 614.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 187 Table 38-2.

GA(w+d)	5%	UA_RI	95%
20+0	0.567	0.690	0.802
21+0	0.557	0.680	0.793
22+0	0.548	0.671	0.784
23+0	0.539	0.663	0.776
24+0	0.530	0.655	0.768
25+0	0.522	0.646	0.760
26+0	0.514	0.639	0.752
27+0	0.506	0.631	0.745
28+0	0.498	0.623	0.737
29+0	0.490	0.615	0.730
30+0	0.482	0.608	0.723
31+0	0.474	0.600	0.715
32+0	0.465	0.592	0.707
33+0	0.457	0.584	0.700
34+0	0.449	0.576	0.692
35+0	0.440	0.567	0.684
36+0	0.431	0.559	0.675
37+0	0.422	0.550	0.667
38+0	0.412	0.540	0.657
39+0	0.402	0.530	0.648
40+0	0.390	0.519	0.637

2.11.2 UA_RI(GA) Kurmanavicius97

UA_RI(GA) Kurmanavicius97
UA_RI - Umbilical Artery Resistivity Index
Fetal Growth

Reference:

J.Kurmanavicius, I.Florio, J.Wisser, G.Hebich, R.Zimmermann, R.Muller, R.Huch, A.Huch. Reference resistance indices of the umbilical, fetal middle cerebral and uterine arteries at 24-42 weeks of gestation. Ultrasound Obstet/ Gynecol. 10 (1997) 112-120.

Used values from publication Table 4.

GA(w+d)	5%	UA_RI	95%
24+0	0.61	0.72	0.83
25+0	0.60	0.71	0.82
26+0	0.59	0.70	0.81
27+0	0.58	0.69	0.80
28+0	0.57	0.68	0.79
29+0	0.56	0.67	0.79
30+0	0.55	0.66	0.78
31+0	0.54	0.65	0.77
32+0	0.53	0.64	0.76
33+0	0.52	0.63	0.75
34+0	0.51	0.62	0.74
35+0	0.50	0.61	0.73
36+0	0.49	0.60	0.73
37+0	0.47	0.59	0.72
38+0	0.46	0.58	0.71
39+0	0.45	0.57	0.70
40+0	0.44	0.56	0.69
41+0	0.43	0.55	0.68
42+0	0.42	0.54	0.67

2.11.3 UA_RI(GA) Chanprapaph00

UA_RI(GA) Chanprapaph00
UA_RI - Umbilical Artery Resistivity Index
Fetal Growth

Reference:

Pharuhas Chanprapaph, Chanane Wanapirak, Theera Tongsong. Umbilical Artery Doppler Waveform Indices in Normal Pregnancies. Thai Journal of Obstetrics and Gynaecology. June 2000, Vol. 12, pp. 103-107.

GA(w+d)	95%CI	UA_RI	95%CI
21+0	0.707	0.756	0.805
22+0	0.719	0.737	0.754
23+0	0.708	0.728	0.747
24+0	0.682	0.706	0.729
25+0	0.7	0.72	0.739
26+0	0.676	0.702	0.727
27+0	0.668	0.698	0.727
28+0	0.636	0.664	0.691
29+0	0.616	0.646	0.675
30+0	0.658	0.686	0.713
31+0	0.655	0.679	0.725
32+0	0.617	0.645	0.672
33+0	0.609	0.645	0.68
34+0	0.584	0.61	0.635
35+0	0.596	0.62	0.643
36+0	0.58	0.602	0.623
37+0	0.588	0.616	0.643
38+0	0.552	0.58	0.607
39+0	0.552	0.576	0.599
40+0	0.577	0.609	0.64

2.11.4 UA_RI(GA) Kofinas92

UA_RI(GA) Kofinas92
UA_RI - Umbilical Artery Resistivity Index
Fetal Growth

Reference:

Alexander D. Kofinas, Mark A. Espeland, Mary Penry, Melissa Swain, Christos G. Hatjis. Uteroplacental Doppler flow velocity waveform indices in normal pregnancy: a statistical exercise and the development of appropriate reference values. American Journal of Perinatology, volume 9, number 2, March 1992.

Used values from publication Table 3.

GA(w+d)	5%	UA_RI	95%
16+0	0.70	0.80	0.90
17+0	0.69	0.79	0.89
18+0	0.68	0.78	0.88
19+0	0.67	0.77	0.87
20+0	0.66	0.76	0.86
21+0	0.65	0.75	0.85
22+0	0.64	0.74	0.84
23+0	0.63	0.73	0.83
24+0	0.62	0.72	0.82
25+0	0.61	0.71	0.81
26+0	0.60	0.70	0.80
27+0	0.59	0.69	0.79
28+0	0.58	0.68	0.78
29+0	0.57	0.67	0.77
30+0	0.56	0.66	0.76
31+0	0.55	0.65	0.75
32+0	0.54	0.64	0.74
33+0	0.53	0.63	0.73
34+0	0.52	0.62	0.72
35+0	0.51	0.61	0.71
36+0	0.50	0.60	0.70
37+0	0.49	0.59	0.69
38+0	0.47	0.57	0.67
39+0	0.46	0.56	0.66
40+0	0.45	0.55	0.65
41+0	0.44	0.54	0.64
42+0	0.43	0.53	0.63

2.11.5 UA_PI(GA) Merz05

UA_PI(GA) Merz05
UA_PI - Umbilical Artery Pulsatility Index
Fetal Growth

References:

Uteroplacental circulation, vol. 1. In Merz E (ed). Ultrasonography in Obstetrics and Gynecology. Stuttgart, New York, Thieme, 2005, pp 469-480, 614.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 188 Table 38-3.

GA(w+d)	5%	UA_PI	95%
20+0	0.940	1.216	1.505
21+0	0.913	1.189	1.476
22+0	0.890	1.165	1.450
23+0	0.869	1.142	1.427
24+0	0.849	1.122	1.405
25+0	0.831	1.102	1.385
26+0	0.813	1.084	1.365
27+0	0.798	1.065	1.346
28+0	0.780	1.048	1.327
29+0	0.764	1.031	1.308
30+0	0.748	1.014	1.290
31+0	0.732	0.997	1.272
32+0	0.716	0.980	1.254
33+0	0.700	0.963	1.236
34+0	0.684	0.946	1.218
35+0	0.668	0.928	1.199
36+0	0.651	0.910	1.180
37+0	0.634	0.891	1.160
38+0	0.615	0.872	1.139
39+0	0.595	0.851	1.117
40+0	0.573	0.828	1.093

2.11.6 UA_PI(GA) Coppens96

UA_PI(GA) Coppens96
UA_PI - Umbilical Artery Pulsatility Index
Fetal Growth

References:

Coppens M., Loquet P., Kollen M, et al. Longitudinal evaluation of uteroplacental and umbilical blood flow changes in normal early pregnancy. Ultrasound Obstet Gynecol 1996;7;114-121.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 186 Table 38-1.

GA(w+d)	5%	UA_PI	95%
8+0	3.21	3.66	4.11
9+0	2.89	3.34	3.78
10+0	2.56	3.01	3.46
11+0	2.24	2.69	3.13
12+0	1.91	2.36	2.81
13+0	1.59	2.04	2.48
14+0	1.26	1.71	2.16

2.11.7 UA_PI(GA) Arduini90

UA_PI(GA) Arduini90
UA_PI - Umbilical Artery Pulsatility Index
Fetal Growth

Reference:

Arduini D., Rizzo G. Normal values of Pulsatility Index from fetal vessels: a cross-sectional study on 1556 healthy fetuses. J Perinat Med 1990;18(3):165-172.

GA(w+d)	5%	UA_PI	95%
20+0	1.04	1.54	2.03
21+0	0.98	1.47	1.96
22+0	0.92	1.41	1.90
23+0	0.86	1.35	1.85
24+0	0.81	1.30	1.79
25+0	0.76	1.25	1.74
26+0	0.71	1.20	1.69
27+0	0.67	1.16	1.65
28+0	0.63	1.12	1.61
29+0	0.59	1.08	1.57
30+0	0.56	1.05	1.54
31+0	0.53	1.02	1.51
32+0	0.50	0.99	1.48
33+0	0.48	0.97	1.46
34+0	0.46	0.95	1.44
35+0	0.44	0.94	1.43
36+0	0.43	0.92	1.42
37+0	0.42	0.92	1.41
38+0	0.42	0.91	1.40
39+0	0.42	0.91	1.40
40+0	0.42	0.91	1.40
41+0	0.42	0.92	1.41
42+0	0.43	0.93	1.42

2.11.8 UA_PI(GA) Baschat03

UA_PI(GA) Baschat03
UA_PI - Umbilical Artery Pulsatility Index
Fetal Growth

Reference:
A. A. Baschat, U. Gembruch. The cerebroplacental Doppler ratio revisited. Ultrasound Obstet Gynecol 2003; 21: 124–127.
Used values from publication Table 1.

GA(w+d)	UA_PI	SD
20+0	1.31	0.26
21+0	1.27	0.18
22+0	1.28	0.17
23+0	1.12	0.12
24+0	1.21	0.14
25+0	1.13	0.16
26+0	1.11	0.13
27+0	1.07	0.17
28+0	1.05	0.13
29+0	1.11	0.19
30+0	1.04	0.23
31+0	0.99	0.13
32+0	0.93	0.19
33+0	0.92	0.17
34+0	0.89	0.13
35+0	0.91	0.11
36+0	0.93	0.18
37+0	0.95	0.24
38+0	0.89	0.16
39+0	1.01	0.17
40+0	0.75	0.16

2.11.9 UA_RATIO_S_D(GA) Kofinas92

UA_RATIO_S_D(GA) Kofinas92
UA_RATIO_S_D - Umbilical Artery S/D Ratio
Fetal Growth

Reference:

Alexander D. Kofinas, Mark A. Espeland, Mary Penry, Melissa Swain, Christos G. Hatjis. Uteroplacental Doppler flow velocity waveform indices in normal pregnancy: a statistical exercise and the development of appropriate reference values. American Journal of Perinatology, volume 9, number 2, March 1992.

Used values from publication Table 3.

GA(w+d)	5%	UA S/D	95%
16+0	3.33	5.00	10.00
17+0	3.23	4.76	9.09
18+0	3.13	4.55	8.33
19+0	3.03	4.35	7.69
20+0	2.94	4.17	7.14
21+0	2.86	4.00	6.67
22+0	2.78	3.85	6.25
23+0	2.70	3.70	5.88
24+0	2.63	3.57	5.56
25+0	2.56	3.45	5.26
26+0	2.50	3.33	5.00
27+0	2.44	3.23	4.76
28+0	2.38	3.13	4.55
29+0	2.33	3.03	4.35
30+0	2.27	2.94	4.17
31+0	2.22	2.86	4.00
32+0	2.17	2.78	3.85
33+0	2.13	2.70	3.70
34+0	2.08	2.63	3.57
35+0	2.04	2.56	3.45
36+0	2.00	2.50	3.33
37+0	1.96	2.44	3.23
38+0	1.89	2.33	3.03
39+0	1.85	2.27	2.94
40+0	1.82	2.22	2.86
41+0	1.79	2.17	2.78
42+0	1.75	2.13	2.70

2.11.10 UA_RATIO_S_D(GA) Chanprapaph00

UA_RATIO_S_D(GA) Chanprapaph00
UA_RATIO_S_D - Umbilical Artery S/D Ratio
Fetal Growth

Reference:

Pharuhas Chanprapaph, Chanane Wanapirak, Theera Tongsong. Umbilical Artery Doppler Waveform Indices in Normal Pregnancies. Thai Journal of Obstetrics and Gynaecology. June 2000, Vol. 12, pp. 103-107.

GA(w+d)	95%CI	UA S/D	95%CI
21+0	3.338	3.560	3.781
22+0	3.406	3.587	3.767
23+0	3.321	3.541	3.760
24+0	3.080	3.386	3.691
25+0	3.179	3.391	3.602
26+0	2.984	3.310	3.635
27+0	2.889	3.158	3.426
28+0	2.650	2.837	3.023
29+0	2.670	2.853	3.035
30+0	2.800	3.059	3.317
31+0	2.709	2.941	3.172
32+0	2.515	2.710	2.904
33+0	2.413	2.690	2.966
34+0	2.317	2.464	2.611
35+0	2.376	2.535	2.693
36+0	2.277	2.397	2.516
37+0	2.326	2.505	2.683
38+0	2.105	2.272	2.438
39+0	2.108	2.248	2.387
40+0	2.246	2.511	2.775

2.11.11 MCA_RI(GA) Tarzamni09

MCA_RI(GA) Tarzamni09
MCA_RI - Middle Cerebral Artery Resistivity Index
Fetal Growth

Reference:

Mohammad-Kazem Tarzamni, Nariman Nezami, Fatemeh Gatreh-Samani, Sakine Vahedinia, Mariam Tarzamni. Doppler Waveform Indices of Fetal Middle Cerebral Artery in Normal 20 to 40 Weeks Pregnancies. Archives of Iranian Medicine, Volume 12, Number 1, 2009: 29 – 34.

Used values from publication Table 1.

GA(w+d)	MCA_RI	SD
20+0	0.76	0.04
21+0	0.77	0.06
22+0	0.76	0.05
23+0	0.78	0.04
24+0	0.81	0.05
25+0	0.81	0.05
26+0	0.82	0.05
27+0	0.83	0.04
28+0	0.85	0.07
29+0	0.84	0.05
30+0	0.83	0.04
31+0	0.82	0.04
32+0	0.82	0.07
33+0	0.79	0.06
34+0	0.79	0.04
35+0	0.80	0.05
36+0	0.75	0.05
37+0	0.73	0.07
38+0	0.68	0.06
39+0	0.68	0.05
40+0	0.67	0.04

2.11.12 MCA_RI(GA) Kurmanavicius97

MCA_RI(GA) Kurmanavicius97
MCA_RI - Middle Cerebral Artery Resistivity Index
Fetal Growth

Reference:

J.Kurmanavicius, I.Florio, J.Wisser, G.Hebich, R.Zimmermann, R.Muller, R.Huch, A.Huch. Reference resistance indices of the umbilical, fetal middle cerebral and uterine arteries at 24-42 weeks of gestation. Ultrasound Obstet/ Gynecol. 10 (1997) 112-120.

Used values from publication Table 4.

GA(w+d)	5%	MCA_RI
24+0	0.78	0.87
25+0	0.79	0.88
26+0	0.80	0.89
27+0	0.80	0.90
28+0	0.80	0.90
29+0	0.79	0.90
30+0	0.79	0.90
31+0	0.78	0.89
32+0	0.76	0.88
33+0	0.75	0.87
34+0	0.73	0.86
35+0	0.72	0.85
36+0	0.70	0.83
37+0	0.68	0.81
38+0	0.66	0.80
39+0	0.63	0.78
40+0	0.61	0.76
41+0	0.58	0.73
42+0	0.56	0.71

2.11.13 MCA_RI(GA) Bahlman02

MCA_RI(GA) Bahlman02
MCA_RI - Middle Cerebral Artery Resistivity Index
Fetal Growth

References:

Bahlmann F, Reinhard I, Krummenauer F, et al. Blood flow velocity waveforms of the fetal middle cerebral artery in normal population: reference values from 18 weeks to 42 weeks of gestation. J Perinat Med 2002;30:490-501.
Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.
Used values from Atlas of Ultrasound Measurements p. 195 Table 39-2.

GA(w+d)	5%	MCA_RI	95%
18+0	0.544	0.687	0.787
19+0	0.574	0.708	0.808
20+0	0.592	0.727	0.828
21+0	0.608	0.744	0.846
22+0	0.622	0.758	0.861
23+0	0.633	0.771	0.874
24+0	0.643	0.782	0.886
25+0	0.651	0.790	0.895
26+0	0.656	0.796	0.902
27+0	0.659	0.801	0.907
28+0	0.661	0.803	0.910
29+0	0.660	0.803	0.911
30+0	0.657	0.801	0.910
31+0	0.652	0.798	0.907
32+0	0.645	0.792	0.902
33+0	0.636	0.783	0.894
34+0	0.625	0.773	0.885
35+0	0.612	0.761	0.873
36+0	0.597	0.747	0.860
37+0	0.579	0.730	0.844
38+0	0.560	0.712	0.826
39+0	0.539	0.692	0.807
40+0	0.515	0.669	0.785
41+0	0.489	0.644	0.761
42+0	0.462	0.618	0.735

2.11.14 MCA_PI(GA) Mari92

MCA_PI(GA) Mari92
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

References:

Mari G, Deter RL. Middle cerebral artery flow velocity waveforms in normal and small-for-gestational-age fetuses. Am J Obstet Gynecol 1992;166:1262-1270.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 197 Table 39-3.

GA(w+d)	2.5%	MCA_PI	97.5%
15+0	0.99	1.56	2.14
16+0	1.08	1.70	2.33
17+0	1.16	1.82	2.51
18+0	1.23	1.94	2.67
19+0	1.30	2.04	2.81
20+0	1.35	2.13	2.93
21+0	1.40	2.20	3.04
22+0	1.44	2.27	3.13
23+0	1.48	2.32	3.20
24+0	1.51	2.36	3.25
25+0	1.52	2.39	3.30
26+0	1.54	2.40	3.32
27+0	1.54	2.41	3.33
28+0	1.54	2.40	3.32
29+0	1.52	2.38	3.30
30+0	1.50	2.35	3.26
31+0	1.48	2.30	3.20
32+0	1.44	2.24	3.12
33+0	1.40	2.17	3.03
34+0	1.35	2.09	2.92
35+0	1.29	2.00	2.79
36+0	1.22	1.89	2.65
37+0	1.15	1.77	2.49
38+0	1.07	1.64	2.32
39+0	0.98	1.50	2.13
40+0	0.89	1.34	1.92
41+0	0.78	1.17	1.70
42+0	0.67	1.00	1.45

2.11.15 MCA_PI(GA) Bahlmann02

MCA_PI(GA) Bahlmann02
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

References:

Bahlmann F, Reinhard I, Krummenauer F, et al. Blood flow velocity waveforms of the fetal middle cerebral artery in normal population: reference values from 18 weeks to 42 weeks of gestation. J Perinat Med 2002;30:490-501.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 197 Table 39-3.

GA(w+d)	5%	MCA_PI	95%
18+0	1.01	1.51	2.02
19+0	1.13	1.59	2.11
20+0	1.19	1.67	2.18
21+0	1.26	1.73	2.25
22+0	1.31	1.78	2.30
23+0	1.35	1.83	2.35
24+0	1.39	1.87	2.40
25+0	1.41	1.90	2.43
26+0	1.43	1.92	2.45
27+0	1.44	1.93	2.47
28+0	1.45	1.94	2.48
29+0	1.44	1.94	2.48
30+0	1.43	1.92	2.47
31+0	1.40	1.90	2.45
32+0	1.37	1.88	2.43
33+0	1.33	1.84	2.39
34+0	1.29	1.80	2.35
35+0	1.23	1.74	2.30
36+0	1.17	1.68	2.24
37+0	1.09	1.61	2.17
38+0	1.01	1.53	2.10
39+0	0.92	1.45	2.02
40+0	0.83	1.35	1.92
41+0	0.72	1.25	1.82
42+0	0.61	1.14	1.72

2.11.16 MCA_PI(GA) Baschat03

MCA_PI(GA) Baschat03
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

References:

Baschat AA, Gembruch U. The cerebroplacental Doppler ratio revisited. Ultrasound Obstet Gynecol 2003;21:124-127.
Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.
Used values from Atlas of Ultrasound Measurements p. 197 Table 39-3.

GA(w+d)	2.5%	MCA_PI	97.5%
20+0	1.22	1.65	2.09
21+0	1.27	1.75	2.24
22+0	1.30	1.83	2.38
23+0	1.34	1.91	2.50
24+0	1.36	1.97	2.61
25+0	1.38	2.02	2.69
26+0	1.40	2.06	2.76
27+0	1.41	2.09	2.81
28+0	1.41	2.10	2.85
29+0	1.41	2.11	2.87
30+0	1.40	2.10	2.87
31+0	1.39	2.08	2.85
32+0	1.37	2.05	2.82
33+0	1.35	2.01	2.77
34+0	1.32	1.95	2.70
35+0	1.28	1.89	2.61
36+0	1.24	1.81	2.51
37+0	1.19	1.72	2.39
38+0	1.14	1.62	2.26
39+0	1.08	1.51	2.10
40+0	1.02	1.39	1.93

2.11.17 MCA_PI(GA) Arduini90

MCA_PI(GA) Arduini90
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

Reference:

Arduini D., Rizzo G. Normal values of Pulsatility Index from fetal vessels: a cross-sectional study on 1556 healthy fetuses. J Perinat Med 1990;18(3):165-172.

GA(w+d)	5%	MCA_PI	95%
20+0	1.36	1.83	2.31
21+0	1.40	1.87	2.34
22+0	1.44	1.91	2.37
23+0	1.47	1.93	2.40
24+0	1.49	1.96	2.42
25+0	1.51	1.97	2.44
26+0	1.52	1.98	2.45
27+0	1.53	1.99	2.45
28+0	1.53	1.99	2.46
29+0	1.53	1.99	2.45
30+0	1.52	1.98	2.44
31+0	1.51	1.97	2.43
32+0	1.49	1.95	2.41
33+0	1.46	1.93	2.39
34+0	1.43	1.90	2.36
35+0	1.40	1.86	2.32
36+0	1.36	1.82	2.28
37+0	1.32	1.78	2.24
38+0	1.27	1.73	2.19
39+0	1.21	1.67	2.14
40+0	1.15	1.61	2.08
41+0	1.08	1.55	2.01
42+0	1.01	1.48	1.94

2.11.18 MCA_PI(GA) Ebbing07

MCA_PI(GA) Ebbing07
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

Reference:

C. Ebbing, S. Rasmussen, T. Kiserud. Middle cerebral artery blood flow velocities and pulsatility index and the cerebroplacental pulsatility ratio: longitudinal reference ranges and terms for serial measurements. Ultrasound Obstet Gynecol 2007; 30: 287–296.

Used values from publication Table 3.

GA(w+d)	5%	MCA_PI	95%
21+0	1.18	1.60	2.19
22+0	1.25	1.69	2.30
23+0	1.32	1.78	2.41
24+0	1.38	1.86	2.52
25+0	1.44	1.94	2.62
26+0	1.50	2.01	2.71
27+0	1.55	2.06	2.78
28+0	1.58	2.11	2.84
29+0	1.61	2.15	2.88
30+0	1.62	2.16	2.90
31+0	1.62	2.16	2.90
32+0	1.61	2.14	2.87
33+0	1.58	2.10	2.82
34+0	1.53	2.04	2.74
35+0	1.47	1.96	2.64
36+0	1.39	1.86	2.52
37+0	1.30	1.75	2.38
38+0	1.20	1.63	2.22
39+0	1.10	1.49	2.05

2.11.19 MCA_PI(GA) Tarzamni09

MCA_PI(GA) Tarzamni09
MCA_PI - Middle Cerebral Artery Pulsatility Index
Fetal Growth

Reference:

Mohammad-Kazem Tarzamni, Nariman Nezami, Fatemeh Gatreh-Samani, Sakine Vahedinia, Mariam Tarzamni. Doppler Waveform Indices of Fetal Middle Cerebral Artery in Normal 20 to 40 Weeks Pregnancies. Archives of Iranian Medicine, Volume 12, Number 1, 2009: 29 – 34.

Used values from publication Table 1.

GA(w+d)	MCA_PI	SD
20+0	1.72	0.29
21+0	1.79	0.26
22+0	1.82	0.28
23+0	1.94	0.28
24+0	1.94	0.43
25+0	1.90	0.36
26+0	1.95	0.39
27+0	2.03	0.38
28+0	2.05	0.49
29+0	2.02	0.40
30+0	1.98	0.34
31+0	1.97	0.35
32+0	1.92	0.33
33+0	1.76	0.30
34+0	1.79	0.28
35+0	1.75	0.33
36+0	1.54	0.26
37+0	1.43	0.31
38+0	1.25	0.21
39+0	1.23	0.15
40+0	1.23	0.16

2.11.20 MCA_PSV(GA) Tarzamni09

MCA_PSV(GA) Tarzamni09
MCA_PSV - Middle Cerebral Artery Peak Systolic Velocity
Fetal Growth

Reference:

Mohammad-Kazem Tarzamni, Nariman Nezami, Fatemeh Gatreh-Samani, Sakine Vahedinia, Mariam Tarzamni. Doppler Waveform Indices of Fetal Middle Cerebral Artery in Normal 20 to 40 Weeks Pregnancies. Archives of Iranian Medicine, Volume 12, Number 1, 2009: 29 – 34.

Used values from publication Table 1.

GA(w+d)	MCA_PSV(cm/s)	SD
20+0	20.00	12.23
21+0	23.15	12.69
22+0	23.77	11.69
23+0	22.72	11.02
24+0	27.92	11.38
25+0	27.14	9.20
26+0	30.56	10.14
27+0	36.13	9.37
28+0	37.24	6.60
29+0	36.54	9.70
30+0	46.42	11.16
31+0	41.24	10.14
32+0	49.28	9.77
33+0	47.30	10.73
34+0	57.10	9.29
35+0	52.06	9.61
36+0	56.65	12.20
37+0	53.93	16.34
38+0	56.97	15.91
39+0	60.85	18.96
40+0	54.42	23.48

2.11.21 MCA_PSV(GA) Ebbing07

MCA_PSV(GA) Ebbing07
MCA_PSV - Middle Cerebral Artery Peak Systolic Velocity
Fetal Growth

Reference:

C. Ebbing, S. Rasmussen, T. Kiserud. Middle cerebral artery blood flow velocities and pulsatility index and the cerebroplacental pulsatility ratio: longitudinal reference ranges and terms for serial measurements. Ultrasound Obstet Gynecol 2007; 30: 287–296.

Used values from publication Table 2.

GA(w+d)	5%	MCA_PSV(cm/s)	95%
21+0	18.12	24.09	31.75
22+0	19.37	25.69	33.79
23+0	20.72	27.41	35.97
24+0	22.15	29.25	38.31
25+0	23.65	31.19	40.80
26+0	25.21	33.22	43.42
27+0	26.83	35.34	46.18
28+0	28.47	37.52	49.05
29+0	30.11	39.74	52.03
30+0	31.73	41.98	55.08
31+0	33.28	44.19	58.18
32+0	34.73	46.34	61.30
33+0	36.04	48.39	64.39
34+0	37.16	50.29	67.41
35+0	38.05	51.99	70.31
36+0	38.66	53.43	73.02
37+0	38.97	54.56	75.49
38+0	38.92	55.34	77.64
39+0	38.51	55.70	79.41

2.11.22 MCA_PSV(GA) Shrestha13

MCA_PSV(GA) Shrestha13
MCA_PSV - Middle Cerebral Artery Peak Systolic Velocity
Fetal Growth

Reference:

Shrestha U, Shrestha I, Ghimire RK, Paudel S. Reference Values of Fetal Peak Systolic Velocity in the Middle Cerebral Artery at 19–40 Weeks of Gestation in Nepalese Population. NJOG VOL. 8 NO. 2 ISSUE 16 Jul-Dec, 2013.

Used values from publication Table 2.

GA(w+d)	5%	MCA_PSV(cm/s)	95%
19+0	17.5380	21.8750	28.1860
20+0	18.0800	23.6150	29.3865
21+0	18.2000	24.1350	30.8600
22+0	19.1200	24.1900	33.1000
23+0	19.4100	25.4400	36.0100
24+0	23.4700	27.5300	36.6320
25+0	24.0400	28.6300	39.0800
26+0	27.5500	32.5700	40.3600
27+0	29.9400	36.4100	42.4700
28+0	31.4900	38.9700	50.8400
29+0	34.5200	42.8900	51.2200
30+0	35.9700	46.5150	56.4800
31+0	37.4300	48.7850	59.5800
32+0	38.7500	50.4250	67.6800
33+0	39.1500	51.6400	71.9300
34+0	40.4325	54.3950	76.7345
35+0	42.2330	58.1400	77.1370
36+0	42.9600	59.6650	80.0200
37+0	44.4550	63.5100	81.2525
38+0	45.7565	65.0450	84.2550
39+0	47.1160	66.7400	84.2690
40+0	47.6400	69.9600	84.4000

2.11.23 CPR(GA) Ebbing07

CPR(GA) Ebbing07
CPR - Cerebroplacental Ratio (MCA PI / UA PI)
PI - Pulsatility Index
MCA - Middle Cerebral Artery
UA - Umbilical Artery
Fetal Growth

Reference:

Ebbing,C.,Rasmussen,S.,Kiserud,T. Middle cerebral artery blood flow velocities and pulsatility index and the cerebroplacental pulsatility ratio: longitudinal reference ranges and terms for serial measurements. Ultrasound Obstet Gynecol, 2007. 30(3): p. 287-96.

Used values from publication Table 5.

GA(w+d)	5%	CPR	95%
21+0	0.90	1.41	2.11
22+0	0.98	1.52	2.25
23+0	1.07	1.63	2.39
24+0	1.16	1.74	2.52
25+0	1.24	1.85	2.65
26+0	1.32	1.95	2.78
27+0	1.40	2.05	2.90
28+0	1.47	2.14	3.00
29+0	1.53	2.21	3.09
30+0	1.58	2.28	3.17
31+0	1.62	2.32	3.23
32+0	1.64	2.35	3.27
33+0	1.65	2.36	3.29
34+0	1.63	2.35	3.29
35+0	1.60	2.32	3.26
36+0	1.55	2.27	3.20
37+0	1.48	2.19	3.12
38+0	1.40	2.09	3.01
39+0	1.29	1.97	2.88

2.11.24 CPR(GA) Baschat03

CPR(GA) Baschat03
CPR - Cerebroplacental Ratio (MCA PI / UA PI)
PI - Pulsatility Index
MCA - Middle Cerebral Artery
UA - Umbilical Artery
Fetal Growth

Reference:
A. A. Baschat, U. Gembruch. The cerebroplacental Doppler ratio revisited. Ultrasound Obstet Gynecol 2003; 21: 124–127.
Used values from publication Table 1.

GA(w+d)	CPR	SD
20+0	1.37	0.40
21+0	1.44	0.25
22+0	1.48	0.29
23+0	1.49	0.23
24+0	1.53	0.22
25+0	1.83	0.48
26+0	1.92	0.55
27+0	2.12	0.61
28+0	2.13	0.52
29+0	1.86	0.43
30+0	2.34	0.55
31+0	2.29	0.34
32+0	2.03	0.48
33+0	2.10	0.40
34+0	2.10	0.45
35+0	2.01	0.34
36+0	2.01	0.46
37+0	2.25	0.66
38+0	1.90	0.41
39+0	1.64	0.29
40+0	1.80	0.44

2.11.25 DA_DIAM(GA) Mielke00

DA_DIAM(GA) Mielke00
DA_DIAM - Ductus Arteriosus Diameter
Fetal Growth

References:

Mielke G, Benda N. Reference ranges for two-dimensional echocardiographic examination of the fetal ductus arteriosus. Ultrasound Ostet Gynecol 2000;15:219-225.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 117 Table 33-2.

GA(w+d)	5%	DA_DIAM(mm)	95%
12+0	0.7	1.0	1.4
13+0	0.8	1.2	1.6
14+0	1.0	1.3	1.8
15+0	1.1	1.5	2.0
16+0	1.2	1.7	2.2
17+0	1.4	1.8	2.4
18+0	1.5	2.0	2.6
19+0	1.6	2.2	2.8
20+0	1.8	2.4	3.0
21+0	1.9	2.5	3.2
22+0	2.0	2.7	3.4
23+0	2.2	2.9	3.6
24+0	2.3	3.0	3.8
25+0	2.4	3.2	4.0
26+0	2.6	3.4	4.2
27+0	2.7	3.5	4.4
28+0	2.8	3.7	4.6
29+0	3.0	3.9	4.8
30+0	3.1	4.0	5.0
31+0	3.2	4.2	5.2
32+0	3.4	4.4	5.4
33+0	3.5	4.5	5.6
34+0	3.6	4.7	5.8
35+0	3.8	4.9	6.0
36+0	3.9	5.0	6.2
37+0	4.1	5.2	6.4
38+0	4.2	5.4	6.6
39+0	4.3	5.5	6.8
40+0	4.5	5.7	7.0

2.11.26 DA_DIAM(GA) Tan92

DA_DIAM(GA) Tan92
DA_DIAM - Ductus Arteriosus Diameter
Fetal Growth

References:

Tan J, Silverman NH, Hoffman JI, et al. Cardiac dimensions determined by cross-sectional echocardiography in the normal human fetus from 18 weeks to term. Am J Cardiol 1992;70:1459-1467.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 116 Table 33-1.

GA(w+d)	2.5%	DA_DIAM(mm)	95%
18+0	1.2	2.2	3.3
19+0	1.3	2.4	3.4
20+0	1.5	2.5	3.5
21+0	1.6	2.6	3.7
22+0	1.7	2.8	3.8
23+0	1.9	2.9	3.9
24+0	2.0	3.0	4.1
25+0	2.1	3.2	4.2
26+0	2.3	3.3	4.3
27+0	2.4	3.4	4.5
28+0	2.5	3.6	4.6
29+0	2.6	3.7	4.7
30+0	2.8	3.8	4.9
31+0	2.9	4.0	5.0
32+0	3.0	4.1	5.1
33+0	3.2	4.2	5.3
34+0	3.3	4.4	5.4
35+0	3.4	4.5	5.5
36+0	3.6	4.6	5.7
37+0	3.7	4.7	5.8
38+0	3.8	4.9	5.9
39+0	4.0	5.0	6.1
40+0	4.1	5.1	6.2
41+0	4.2	5.3	6.3
42+0	4.4	5.4	6.5

2.11.27 DA_PSV(GA) Mielke00

DA_PSV(GA) Mielke00
DA_PSV - Ductus Arteriosus Peak Systolic Velocity
Fetal Growth

References:

Mielke G, Brenda N. Blood flow velocity waveforms of the fetal pulmonary artery and the ductus arteriosus: reference ranges from 13 weeks to term. Ultrasound Obstet Gynecol 2000;15;213-218.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 118 Table 33-3.

GA(w+d)	5%	DA_PSV(cm/s)	95%
13+0	34	43	56
14+0	36	47	59
15+0	39	50	63
16+0	42	54	67
17+0	45	58	71
18+0	48	61	76
19+0	51	65	81
20+0	54	70	86
21+0	57	74	91
22+0	60	78	96
23+0	63	82	102
24+0	67	86	107
25+0	70	90	113
26+0	73	94	118
27+0	75	98	124
28+0	78	102	130
29+0	81	106	135
30+0	83	109	141
31+0	86	113	146
32+0	88	116	151
33+0	89	119	156
34+0	91	122	161
35+0	92	124	165
36+0	93	127	170
37+0	94	129	174
38+0	94	130	178
39+0	94	132	181
40+0	93	133	184

2.11.28 DA_PSV(GA) Brezinka92

DA_PSV(GA) Brezinka92
DA_PSV - Ductus Arteriosus Peak Systolic Velocity
Fetal Growth

Reference:

C. Brezinka, T. W. H. Huisman, T. Stijnen, J. W. Wladimiroff. Normal Doppler flow velocity waveforms in the fetal ductus arteriosus in the first half of pregnancy. Ultrasound Obstet. Gynecol. 2 (1992) 397-401.

Used approximate values from publication Figure 2.

GA(w+d)	5%	DA_PSV(cm/s)	95%
11+0	14	33.01	52
26+0	76	90.41	114

2.11.29 MPA_DIAM(GA) Mielke00

MPA_DIAM(GA) Mielke00
MPA_DIAM - Main Pulmonary Artery Diameter
Fetal Growth

References:

Mielke G, Benda N. Reference ranges for two-dimensional echocardiographic examination of the fetal ductus arteriosus. Ultrasound Ostet Gynecol 2000;15:219-225.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 117 Table 33-2.

GA(w+d)	5%	MPA_DIAM(mm)	95%
12+0	1.2	1.6	2.0
13+0	1.4	1.9	2.3
14+0	1.7	2.1	2.6
15+0	1.9	2.4	2.9
16+0	2.1	2.6	3.2
17+0	2.4	2.9	3.5
18+0	2.6	3.2	3.8
19+0	2.8	3.4	4.1
20+0	3.0	3.7	4.3
21+0	3.3	4.0	4.6
22+0	3.5	4.2	4.9
23+0	3.7	4.5	5.2
24+0	4.0	4.7	5.5
25+0	4.2	5.0	5.8
26+0	4.4	5.3	6.1
27+0	4.6	5.5	6.4
28+0	4.9	5.8	6.7
29+0	5.1	6.0	7.0
30+0	5.3	6.3	7.3
31+0	5.6	6.6	7.6
32+0	5.8	6.8	7.9
33+0	6.0	7.1	8.2
34+0	6.2	7.3	8.4
35+0	6.5	7.6	8.7
36+0	6.7	7.9	9.0
37+0	6.9	8.1	9.3
38+0	7.2	8.4	9.6
39+0	7.4	8.7	9.9
40+0	7.6	8.9	10.2

2.11.30 MPA_DIAM(GA) Ruano07

MPA_DIAM(GA) Ruano07
MPA_DIAM - Main Pulmonary Artery Diameter
Fetal Growth

Reference:

Rodrigo Ruano, Mariane de Fatima Yukie Maeda, Juliana Ikeda Niigaki, Marcelo Zugaib. Pulmonary Artery Diameters in Healthy Fetuses From 19 to 40 Weeks Gestation. J Ultrasound Med 2007; 26:309–316.

Used values from publication Table 1.

GA(w+d)	10%	MPA_DIAM(mm)	90%
19+0	1.88	2.93	4.00
20+0	2.12	3.23	4.37
21+0	2.36	3.53	4.73
22+0	2.60	3.83	5.09
23+0	2.84	4.13	5.45
24+0	3.08	4.43	5.81
25+0	3.32	4.73	6.17
26+0	3.56	5.03	6.53
27+0	3.80	5.33	6.89
28+0	4.04	5.63	7.25
29+0	4.28	5.93	7.61
30+0	4.53	6.23	7.98
31+0	4.77	6.53	8.34
32+0	5.01	6.83	8.70
33+0	5.25	7.13	9.06
34+0	5.49	7.43	9.42
35+0	5.73	7.73	9.78
36+0	5.97	8.03	10.14
37+0	6.21	8.33	10.50
38+0	6.45	8.63	10.86
39+0	6.69	8.93	11.22
40+0	6.93	9.23	11.59

2.11.31 MPA_PSV(GA) Mielke00

MPA_PSV(GA) Mielke00
MPA_PSV - Main Pulmonary Artery Peak Systolic Velocity
Fetal Growth

References:

Mielke G, Brenda N. Blood flow velocity waveforms of the fetal pulmonary artery and the ductus arteriosus: reference ranges from 13 weeks to term. Ultrasound Obstet Gynecol 2000;15;213-218.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 118 Table 33-3.

GA(w+d)	5%	MPA_PSV(cm/s)	95%
13+0	28	38	47
14+0	30	40	50
15+0	32	43	53
16+0	34	45	56
17+0	36	48	59
18+0	38	50	62
19+0	40	53	65
20+0	42	55	68
21+0	43	57	71
22+0	45	60	74
23+0	47	62	77
24+0	49	65	80
25+0	51	67	82
26+0	53	69	85
27+0	54	72	87
28+0	56	74	90
29+0	57	76	92
30+0	59	78	94
31+0	60	80	96
32+0	62	82	98
33+0	63	83	100
34+0	64	85	102
35+0	65	86	103
36+0	66	87	105
37+0	66	88	106
38+0	67	89	107
39+0	67	90	108
40+0	67	91	108

2.11.32 MPA_PSV(GA) Groenenberg90

MPA_PSV(GA) Groenenberg90
MPA_PSV - Main Pulmonary Artery Peak Systolic Velocity
Fetal Growth

Reference:

I. A. L. Groenenberg, T. Stijnen, J. W. Wladimiroff. Blood Flow Velocity Waveforms in the Fetal Cardiac Outflow Tract as a Measure of Fetal Well-Being in Intrauterine Growth Retardation. Pediatric Research 27: 379-382, 1990.

Used approximate values from publication Fig. 4.

GA(w+d)	5%	MPA_PSV(cm/s)	95%
19+0	33	39.11	45
33+0	58	63.89	70

2.11.33 UTA_RI(GA) Merz05

UTA_RI(GA) Merz05
UTA_RI - Uterine Artery Resistivity Index
Fetal Growth

References:

Uteroplacental circulation, vol. 1. In Merz E (ed). Ultrasonography in Obstetrics and Gynecology. Stuttgart, New York, Thieme, 2005, pp 469-480, 613.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 181 Table 37-3.

GA(w+d)	5%	UTA_RI	95%
18+0	0.222	0.447	0.659
19+0	0.204	0.429	0.641
20+0	0.194	0.419	0.630
21+0	0.186	0.411	0.622
22+0	0.180	0.405	0.615
23+0	0.175	0.400	0.610
24+0	0.171	0.395	0.605
25+0	0.167	0.391	0.601
26+0	0.163	0.387	0.597
27+0	0.160	0.384	0.593
28+0	0.157	0.380	0.590
29+0	0.154	0.378	0.587
30+0	0.152	0.375	0.584
31+0	0.150	0.372	0.581
32+0	0.147	0.370	0.578
33+0	0.145	0.368	0.576
34+0	0.144	0.366	0.574
35+0	0.142	0.364	0.571
36+0	0.140	0.362	0.569
37+0	0.139	0.360	0.567
38+0	0.137	0.358	0.566
39+0	0.136	0.357	0.564
40+0	0.135	0.355	0.562

2.11.34 UTA_RI(GA) Kurmanavicius97

UTA_RI(GA) Kurmanavicius97
UTA_RI - Uterine Artery Resistivity Index
Fetal Growth

Reference:

J.Kurmanavicius, I.Florio, J.Wisser, G.Hebich, R.Zimmermann, R.Muller, R.Huch, A.Huch. Reference resistance indices of the umbilical, fetal middle cerebral and uterine arteries at 24-42 weeks of gestation. Ultrasound Obstet/ Gynecol. 10 (1997) 112-120.

Used mean values from publication Table 5.

GA(w+d)	5%	UTA_RI	95%
24+0	0.33	0.45	0.61
25+0	0.33	0.45	0.61
26+0	0.33	0.45	0.61
27+0	0.33	0.44	0.61
28+0	0.33	0.44	0.60
29+0	0.32	0.44	0.60
30+0	0.32	0.44	0.60
31+0	0.32	0.44	0.59
32+0	0.32	0.44	0.59
33+0	0.32	0.43	0.59
34+0	0.32	0.43	0.59
35+0	0.32	0.43	0.58
36+0	0.32	0.43	0.58
37+0	0.32	0.43	0.58
38+0	0.32	0.43	0.57
39+0	0.32	0.42	0.57
40+0	0.32	0.42	0.57
41+0	0.31	0.42	0.56
42+0	0.31	0.42	0.56

2.11.35 UTA_PI(GA) Merz05

UTA_PI(GA) Merz05
UTA_PI - Uterine Artery Pulsatility Index
Fetal Growth

References:

Uteroplacental circulation, vol. 1. In Merz E (ed). Ultrasonography in Obstetrics and Gynecology. Stuttgart, New York, Thieme, 2005, pp 469-480, 613.

Goldberg, Barry B., McGahan, John P. (eds.). Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006.

Used values from Atlas of Ultrasound Measurements p. 181 Table 37-4.

GA(w+d)	5%	UTA_PI	95%
18+0	0.509	0.888	1.407
19+0	0.460	0.838	1.356
20+0	0.436	0.812	1.328
21+0	0.420	0.795	1.309
22+0	0.407	0.781	1.293
23+0	0.397	0.769	1.280
24+0	0.388	0.759	1.268
25+0	0.381	0.751	1.258
26+0	0.374	0.743	1.248
27+0	0.369	0.736	1.239
28+0	0.363	0.729	1.230
29+0	0.358	0.722	1.222
30+0	0.354	0.716	1.214
31+0	0.349	0.711	1.207
32+0	0.345	0.705	1.199
33+0	0.341	0.700	1.192
34+0	0.337	0.695	1.185
35+0	0.333	0.690	1.178
36+0	0.330	0.684	1.171
37+0	0.326	0.679	1.164
38+0	0.322	0.674	1.157
39+0	0.318	0.669	1.150
40+0	0.313	0.663	1.143

2.11.36 UTA_PI(GA) Gomez08

UTA_PI(GA) Gomez08
UTA_PI - Uterine Artery Pulsatility Index
Fetal Growth

Reference:

O. Gomez, F. Figueras, S. Fernandez, M. Bennasar, J.M. Martinez, B. Puerto, E. Gratacos. Reference ranges for uterine artery mean pulsatility index at 11–41 weeks of gestation. Ultrasound Obstet Gynecol 2008; 32: 128–132.

Used values from publication Table 2.

GA(w+d)	5%	UTA_PI	95%
11+0	1.18	1.79	2.70
12+0	1.11	1.68	2.53
13+0	1.05	1.58	2.38
14+0	0.99	1.49	2.24
15+0	0.94	1.41	2.11
16+0	0.89	1.33	1.99
17+0	0.85	1.27	1.88
18+0	0.81	1.20	1.79
19+0	0.78	1.15	1.70
20+0	0.74	1.10	1.61
21+0	0.71	1.05	1.54
22+0	0.69	1.00	1.47
23+0	0.66	0.96	1.41
24+0	0.64	0.93	1.35
25+0	0.62	0.89	1.30
26+0	0.60	0.86	1.25
27+0	0.58	0.84	1.21
28+0	0.56	0.81	1.17
29+0	0.55	0.79	1.13
30+0	0.54	0.77	1.10
31+0	0.52	0.75	1.06
32+0	0.51	0.73	1.04
33+0	0.50	0.71	1.01
34+0	0.50	0.70	0.99
35+0	0.49	0.69	0.97
36+0	0.48	0.68	0.95
37+0	0.48	0.67	0.94
38+0	0.47	0.66	0.92
39+0	0.47	0.65	0.91
40+0	0.47	0.65	0.90
41+0	0.47	0.65	0.89

----

3 Human Gynecological (GYN) exam measurements and calculations

3.1 Uterus, Cervix, Ovary, Kidney, Follicle Volumes

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * pi / 6

If was measured only parameter L, then V = L * L * L * pi / 6.

If were measured only parameters L and H, then V = L * H * H * pi / 6.

Here constant pi = 3.14159265358979323846264338327950.

4 Human Abdominal exam measurements and calculations

4.1 Liver

4.1.1 Liver Volume

Liver Volume is calculated using the following equation:
LV = 133.2 + 0.422 * (CC*AP*LL),
here
LV [ml] - Liver Volume,
CC [cm] - Cranio-Caudal diameter,
AP [cm] - Antero-Posterior diameter,
LL [cm] - Latero-Lateral diameter.

References:
Zoli M., et al. 1989. A rapid method for the in vivo measurement of liver volume. Liver, 1989, 9(3): 159-63.
Suhas G. Parulekar, Aparna Balachandran. 2006. Ultrasound measurements of the Liver. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 414-418.

4.2 Gallbladder

4.2.1 Gallbladder Volume

Gallbladder Volume is calculated using the following equation:
GBV = (pi/6) * L * W * H,
here
GBV [ml] - Gallbladder Volume,
L [cm] - lenght,
W [cm] - width,
H [cm] - height.

References:
Bijan Bijan, Hedieh Eslamy, John P. McGaham. 2006. Ultrasound Measurements of the Gallbladder. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 428-430.

4.2.2 Gallbladder Measurements

Wall [mm] - Gallbladder Wall Thickness

EBD [mm] - Extrahepatic Bile Duct diameter
CBD [mm] - Common Bile Duct diameter
CHD [mm] - Common Hepatic Duct diameter

References:

Bijan Bijan, Hedieh Eslamy, John P. McGaham. 2006. Ultrasound Measurements of the Gallbladder. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 425-428.

Bijan Bijan, Hedieh Eslamy, John P. McGaham. 2006. Ultrasound Measurements of the Extrahepatic Bile Ducts. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 419-425.

Wu CC, Ho YH, Chen CY. 1984. Effect of aging on common bile duct diameter: a real-time ultrasonography study. J. Clin. Ultrasound, 1984; 12:473-478.

Keats TE, Sistorm C. Atlas of Radiologic Measurement, 7th ed. St. Louis, Mosby, 2001.

4.3 Pancreas

4.3.1 Pancreas Measurements

Head [mm] - Pancreas Head diam
Body [mm] - Pancreas Body diam
Tail [mm] - Pancreas Tail diam

Duct Head [mm] - Pancreatic Duct diam in Head
Duct Body [mm] - Pancreatic Duct diam in Body

References:

Bijan Bijan, Hedieh Eslamy, John P. McGaham. 2006. Ultrasound Measurements of the Pancreas. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 431-438.

Niederau C, Sonnenberg A, Muller JE, et al. Sonographic measurements of the normal liver, spleen, pancreas, and portal vein. Radiology 1983; 149: 537-540.

Weill F, Schraub A, Eisenscher A, et al. Ultrasonography of the normal pancreas. Success rate and criteria for normality. Radiology 1977; 123: 417-423.

Haber K, Freimanis AK, Asher WM. Demonstration and dimensional analysis of the normal pancreas with gray-scale echography. AJR Am J Roengenol 1976; 126: 624-628.

Tanaka S, Nakaizumi A, Ioka T, et al. Main pancreatic duct dilation: a sign of high risk of pancreatic cancer. Jpn J Clin Oncol 2002; 32: 407-411.

4.4 Spleen

4.4.1 Splenic Volume

Splenic Volume is calculated using the following equation:
SV = (pi/6) * L * W * T,

here

SV [ml] - Splenic Volume,
L [cm] - lenght,
W [cm] - width,
T [cm] - thickness.

References:

Suhas G. Parulekar, Aparna Balachandran. 2006. Ultrasound Measurements of the Spleen. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 439-443.

4.5 Gastrointestinal Tract

4.5.1 Appendix Measurements

Wall [mm] - Appendix Wall Thickness
Diam [mm] - Appendix Diameter

References:

John P. McGaham. 2006. Ultrasound Measurements of the Gastrointestinal Tract. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 443-445.

4.5.2 Bowel Measurements

Bowel Wall thickness:
St [mm] - thickness at Stomach
SB [mm] - thickness Small Bowel
LB [mm] - thickness Large Bowel

References:

John P. McGaham. 2006. Ultrasound Measurements of the Gastrointestinal Tract. In Goldberg, Barry B., McGahan, John P. (eds.),. Atlas of Ultrasound Measurements, 2nd ed. Mosby Inc. 2006, pp. 443-445.

4.6 Urinary Bladder

4.6.1 Urinary Bladder Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.570

If was measured only parameter L, then V = L * L * L * 0.570.

If were measured only parameters L and H, then V = L * H * H * 0.570.

Reference:

Egon J.W. Merks. Instantaneous Ultrasonic Assessment of Urinary Bladder Volume. Optima Grafische Communicatie, Rotterdam, the Netherlands. 2009.

4.7 Right / Left Kidney

4.7.1 Kidney Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.523

If was measured only parameter L, then V = L * L * L * 0.523.

If were measured only parameters L and H, then V = L * H * H * 0.523.

Reference:

Emamian, S.A., et al. Kidney Dimensions at sonography: correlation with age, Sex, and Habitus in 665 Adult Volunteers. American Journal of Radiology, January, 1993, 160: 83-86.

4.7.2 Kidney Measurements

Pelvis [mm] - Pelvis Diameter

4.8 Liver to Kidney Ratio (LKR)

For Liver and both kidneys can be measured parameters of *region of interest (ROI)* and its distance:
Area [cm2] - ROI area using ellipse,
Long Axis [cm] - ellipse long axis (displayed of measured ROI),
Short Axis [cm] - ellipse short axis (displayed of measured ROI),
Dist [cm] - ROI distance (depth).

When is clicked “Calculate” button, the software for ellipse ROI calculates average gray value (Avg) and standard deviation (StdDev) of ROI gray values. Gray values are in the interval [0,255]. For Avg and StdDev calculation the software temporarily turns off Image Enhancement, Speckle Reduction, Rejection and sets default linear Palette. After calculation they are restored to previous values. At first must be clicked “Calculate” for liver and then for kidneys. Frame Averaging must be turned off manually during scanning. Other values must be set according to used research protocol.

For each kidney is calculated Liver to Kidney Ratio (LKR) using the following equation:

LKR = Liver Avg / Kidney Avg,

where Avg are average gray values in defined liver and kidney ROIs.

IMPORTANT. The software provides LKR calculations only as a tool for hepatorenal index and steatosis research (see reference). LKR cannot be directly used for diagnosis.

Reference:

Webb M, Yeshua H, Zelber-Sagi S, et al. Diagnostic value of a computerized hepatorenal index for sonographic quantification of liver steatosis. AJR 2009; 192:909–914.

5 Human Urological exam measurements and calculations

5.1 Kidney Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.523
If was measured only parameter L, then V = L * L * L * 0.523.
If were measured only parameters L and H, then V = L * H * H * 0.523.

Reference:

Emamian, S.A., et al. Kidney Dimensions at sonography: correlation with age, Sex, and Habitus in 665 Adult Volunteers. American Journal of Radiology, January, 1993, 160: 83-86.

5.2 Bladder Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.570
If was measured only parameter L, then V = L * L * L * 0.570.
If were measured only parameters L and H, then V = L * H * H * 0.570.

Reference:

Egon J.W. Merks. Instantaneous Ultrasonic Assessment of Urinary Bladder Volume. Optima Grafische Communicatie, Rotterdam, the Netherlands. 2009.

5.3 Residual Urine Volume (RUV)

Input:

Longitudinal Section Area (LSAR)	[cm2]
Transversal Section Area (TSAR)	[cm2]

Result:

Residual Urine Volume (RUV)	[cm3]

Equation:

RUV = exp (0.8304 + 0.5625*ln(LSAR) + 0.7211*ln(TSAR))

References:

Dicuio M., Pomara G., Menchini Fabris F., Ales V., Dahlstrand C., Morelli G. Measurements of urinary bladder volume: Comparison of five ultrasound calculation methods in volunteers. Archivio italiano di urologia, andrologia: organo ufficiale [di] Società italiana di ecografia urologica e nefrologica / Associazione ricerche in urologia, 77(1):60-2, April 2005.

Tochiyo Tamura, Wenxi Chen. Seamless Healthcare Monitoring. Advancements in Wearable, Attachable, and Invisible Devices. Springer, 2018.

5.4 Prostate Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.523
If was measured only parameter L, then V = L * L * L * 0.523.
If were measured only parameters L and H, then V = L * H * H * 0.523.

Reference:

R.C. Sanders, T.C. Winter. Clinical Sonography: A Practical Guide. 4th edition. 2007.

5.5 Prostate Specific Antigen Density

Input:

Prostate Specific Antigen (PSA) level	[ng/ml]
(PSA level is entered at software Patient window after selecting Urology exam)	
Prostate Volume (V)	[cm3]

Result:

Prostate Specific Antigen Density (PSAD)	[ng/ml/cm3]

Equation:

PSAD = PSA/V.

Reference:

J. Hickey, F. Goldberg. Ultrasound Review of the Abdomen, Male Pelvis & Small Parts. Philadelphia: Lippincott, 1999.

5.6 Prostate Adenoma Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

Volume measurement equation is the same as described in “Prostate Volume” section.

5.7 Testis Volume

Input:

Length (L)	[cm]
Height (H)	[cm]
Width (W)	[cm]

Result:

Volume (V)	[cm3]

Equation:

V = L * H * W * 0.523
If was measured only parameter L, then V = L * L * L * 0.523.
If were measured only parameters L and H, then V = L * H * H * 0.523.

Reference:

K. Jayaprakasan, Sonal Panchal, Roy Homburg. Ultrasound in Subfertility: Routine Applications and Diagnostic Challenges. Jaypee Brothers Medical Pub, first edition (March 1, 2014), p. 191.

6 Human General exam measurements and calculations

6.1 General exam calculations

6.1.1 Body Surface Area (BSA)

6.1.1.1 BSA via Height and Weight

Input:

Height (H)	[cm]	range 15.0 - 204.0 cm
Weight (W)	[kg]	range 0.5 - 160.0 kg

Result:

Body Surface Area (BSA)	[m2]

Equation:

BSA = 0.007184 * pow(W, 0.425) * pow(H, 0.725)

Reference:

DuBois, d., DuBois, E.F., A Formula to Estimate the Approximate Surface Area if Height and Weight Be Known. Nutrition, Sept-Oct 1989, Vol. 5, No. 5, pp. 303-313.

6.1.1.2 BSA via Weight

Input:

Weight (W)	[kg]	range 0.5 - 160.0 kg

Result:

Body Surface Area (BSA)	[m2]

Equation:

BSA = 0.0004688 * pow(1000*W, 0.8168 - 0.0154 * log10(1000*W))

Reference:

Boyd, Edith. The Growth of the Surface Area of the Human Body (originally published in 1935 by the University of Minnesota Press), Greenwood Press, Westport, Connecticut, 1975, p. 102.

6.2 Pulsed Wave (PW) Doppler and Continuous Wave (CW) Doppler mode Human General exam measurements and calculations

Pulsed Wave (PW) Doppler and Continuous Wave (CW) Doppler mode measurements and calculations are available only if ultrasound scanner supports PW/CW Doppler scanning mode.

6.2.1 PW/CW Stroke Volume (SV) using Flow Area

Stroke Volume (SV) using flow area is calculated according to the following equation:

$SV = A \cdot abs(VTI)$,

here

SV [ml] - Stroke Volume,
A [cm2] - flow area (measured on B mode image),
VTI [cm] - Velocity Time Integral.

Reference:

Hatle, Liv, Angelsen, Bjorn. (1985). Doppler Ultrasound in Cardiology: Physical Principles and Clinical Applications. 2nd ed., Lea and Febiger, Philadelphia, Pennsylvania, 1985, p. 306.

Oh, J.K., J.B. Seward, A.J. Tajik. (1999). The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, 1999, p. 64.

6.2.2 PW/CW Stroke Volume (SV) using Flow Diameter

Stroke Volume (SV) using flow diameter is calculated according to the following equation:

$SV = \pi \cdot (d/2)^2 \cdot abs(VTI)$,

$\pi = 3.14159265$,

here

SV [ml] - Stroke Volume,
d [cm] - flow diameter (measured on B mode image),
VTI [cm] - Velocity Time Integral.

Reference:

Hatle, Liv, Angelsen, Bjorn. (1985). Doppler Ultrasound in Cardiology: Physical Principles and Clinical Applications. 2nd ed., Lea and Febiger, Philadelphia, Pennsylvania, 1985, p. 306.

Goldberg, Barry B., Kurtz, Alfred B. (1990). Atlas of Ultrasound Measurements. Year Book Medical Publishers, Inc., 1990, p. 78.

Huntsman L. L., et al. Noninvasive Doppler determination of cardiac output in man-clinical validation. Circulation 1983; 106:1057-1065.

6.2.3 PW/CW Stroke Volume Index (SI)

Stroke Volume Index (SI) is calculated using the following equation:
SI= SV / BSA,

here

SI [ml/m2]	- Stroke Volume Index,
SV [ml]	- Stroke Volume,
BSA [m2]	- Body Surface Area.

6.2.4 PW/CW Cardiac Output (CO)

Cardiac Output (CO) is calculated using the following equation:
CO = SV * HR / 1000,

here

CO [l/min]	- Cardiac Output,
SV [ml]	- Stroke Volume,
HR [beats/min]	- Heart Rate.

Reference:

J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 59.

Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

Calafiore, P., Stewart, W.J. (1990). Doppler Echocardiographic Quantitation of Volumetric Flow Rate. Cardiology Clinics, May 1990, vol. 8, no. 2, pp. 191-202.

6.2.5 PW/CW Cardiac Index (CI)

Cardiac Index (CI) is calculated using the following equation:
CI = CO / BSA,

here

CI [l/min/m2]	- Cardiac Index,
CO [l/min]	- Cardiac Output,
BSA [m2]	- Body Surface Area.

6.2.6 PW/CW Area calculation using Area and VTI (Continuity Equation)

Area can be calculated by using the principle of conservation of mass: "what comes in must go out".

$$Area2 = Area1 \cdot \frac{abs(VTI1)}{abs(VTI2)},$$

here

Area2 [cm2] - calculated area, corresponding to VTI2,
Area1 [cm2] - area, corresponding to VTI1,
VTI1 [cm] - Velocity Time Integral (VTI) of first area,
VTI2 [cm] - Velocity Time Integral (VTI) of second area.

References:

Zoghbi W.A., et al. Accurate noninvasive quantification of stenotic aortic valve area by Doppler echocardiography. Circulation 1986; 73:452-459.

Grayburn P.A., et al. Pivotal role of aortic valve area calculation by the continuity equation for Doppler assessment of aortic stenosis in patients with combined aortic stenosis and regurgitation. Am J. Cardiol 1988; 61:376-381.

Richards, K.L., et al. (1986). Calculation of Aortic Valve Area by Doppler Echocardiography: A Direct Application of the Continuity Equation. Circulation, vol 73, no. 5, May 1986, pp. 964-969.

6.2.7 PW/CW Area calculation using Area and Velocity (Continuity Equation)

Area can be calculated by using the principle of conservation of mass: "what comes in must go out".

$$Area2 = Area1 \cdot \frac{abs(Vel1)}{abs(Vel2)},$$

here

Area2 [cm2] - calculated area, corresponding to Vel2,
Area1 [cm2] - area, corresponding to Vel1,
Vel1 [cm/s] - velocity at first area,
Vel2 [cm/s] - velocity at second area.

Note. Area calculation using velocities is not so accurate like using VTI, but is more simple and can generate a very close result.

References:

Zoghbi W.A., et al. (1986). Accurate noninvasive quantification of stenotic aortic valve area by Doppler echocardiography. Circulation 1986; 73:452-459.

Grayburn P.A., et al. (1988). Pivotal role of aortic valve area calculation by the continuity equation for Doppler assessment of aortic stenosis in patients with combined aortic stenosis and regurgitation. Am. J. Cardiol. 1988; 61:376-381.

Richards, K.L., et al. (1986). Calculation of Aortic Valve Area by Doppler Echocardiography: A Direct Application of the Continuity Equation. Circulation, vol 73, no. 5, May 1986, pp. 964-969.

Feigenbaum, Harvey. (1995). Echocardiography. 5th edition.

6.2.8 PW/CW Area calculation using Diameter and VTI (Continuity Equation)

Area can be calculated by using the principle of conservation of mass: "what comes in must go out".

$$Area2 = \pi \cdot \left(\frac{d1}{2}\right)^2 \cdot \frac{abs(VTI1)}{abs(VTI2)},$$

here

Area2 [cm2]	- calculated area, corresponding to VTI2,
d1 [cm]	- diameter, corresponding to VTI1,
VTI1 [cm]	- Velocity Time Integral (VTI) of first area that is defined by d1,
VTI2 [cm]	- Velocity Time Integral (VTI) of second area.

References:

Richards, K.L., et al. (1986). Calculation of Aortic Valve Area by Doppler Echocardiography: A Direct Application of the Continuity Equation. Circulation, vol 73, no. 5, May 1986, pp. 964-969.

6.2.9 PW/CW Area calculation using Diameter and Velocity (Continuity Equation)

Area can be calculated by using the principle of conservation of mass: "what comes in must go out".

$$Area2 = \pi \cdot \left(\frac{d1}{2}\right)^2 \cdot \frac{abs(Vel1)}{abs(Vel2)},$$

here

Area2 [cm2]	- calculated area, corresponding to Vel2,
d1 [cm2]	- diameter, corresponding to Vel1,
Vel1 [cm/s]	- velocity at first area that is defined by d1,
Vel2 [cm/s]	- velocity at second area.

Note. Area calculation using velocities is not so accurate like using VTI, but is more simple and can generate a very close result.

References:

Richards, K.L., et al. (1986). Calculation of Aortic Valve Area by Doppler Echocardiography: A Direct Application of the Continuity Equation. Circulation, vol 73, no. 5, May 1986, pp. 964-969.

6.2.10 PW/CW Velocity Ratio S/D

S/D velocity ratio is calculated using the following equation:

Ratio(VelS,VelD) = abs(VelS) / abs(VelD),

here

Ratio(VelS,VelD) [unitless]	- ratio of two velocities,
VelS [cm/s]	- velocity at systole,
VelD [cm/s]	- velocity at diastole.

References:

Ameriso, S., et al. (1990). Pulseless Transcranial Doppler Finding in Takayasu's Arteritis. Journal of Clinical Ultrasound. September 1990, vol. 18, pp. 592-596.

6.2.11 PW/CW Velocity Ratio D/S

D/S velocity ratio is calculated using the following equation:

Ratio(VelD,VelS) = abs(VelD) / abs(VelS),

here

Ratio(VelD,VelS) [unitless]	- ratio of two velocities,
VelD [cm/s]	- velocity at diastole,
VelS [cm/s]	- velocity at systole.

References:

Neumyer, Marsha M., et al. (1989). The Differentiation of Renal Artery Stenosis from Renal Parenchymal Disease by Duplex Ultrasonography. Journal of Vascular Technology. Scientific Article. October 1989, pp. 205-216.

6.2.12 PW/CW Delta Pressure : Delta Time (dP:dt)

dP/dt ratio is calculated using the following equation:

Ratio(dP,dt) = abs(PG1 - PG2) / abs(t1 - t2),

here

Ratio(dP,dt) [mmHg/s]	- ratio of pressure gradients difference and time interval,
PG1 [mmHg]	- Pressure Gradient (PG) at first point,
t1 [s]	- time at first point,
PG2 [mmHg]	- Pressure Gradient (PG) at second point,
t2 [s]	- time at second point.

References:

Otto, C. M. (2000). Textbook of Clinical Echocardiography. 2nd ed., W. B. Saunders Company, 2000.

6.2.13 PW/CW Volume Flow using Diameter

Volume Flow is calculated using the following equation:

$$VF = \frac{60}{1000} \cdot \pi \cdot \left(\frac{d}{2}\right)^2 \cdot abs(Vmean),$$

here

VF [l/min] - Volume Flow,
d [cm] - flow diameter,
Vmean [cm/s] - flow mean velocity.

References:

Burns, Peter. N. (1986). The Physical Principles of Doppler and Spectral Analysis. Journal of Clinical Ultrasound. November/December 1987, vol. 15, no. 9, pp. 567-590.

6.2.14 PW/CW Volume Flow using Area

Volume Flow is calculated using the following equation:

$$VF = \frac{60}{1000} \cdot Area \cdot abs(Vmean),$$

here

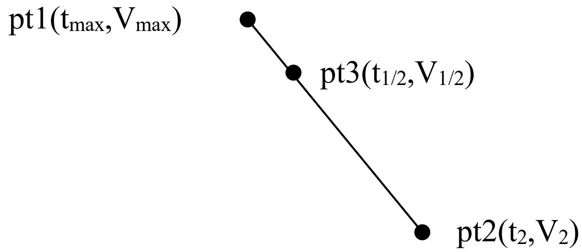
VF [l/min] - Volume Flow,
Area [cm2] - flow area,
Vmean [cm/s] - flow mean velocity.

References:

Burns, Peter. N. (1986). The Physical Principles of Doppler and Spectral Analysis. Journal of Clinical Ultrasound. November/December 1987, vol. 15, no. 9, pp. 567-590.

Alan, Paul L., et al. (2000). Clinical Doppler Ultrasound. 4th ed., Harcourt Publishers Limited. 2000, pp. 36-38.

6.2.15 PW/CW Pressure Half Time (PHT)



Pressure Half Time (PHT) is the time interval ($PHT = t_{1/2} - t_{\max}$) for the peak pressure gradient to reach its half level ($V_{1/2} = V_{\max} \cdot \sqrt{1/2}$). PHT using one decceleration slope with two end-points ($t_{\max}, V_{\max}$) and (t_2, V_2) is calculated according to the following equation:

$$PHT = 1000 \cdot abs\left(V_{\max} \cdot \frac{\Delta t}{\Delta V} \cdot \left(\frac{1}{\sqrt{2}} - 1 \right) \right),$$

here

$\Delta t = t_2 - t_{\max}$,

$\Delta V = V_2 - V_{\max}$,

PHT [ms]	- Pressure Half Time in miliseconds,
tmax [s]	- time of point with maximal velocity Vmax,
Vmax [cm/s]	- maximal velocity,
t2 [s]	- time of the second slope point,
V2 [cm/s]	- velocity at the second slope point.

References:

Hatle L., Angelsen B. (1985). Doppler Ultrasound in Cardiology: Physical Principles and Clinical Applications. Philadelphia, Lea & Febiger, 1985.

Hatle L., et al. (1979). Non-invasive Assessment of Atrioventricular Pressure Halftime by Doppler Ultrasound. Circulation, vol. 60, 1979, pp. 1096-1104.

Reynolds, Terry. (2000). The Echocardiographer's Pocket Reference. 2nd ed., School of Cardiac Ultrasound. Arizona Heart Institute, 2000, p. 391.

6.2.16 PW/CW Mitral Valve Area using PHT

Mitral Valve Area (MVA) using Pressure Half Time (PHT) is calculated using the following equation:

MVA = 220 / PHT,

here

MVA [cm2]	- Mitral Valve Area,
PHT [ms]	- Pressure Half Time,
220	- empirical constant.

References:

Reynolds, Terry. (2000). The Echocardiographer's Pocket Reference. 2nd ed., School of Cardiac Ultrasound. Arizona Heart Institute, 2000, p. 464.

Goldberg, Barry B., Kurtz, Alfred B. (1990). Atlas of Ultrasound Measurements. Year Book Medical Publishers, Inc., 1990, p. 65.

Stamm, R. Brad, et al. (1983). Quantification of Pressure Gradients Across Stenotic Valves by Doppler Ultrasound. Journal of American College of Cardiology, 1983, vol. 2, no. 4, pp. 707-718.

6.3 Elastography mode Human General exam measurements and calculations

Elastography mode measurements and calculations are available only if ultrasound scanner supports Elastography scanning mode.

6.3.1 Strain Ratio (SR)

Strain Ratio (SR) calculates the ratio between average strain intensities in defined regions of interest. Equation is as follows:

B/A SR = StrainB / StrainA,

here

B/A SR [unitless]	- ratio between average strains in regions B and A,
StrainB [%]	- average strain in reference region B, e.g., fat,
StrainA [%]	- average strain in lesion region A.

Strain values are in the interval [0;255]. Percentages are calculated using val_p = 100*val_g/255 %, here val_p - value in percentages, val_g - value in grays [0;255].

References:

Christoph F. Dietrich, Richard G. Barr, André Farrokh, Manjiri Dighe, Michael Hocke, Christian Jenssen, Yi Dong, Adrian Saftoiu, Roald Flesland Havre. Strain Elastography - How To Do It? Ultrasound Int Open. 2017 Sep; 3(4): E137–E149. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5720889/

6.3.2 E/B Distances Ratio

E/B Distances Ratio is calculated using the following equation:

E/B Ratio = DistE / DistB,

here

B/A Ratio [unitless]	- ratio between distance E and distance B,
DistB [mm]	- distance/diameter of lesion on B mode image,
DistE [mm]	- distance/diameter of lesion on Elastography mode image.

References:

Christoph F. Dietrich, Richard G. Barr, André Farrokh, Manjiri Dighe, Michael Hocke, Christian Jenssen, Yi Dong, Adrian Saftoiu, Roald Flesland Havre. Strain Elastography - How To Do It? Ultrasound Int Open. 2017 Sep; 3(4): E137–E149. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5720889/

7 Human Endocrinology exam measurements and calculations

7.1 Thyroid Lobe Volume

Input:

Length (L)	[cm]
Width (W)	[cm]
Thickness (T)	[cm]

Result:

Lobe Volume (V)	[cm3]

Equation:

V = L * W * T * 0.479

Reference:

Kharchenko, V.P., Kotlyarov, P.M., Mogutov, M.S., Alexandrov, Y.K., Sencha, A.N., Patrunov, Y.N., Belyaev, D.V. Ultrasound Diagnostics of Thyroid Diseases. Springer, 2010.

7.2 Thyroid Volume

Input:

Left Lobe Volume (V1)	[cm3]
Right Lobe Volume (V2)	[cm3]

Result:

Thyroid Volume (V)	[cm3]

Equation:

V = V1 + V2

Thyroid volume is equal to the sum of the volumes of both lobes.
The volume of the isthmus is not included.

Reference:

8 Human Musculoskeletal exam measurements and calculations

8.1.1 Hip Angles

Input:

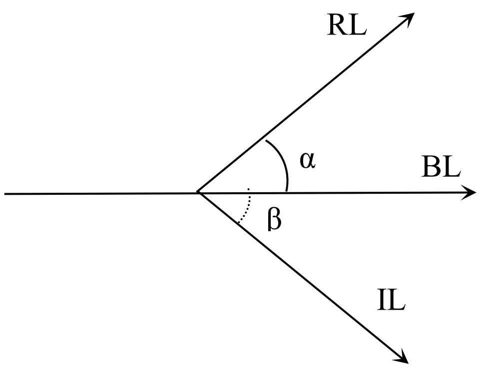
Baseline (BL),
Roof line (RL),
Inclination line (IL).

Result:

α - the angle between BL and RL,
β - the angle between BL and IL.

Equation:

For calculation of angles between vectors are used the same equations that are presented in section "B Angle (2 lines)". Arrows denote second point of each line.



Reference:

Graf, R. Fundamentals of Sonographic Evaluation of the Infant Hip. Semin. Ultrasound CT MR 1986: 4:331-338.

8.1.2 Femoral Head Coverage (FHC)

Input:

d [mm]	- distance from the baseline to the medial aspect of the femoral head;
D [mm]	- maximum diameter of the femoral head.

Result:

FHC [%]	- Femoral Head Coverage.

Equation:

FHC% = (d/D)*100%.

Reference:

Bianchi, S., Martinoli, C. Ultrasound of the Musculoskeletal System. 2007, XIV, 976 p. ISBN 978-3-540-42267-9.

9 Human Vascular exam measurements and calculations

For Vascular measurements and calculations are used the following abbreviations:

CCA	Common Carotid Artery
ICA	Internal Carotid Artery
ECA	External Carotid Artery
PSV	Peak Systole Velocity
EDV	End Diastole Velocity
Rt.	Right side
Lt.	Left side
Prox.	Proximal
Mid.	Middle
Dist.	Distal
UEA	Upper Extremity Arteries
UEV	Upper Extremity Veins
LEA	Lower Extremity Arteries
LEV	Lower Extremity Veins
VFD	Volume Flow using Diameter

9.1 Stenosis % using two distances (areas)

See section "B Stenosis %".

References:

Sladjana Petrovic, et al. 2006. The significance of Color Doppler sonography in selection of patients for Carotid endarterectomy. Acta Fac. Med. NAISS 23 (1): 31-38, 2006.

9.2 Systolic and diastolic velocities ratio

Velocities ratio using two PW/CW mode points at systole and diastole is calculated using the following equation:

Ratio(PSV,EDV) = abs(PSV) / abs(EDV),

here

Ratio(PSV,EDV) [unitless]	- velocities ratio,
PSV [cm/s]	- Peak Systole Velocity,
EDV [cm/s]	- End Diastole Velocity.

Also please see section "PW Velocities A/B Ratio".

9.3 Velocities ratio

Ratios of velocities ICA PSV/CCA PSV, ICA EDV/CCA EDV, ICA PSV/CCA EDV, ECA PSV/CCA PSV, ECA EDV/CCA EDV, ECA PSV/CCA EDV at Rt. (Lt.) Prox. (Mid., Dist.) locations are calculated using the following equation:

RatioAB(V1,V2) = abs(V1) / abs(V2),

here

RatioAB(V1,V2) [unitless]	- velocities ratio,
V1 [cm/s]	- velocity at point pt1,
V2 [cm/s]	- velocity at point pt2.

Also please see section "PW/CW Velocities A/B Ratio".

References:

Edward G. Grant, et al. 2003. Carotid Artery Stenosis: Gray-Scale and Doppler US Diagnosis. Society of Radiologists in Ultrasound Consensus Conference. Vol. 229, No. 2, 2003.

Marie Gerhard-Herman, et al. 2006. Guidelines for Noninvasive Vascular Laboratory Testing: A Report from the American Society of Echocardiography and the Society of Vascular Medicine and Biology. Journal of the American Society of Echocardiography, pp. 955-972, August 2006.

Hoe-Chin Chua, Yih-Yian Sitoh, Arul Earnest, N. Venketasubramanian. Detection of Internal Carotid Artery Stenosis with Duplex Velocity Criteria Using Receiver Operating Characteristic Analysis. Ann. Acad. Med. Singapore 2007; 36:247-52.

9.4 Volume Flow using Diameter

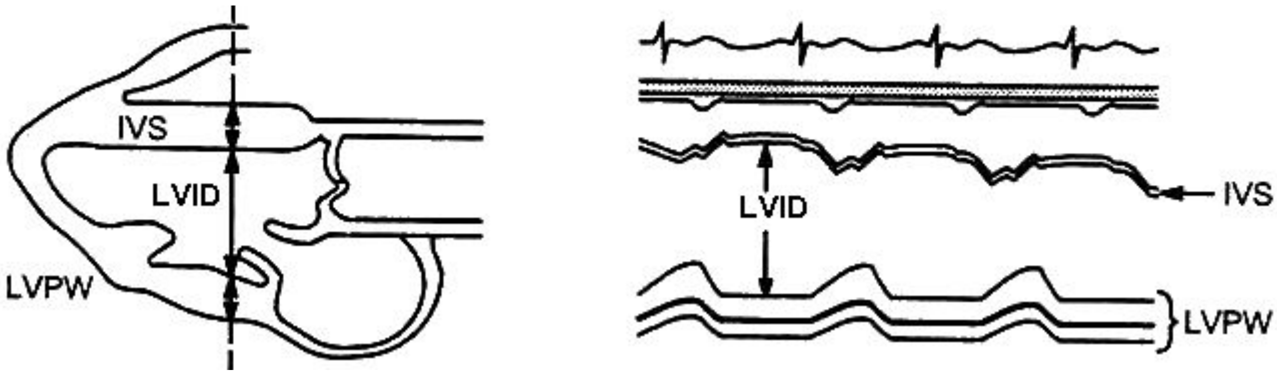
See section “PW/CW Volume Flow using Diameter” of General exam measurements.

10 Human Cardiology exam measurements and calculations

10.1 B and M modes Left Ventricle, Aortic Valve, Left Atrial (PLAX, Parasternal Long Axis) measurements and calculations

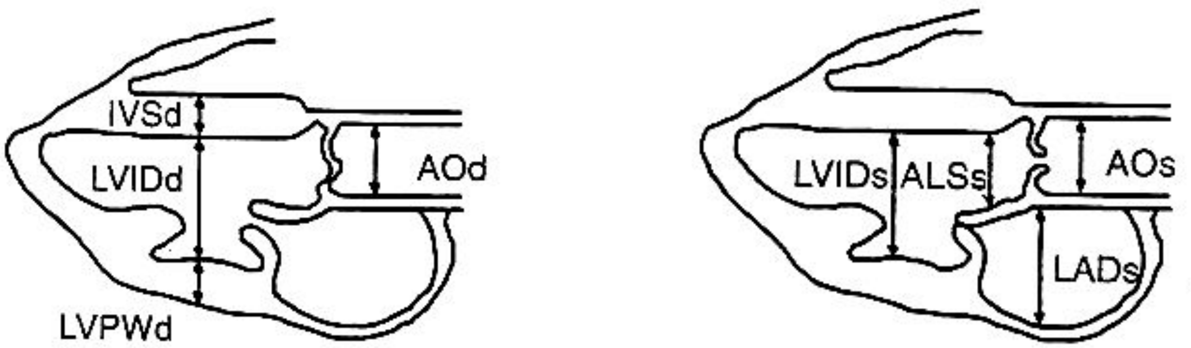
Measurements:

Abbreviation	Item description	Units	Meas. tool
IVSd	Interventricular Septal Thickness, diastole	[cm]	distance
LVIDd	Left Ventricle Internal Diameter, diastole	[cm]	distance
LVPWd	Left Ventricle Posterior Wall Thickness, diastole	[cm]	distance
AOd	Aortic Root Dimension, diastole	[cm]	distance
IVSs	Interventricular Septal Thickness, systole	[cm]	distance
LVIDs	Left Ventricle Internal Diameter, systole	[cm]	distance
LVPWs	Left Ventricle Posterior Wall Thickness, systole	[cm]	distance
LADs	Left Atrial Dimension, systole	[cm]	distance



(a) B mode (b) M mode

Fig. 1. Left Ventricle



(a) Diastole (b) Systole

Fig. 2. Left Ventricle, Aortic Valve, Left Atrial; B mode

10.1.1 Body Surface Area (BSA)

10.1.1.1 BSA via Height and Weight

Input:

Height (H)	[cm]	range 15.0 - 204.0 cm
Weight (W)	[kg]	range 0.5 - 160.0 kg

Result:

Body Surface Area (BSA)	[m2]

Equation:

BSA = 0.007184 * pow(W, 0.425) * pow(H, 0.725)

Reference:

DuBois, d., DuBois, E.F., A Formula to Estimate the Approximate Surface Area if Height and Weight Be Known. Nutrition, Sept-Oct 1989, Vol. 5, No. 5, pp. 303-313.

10.1.1.2 BSA via Weight

Input:

Weight (W)	[kg]	range 0.5 - 160.0 kg

Result:

Body Surface Area (BSA)	[m2]

Equation:

BSA = 0.0004688 * pow(1000*W, 0.8168 - 0.0154 * log10(1000*W))

Reference:

Boyd, Edith. The Growth of the Surface Area of the Human Body (originally published in 1935 by the University of Minnesota Press), Greenwood Press, Westport, Connecticut, 1975, p. 102.

10.1.2 Heart Rate

Input:
HR2BT (two heart beats time) [s]
Result:
HR2B (Heart Rate calculated using 2 beats) [beats/min]
Equation:
HR2B = 120 / HR2BT

10.1.3 Left ventricle volume (Cubed method; LVID)

Input:
LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]
Result:
EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]
Equation:
EDV = pow (LVIDd, 3)
ESV = pow (LVIDs, 3)
Reference:
Dodge, HT, Sandler, DW, et al. The Use of Biplane Angiography for the Measurement of Left Ventricular Volume in Man. American Heart Journal, 1960, Vol. 60, pp. 762-776.
Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

10.1.4 Left ventricle volume (Teichholz method; LVID)

Input:
LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]
Result:
EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]
Equation:
EDV = pow (LVIDd, 3) * 7 / (2.4 + LVIDd)
ESV = pow (LVIDs, 3) * 7 / (2.4 + LVIDs)
Reference:
L.E. Teichholz, T. Kreulen, M.V. Herman, et al. Problems in echocardiographic volume determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy. American Journal of Cardiology, (1976), vol. 37, pp. 7-11.

10.1.5 Left ventricle volume (Gibson method; LVID)

Input:

LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]

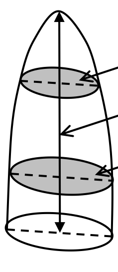
Result:

EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]

Equation:

EDV = (pi / 6) * pow (LVIDd, 2) * (0.98 * LVIDd + 0.59)
ESV = (pi / 6) * pow (LVIDs, 2) * (1.14 * LVIDs + 4.18)
here pi = 3.14159265

10.1.6 Left ventricle volume (Simpson's LVAM-LVAP method)



Input:

LVL (Left ventricle long axis length) [cm]
LVAM (Short axis area at the level of mitral valve) [cm2]
LVAP (Short axis area at the level of papillary muscle) [cm2]

Result:

V (Left ventricle volume) [ml]

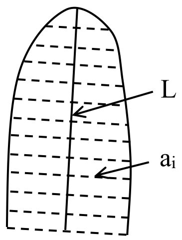
Equation:

V = (LVL / 3) * (LVAM + (LVAM+LVAP)/2 + LVAP/3).

Reference:

Thiele H, et al. Improved accuracy of quantitative assessment of left ventricular volume and ejection fraction by geometric models with steady-state free precession. J. Cardiovasc. Magn. Reson. 2002; 4(3):327-39.

10.1.7 Left ventricle volume (Simpson's single plane method)



Left ventricle volume using single plane Simpson's method (method of disks) is calculated using the following equation:

$$V = \frac{\pi}{4} \cdot \sum_{i=1}^{N} a_i^2 \frac{L}{N},$$

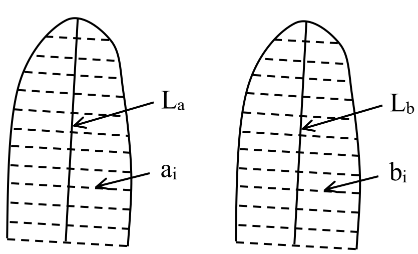
here
V - volume [ml],
L - long axis length [cm],
a_i - i-th disk's diameter [cm],
N - the number of disks (e.g., N=20).

This measurement is performed in apical two chamber view or apical four chamber view.

Reference:

Schiller, N.B., et al., Recommendations for Quantification of the LV by Two-Dimensional Echocardiography. Journal of the American Society of Echocardiography, Sept-Oct 1989, Vol.2, No. 5, p. 364.

10.1.8 Left ventricle volume (Simpson's biplane method)



Left ventricle volume using biplane Simpson's method (method of disks) is calculated using the following equation:

$$V = \frac{\pi}{4} \cdot \sum_{i=1}^{N} a_i b_i \frac{L}{N},$$

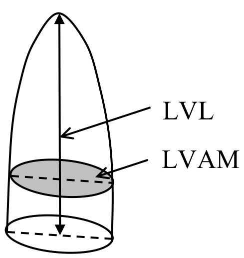
here
V - volume [ml],
L - long axis length [cm],
$L=max(L_a,L_b)$, L_a, L_b - long axis in each plane,
a_i - i-th disk's diameter in one plane [cm],
b_i - i-th disk's diameter in another (perpendicular) plane [cm],
N - the number of disks (e.g., N=20).

For this measurement one trace is painted in apical two chamber view, and another in apical four chamber view.

Reference:

Schiller, N.B., et al., Recommendations for Quantification of the LV by Two-Dimensional Echocardiography. Journal of the American Society of Echocardiography, Sept-Oct 1989, Vol.2, No. 5, p. 364.

10.1.9 Left ventricle volume (Bullet method)



Input:

LVL (Left ventricle long axis length)	[cm]
LVAM (Short axis area at the level of mitral valve)	[cm2]

Result:

V (Left ventricle volume)	[ml]

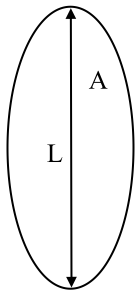
Equation:

V = (5 / 6) * LVL * LVAM.

Reference:

Thiele H, et al. Improved accuracy of quantitative assessment of left ventricular volume and ejection fraction by geometric models with steady-state free precession. J. Cardiovasc. Magn. Reson. 2002; 4(3):327-39.

10.1.10 Left ventricle volume (Ellipsoid single plane method)



$$V = \frac{8}{3\pi} \cdot \frac{A^2}{L},$$

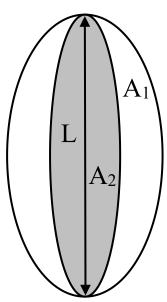
here

V - volume [ml],
A - area [cm2],
L - long axis length [cm],
$\pi = 3.14159265$

Reference:

Thiele H, et al. Improved accuracy of quantitative assessment of left ventricular volume and ejection fraction by geometric models with steady-state free precession. J. Cardiovasc. Magn. Reson. 2002; 4(3):327-39.

10.1.11 Left ventricle volume (Ellipsoid biplane method)



$$V = \frac{8}{3\pi} \cdot \frac{A_1 A_2}{L},$$

here

V - volume [ml],
A_1 - area in one plane [cm2],
A_2 - area in another (orthogonal) plane [cm2],
L - long axis length [cm], L = max(L_1,L_2),
$\pi = 3.14159265$

Reference:

Thiele H, et al. Improved accuracy of quantitative assessment of left ventricular volume and ejection fraction by geometric models with steady-state free precession. J. Cardiovasc. Magn. Reson. 2002; 4(3):327-39.

10.1.12 Stroke Volume

Input:

EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]

Result:

SV (Stroke Volume) [ml]

Equation:

SV = EDV - ESV

Reference:

Gorge G, et al. High Resolution Two-dimensional Echocardiography Improves the Quantification of Left Ventricular Function. J Am Soc Echo, 1992; 5: 125-34.

Roelandt, Joseph. Practical Echocardiology. Ultrasound in Medicine Series, Vol. 1, ed., Denis White, Research Studies Press, 1977, p. 124.

10.1.13 Stroke Volume Index

Input:

SV (Stroke Volume) [ml]
BSA (Body Surface Area) [m2]

Result:

SVI (Stroke Volume Index) [ml/m2]

Equation:

SI = SV / BSA

10.1.14 Ejection Fraction

Input:

EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]

Result:

EF (Ejection Fraction) [%]

Equation:

EF = ((EDV - ESV) / EDV) * 100%

Reference:

J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, 1999.

Pombo, J.F. Left Ventricular Volumes and Ejection by Echocardiography. Circulation, 1971, Vol. 43, pp. 480-490.

Laurenceau J.L., Malergue M.C., The Essentials of Echocardiography. Le Hague:Martinus Nijhoff, 1981.

10.1.15 Cardiac Output

Input:

SV (Stroke Volume) [ml]
HR (Heart Rate) [beats/min]

Result:

CO (Cardiac Output) [l/min]

Equation:

CO = SV * HR / 1000

Reference:

J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 59.

Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

10.1.16 Cardiac Index

Input:

CO (Cardiac Output) [l/min]
BSA (Body Surface Area) [m2]

Result:

CI (Cardiac Index) [l/min/m2]

Equation:

CI = CO / BSA

10.1.17 Interventricular Shortening

Input:

IVSd (Interventricular Septal Thickness, diastole) [cm]
IVSs (Interventricular Septal Thickness, systole) [cm]

Result:

STIVS (Interventricular Shortening) [%]

Equation:

STIVS = ((IVSs / IVSd) - 1) * 100%

Reference:

Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

J.L. Laurenceau, M.C. Malergue. The Essentials of Echocardiography. Le Hague: Martinus Nijhoff, (1981), p. 71.

10.1.18 Left Ventricle Internal Dimension Fractional Shortening

Input:

LVIDd (Left Ventricle Internal Diameter, diastole) [cm]
LVIDs (Left Ventricle Internal Diameter, systole) [cm]

Result:

FS (Fractional Shortening) [%]

Equation:

FS = (1 - (LVIDs / LVIDd)) * 100%

Reference:

J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 59.

Harvey Feigenbaum. Echocardiography. 1995.

10.1.19 Left Ventricle Posterior Wall Shortening

Input:

LVPWd (Left Ventricle Posterior Wall Thickness, diastole) [cm]
LVPWs (Left Ventricle Posterior Wall Thickness, systole) [cm]

Result:

STPW (Posterior Wall Shortening) [%]

Equation:

STPW = ((LVPWs / LVPWd) - 1) * 100%

Reference:

J.L. Laurenceau, M.C. Malergue. The Essentials of Echocardiography. Le Hague: Martinus Nijhoff, (1981), p. 71.

10.1.20 Left Ventricle Mass

Input:

IVSd (Interventricular Septal Thickness, diastole) [cm]
LVIDd (Left Ventricle Internal Diameter, diastole) [cm]
LVPWd (Left Ventricle Posterior Wall Thickness, diastole) [cm]

Result:

LVM (Left Ventricle Cardiac Mass) [g]

Equation:

LVM = 1.04 * (pow (IVSd + LVPWd + LVIDd , 3) - pow (LVIDd, 3)) - 13.6

Reference:

John H. Phillips. Practical Quantitative Doppler Echocardiography. CRC Press, 1991.

10.1.21 Cardiac Mass Index

Input:

LVM (Left Ventricle Cardiac Mass) [g]
BSA (Body Surface Area) [m2]

Result:

CMI (Cardiac Mass Index) [g/m2]

Equation:

CMI = LVM / BSA

10.1.22 LA/AO Ratio

Input:

LADs (Left Atrium Dimension, systole) [cm]
AOd (Aortic Root Dimension, diastole) [cm]

Result:

LADs_AOd_Ratio (LA/AO Ratio) [%]

Equation:

LADs_AOd_Ratio = (LADs / AOd) * 100%

Reference:

Feigenbaum, H. Echocardiography. Philadelphia: Lea and Febiger, (1994), p. 206.

Roelandt, Joseph, Practical Echocardiology, Ultrasound in Medicine Series, Vol. 1, Denis White, ed., Research Studies Press, 1977, p. 270.

Schiller, N.B., et al. Recommendations for Quantification of the LV by Two-Dimensional Echocardiography. J Am Soc Echo, Sept-Oct 1989, Vol. 2, No. 5, p. 364.

10.2 PW/CW mode Human Cardiology measurements and calculations

10.2.1 Left Ventricle

10.2.1.1 Stroke Volume, Stroke Volume Index, Cardiac Output, Cardiac Index

Stroke Volume (SV) is calculated using the following equation:

$$SV = \pi \cdot (LVOT\ \ Diam / 2)^2 \cdot abs(LVOT\ \ VTI),$$

$$\pi = 3.14159265,$$

here

SV [ml]	- Stroke Volume,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT VTI [cm]	- LVOT subvalvular Velocity Time Integral.

Stroke Volume Index (SI) is calculated using the following equation:
SI= SV / BSA,

here

SI [ml/m2]	- Stroke Volume Index,
SV [ml]	- Stroke Volume,
BSA [m2]	- Body Surface Area.

Cardiac Output (CO) is calculated using the following equation:
CO = SV * HR / 1000,

here

CO [l/min]	- Cardiac Output,
SV [ml]	- Stroke Volume,
HR [beats/min]	- Heart Rate.

Cardiac Index (CI) is calculated using the following equation:
CI = CO / BSA,

here

CI [l/min/m2]	- Cardiac Index,
CO [l/min]	- Cardiac Output,
BSA [m2]	- Body Surface Area.

References:

Huntsman L.L., et al. Noninvasive Doppler determination of cardiac output in man-clinical validation. Circulation 1983; 106:1057-1065.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael’s Hospital, University of Toronto. February, 2006.

10.2.1.2 Delta Pressure : Delta Time (dP:dt)

dP/dt ratio is calculated using the following equation:

Ratio(dP,dt) = abs(PG1 - PG2) / abs(t1 - t2),

here

Ratio(dP,dt) [mmHg/s]	- ratio of pressure gradients difference and time interval,
PG1 [mmHg]	- Pressure Gradient (PG) at first point,
t1 [s]	- time at first point,
PG2 [mmHg]	- Pressure Gradient (PG) at second point,
t2 [s]	- time at second point.

References:

Chung N.S., et al. Measurement of left ventricular dP/dt by simultaneous Doppler echocardiography and cardiac catheterization. J. Am. Soc. Echocardiography 1992; 5:147-152.

Oh J.K., et al. The Echo Manual. 2nd ed., p. 70, 1999.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.1.3 Left Ventricle Myocardial Performance Index (Tei index)

Left Ventricle (LV) Myocardial Performance Index (MPI) is calculated using the following equation:

$$LV\ \ MPI = \frac{abs(MCOT - LVET)}{LVET},$$

here

MCOT [ms]	- Mitral Valve Closure to Opening Time,
LVET [ms]	- LV Ejection time,
LV MPI [unitless]	- LV Myocardial Performance Index (MPI).

References:

Tei C., Ling L.H., Hodge D.O., et al. New index of combined systolic and diastolic myocardial performance: a simple and reproducible measure of cardiac function - a study in normals and dilated cardiomyopathy. J. Cardiology 1995; 26: 357-366.

Oh J.K., et al. The Echo Manual. 2nd ed., p. 55, 1999.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.2 Mitral Valve

10.2.2.1 Mitral Valve Area (MVA) using Pressure Half Time (PHT)

Mitral Valve Area (MVA) using Pressure Half Time (PHT) is calculated using the following equation:

MVA = 220 / PHT,

here

MVA [cm2]	- Mitral Valve Area,
PHT [ms]	- Pressure Half Time (for equation see section "PW Presure Half Time"),
220	- empirical constant.

References:

Hatle L., Angelsen B. Doppler Ultrasound in Cardiology: Physical Principles and Clinical Applications. Philadelphia, Lea & Febiger, 1985.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.2.2 Mitral Valve Area (MVA) using Continuity Equation (LVOT, MV VTI)

Mitral Valve Area (MVA) using continuity equation is calculated as follows:

$$MVA = \pi \cdot \left(\frac{LVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(LVOT\ \ VTI)}{abs(MV\ VTI)},$$

here

MVA [cm2]	- Mitral Valve Area (MVA), corresponding to MV VTI,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT VTI [cm]	- LVOT Velocity Time Integral (VTI),
MV VTI [cm]	- Mitral Valve (MV) Velocity Time Integral (VTI).

10.2.2.3 Mitral Valve Area (MVA) using Continuity Equation (LVOT, MV Vmax)

Mitral Valve Area (MVA) using continuity equation is calculated as follows:

$$MVA = \pi \cdot \left(\frac{LVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(LVOT\ \ V\max)}{abs(MV\ V\max)},$$

here

MVA [cm2]	- Mitral Valve Area (MVA), corresponding to MV Vmax,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT Vmax [cm/s]	- LVOT maximal Velocity,
MV Vmax [cm/s]	- Mitral Valve (MV) maximal Velocity.

10.2.2.4 Delta Pressure : Delta Time (dP:dt)

See section "PW/CW Delta Pressure : Delta Time (dP:dt)".

10.2.2.5 Mitral Valve E/A ratio

Mitral Valve (MV) ratio E/A is calculated using the following equation:

Ratio(E,A) = abs(E) / abs(A),

here

Ratio(E,A) [unitless]	- ratio of peak E and A velocities,
E [cm/s]	- MV E velocity,
A [cm/s]	- MV A velocity.

10.2.3 Aortic Valve

10.2.3.1 Aortic Valve Area (AVA) using Continuity Equation (LVOT, AV VTI)

Aortic Valve Area (AVA) using continuity equation is calculated as follows:

$$AVA = \pi \cdot \left(\frac{LVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(LVOT\ \ VTI)}{abs(AV\ VTI)},$$

here

AVA [cm2]	- Aortic Valve Area (AVA), corresponding to AV VTI,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT VTI [cm]	- LVOT Velocity Time Integral (VTI),
AV VTI [cm]	- Aortic Valve (AV) Velocity Time Integral (VTI).

References:

Zoghbi WA, et al. Accurate noninvasive quantification of stenotic aortic valve area by Doppler echocardiography. Circulation 1986; 73: 452-459.

Grayburn PA, et al. Pivotal role of aortic valve area calculation by the continuity equation for Doppler assessment of aortic stenosis in patients with combined aortic stenosis and regurgitation. Am. J. Cardiology 1988; 61: 376-381.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.3.2 Aortic Valve Area (AVA) using Continuity Equation (LVOT, AV Vmax)

Aortic Valve Area (AVA) using continuity equation is calculated as follows:

$$AVA = \pi \cdot \left(\frac{LVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(LVOT\ \ V\max)}{abs(AV\ V\max)},$$

here

AVA [cm2]	- Aortic Valve Area (AVA), corresponding to AV Vmax,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT Vmax [cm/s]	- LVOT maximal Velocity,
AV Vmax [cm/s]	- Aortic Valve (AV) maximal Velocity.

References:

Zoghbi W.A., et al. Accurate noninvasive quantification of stenotic aortic valve area by Doppler echocardiography. Circulation 1986; 73: 452-459.

Grayburn P.A., et al. Pivotal role of aortic valve area calculation by the continuity equation for Doppler assessment of aortic stenosis in patients with combined aortic stenosis and regurgitation. Am. J. Cardiology 1988; 61: 376-381.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.3.3 Aortic Valve Index (AVI)

Aortic Valve Index (AVI) is calculated using the following equation:

AVI = AVA / BSA,

here

AVI [cm2/m2] - Aortic Valve Index,
AVA [cm2] - Aortic Valve Area (AVA),
BSA [m2] - Body Surface Area.

References:

Zoghbi W.A., et al. Accurate noninvasive quantification of stenotic aortic valve area by Doppler echocardiography. Circulation 1986; 73:452-459.

Grayburn P.A., et al. Pivotal role of aortic valve area calculation by the continuity equation for Doppler assessment of aortic stenosis in patients with combined aortic stenosis and regurgitation. Am. J. Cardiology 1988; 61: 376-381.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

Carabello B.A., et al. ACC/AHA 2006 guidelines for the management of patients with valvular heart disease. Circulation 2006; 114 (5): e84-231.

Pibarot P., Dumesnil J.G. Hemodynamic and clinical impact of prosthesis-patient mismatch in the aortic valve position and its prevention. J. Am. Coll. Cardiology 2000; 36: 1131-41.

Jamieson E., et. al. Surgical Management of Valvular Heart Disease 2004. Canadian Cadiovascular Society Consensus Conference. Can. J. Cardiology, vol. 2004; 20 Suppl E: 18E-19E.

10.2.3.4 Dimensionless Performance Index using VTI

Dimensionless Performance Index (DPI) is calculated using the following equation:

$$DPI = \frac{abs(LVOT\ VTI)}{abs(AV\ VTI)},$$

here

DPI [unitless] - Dimensionless Performance Index,
LVOT VTI [cm] - Left Ventricular Outflow Tract VTI,
AV VTI [cm] - Aortic Valve VTI.

References:

Oh J.K., Taliercio C.P., Holmes D.R. Jr., et al. Journal of the American College of Cardiology 11: 1227-1234, 1988.

10.2.3.5 Dimensionless Performance Index using Vmax

Dimensionless Performance Index (DPI) is calculated using the following equation:

$$DPI = \frac{abs(LVOT\ V\max)}{abs(AV\ V\max)},$$

here

DPI [unitless]	- Dimensionless Performance Index,
LVOT VTI [cm]	- Left Ventricular Outflow Tract Vmax,
AV VTI [cm]	- Aortic Valve Vmax.

References:

Oh J.K., Taliercio C.P., Holmes D.R. Jr., et al. Journal of the American College of Cardiology 11: 1227-1234, 1988.

10.2.3.6 Aortic Valve Pressure Half Time

See section "PW/CW Pressure Half Time (PHT)".

10.2.4 Right Ventricle

10.2.4.1 Right Ventricle VTI

See section "PW/CW Trace Velocity Time Integral (VTI)".

10.2.4.2 Delta Pressure : Delta Time (dP:dt)

See section "PW/CW Delta Pressure : Delta Time (dP:dt)".

10.2.4.3 Right Ventricle Myocardial Performance Index (Tei index)

Right Ventricle (RV) Myocardial Performance Index (MPI) is calculated using the following equation:

$$RV\ \ MPI = \frac{abs(TCOT - RVET)}{RVET},$$

here

TCOT [ms] - Tricuspid Valve Closure to Opening Time,
RVET [ms] - RV Ejection time,
RV MPI [unitless] - RV Myocardial Performance Index (MPI).

References:

Tei C., Dujardin K.S., Hodge D.O., et al. Doppler echocardiographic index for assessment of global right ventricular function. J. Am. Soc. Echocardiography 1996; 9: 838-847.

Oh J.K., et al. The Echo Manual. 2nd ed., p. 55, 1999.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.4.4 Mean Pulmonary Artery Pressure (MPAP)

Mean Pulmonary Artery Pressure (MPAP) is calculated using the following equations:

MPAP = pow(10, -0.0068*RVATP+2.1), if was measured only RVATP,
MPAP = pow(10, -2.8*Ratio(RVATP,RVETP)+2.4), if were measured RVATP and RVETP,

here

Ratio(RVATP,RVETP) = RVATP/RVETP,
RVATP [ms] - Acceleration Time,
RVETP [ms] - RV Ejection Time,

MPAP [mmHg] - Mean Pulmonary Artery Pressure.

Reference:

A.Kitabatake, M.Inoue, M.Asao, T.Masuyama, J.Tanouchi, T.Morita, M.Mishima, M.Uematsu, T.Shimazu, M.Hori and H.Abe. Noninvasive evaluation of pulmonary hypertension by a pulsed Doppler technique. Circulation 1983; Vol 68, No 2, pp. 302-309.

10.2.5 Tricuspid Valve

10.2.5.1 Tricuspid Valve Area (TVA) using Continuity Equation (RVOT, TV VTI)

Tricuspid Valve Area (AVA) using continuity equation is calculated as follows:

$$TVA = \pi \cdot \left(\frac{RVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(RVOT\ \ VTI)}{abs(TV\ VTI)},$$

here

TVA [cm2]	- Tricuspid Valve Area (TVA), corresponding to TV VTI,
RVOT Diam [cm]	- Right Ventricular Outflow Tract (RVOT) diameter,
RVOT VTI [cm]	- RVOT Velocity Time Integral (VTI),
TV VTI [cm]	- Tricuspid Valve (TV) Velocity Time Integral (VTI).

References:

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.5.2 Tricuspid Valve Area (TVA) using Continuity Equation (RVOT, TV Vmax)

Tricuspid Valve Area (TVA) using continuity equation is calculated as follows:

$$TVA = \pi \cdot \left(\frac{RVOT\ \ Diam}{2} \right)^2 \cdot \frac{abs(RVOT\ \ V\max)}{abs(TV\ V\max)},$$

here

TVA [cm2]	- Tricuspid Valve Area (TVA), corresponding to TV Vmax,
RVOT Diam [cm]	- Right Ventricular Outflow Tract (RVOT) diameter,
RVOT Vmax [cm/s]	- RVOT maximal Velocity,
TV Vmax [cm/s]	- Tricuspid Valve (TV) maximal Velocity.

References:

Chow, Chi-Ming. CardioMath Equations Info. St. Michael's Hospital, University of Toronto. February, 2006.

10.2.5.3 Tricuspid Valve E/A ratio

Tricuspid Valve (TV) ratio E/A is calculated using the following equation:

Ratio(E,A) = abs(E) / abs(A),

here

Ratio(E,A) [unitless]	- ratio of peak E and A velocities,
E [cm/s]	- MV E velocity,
A [cm/s]	- MV A velocity.

10.2.5.4 Tricuspid Valve Pressure Half Time

See section "PW/CW Pressure Half Time (PHT)".

10.2.6 Pulmonic Valve

10.2.6.1 Pulmonic Valve VTI

See section "PW/CW Trace Velocity Time Integral (VTI)".

10.2.6.2 Pulmonic Valve Pressure Half Time

See section "PW/CW Pressure Half Time (PHT)".

10.2.6.3 Dimensionless Performance Index using VTI

Dimensionless Performance Index (DPI) is calculated using the following equation:

$$DPI = \frac{abs(RVOT\ VTI)}{abs(PV\ VTI)},$$

here

DPI [unitless]	- Dimensionless Performance Index,
RVOT VTI [cm]	- Right Ventricular Outflow Tract VTI,
PV VTI [cm]	- Pulmonic Valve VTI.

10.2.6.4 Dimensionless Performance Index using Vmax

Dimensionless Performance Index (DPI) is calculated using the following equation:

$$DPI = \frac{abs(RVOT\ V\max)}{abs(PV\ V\max)},$$

here

DPI [unitless]	- Dimensionless Performance Index,
RVOT VTI [cm]	- Right Ventricular Outflow Tract Vmax,
PV VTI [cm]	- Pulmonic Valve Vmax.

10.2.7 Pulmonary Vein S/D ratio

Pulmonary Vein ratio S/D is calculated using the following equation:

Ratio(S,D) = abs(S) / abs(D),

here

Ratio(S,D) [unitless] - ratio of S and D velocities,
S [cm/s] - systolic velocity,
D [cm/s] - diastolic velocity.

References:

Qureshi A.M., et al. Transcatheter angioplasty for acquired pulmonary vein stenosis after radiofrequency ablation. Circulation. 2003 Sep 16; 108 (11): 1336-42.

Decuypere V., Delcroix M., Budts W. Left main coronary artery and right pulmonary vein compression by a large pulmonary artery aneurysm. Heart. 2004 Apr; 90 (4): e21.

Hunley S.O., Reeves W.C., Williams M.J., Campbell J., Sorrell V.L. Thoracic Aortic Aneurysm Presenting as Pulmonary Vein Stenosis: A Case Presentation and Review of the Literature. Echocardiography. 1998 Jul; 15 (5): 493-498.

Antonini-Canterin F., Piazza R., Ascione L., Pavan D., Nicolosi G.L. Value of transesophageal echocardiography in the diagnosis of compressive, atypically located pericardial cysts. J. Am. Soc. Echocardiogr. 2002 Feb; 15 (2): 192-4.

Miyaji K., et al. Differences between flow profiles of pulmonary vein anastomoses affected by peripheral atelectasis in cadaveric and bilateral living-donor lobar lung transplantations. J. Am. Soc. Echocardiogr. 2004 Sep; 17 (9): 1003-4.

10.2.8 Hepatic Vein S/D ratio

See section "PW/CW Velocity Ratio S/D".

10.2.9 Shunts

10.2.9.1 Pulmonary-Systemic Flow Ratio (Qp:Qs)

Pulmonary-Systemic Flow Ratio (Qp:Qs) is calculated using the following equation:

Ratio(Qp,Qs) = abs(Qp) / abs(Qs),

$Qp = \pi \cdot (RVOT\ \ Diam / 2)^2 \cdot abs(RVOT\ \ VTI)$,

$Qs = \pi \cdot (LVOT\ \ Diam / 2)^2 \cdot abs(LVOT\ \ VTI)$,

$\pi = 3.14159265$,

here

Ratio(Qp,Qs) [unitless]	- Pulmonary-Systemic Flow Ratio,
Qp [ml]	- pulmonic flow volume,
RVOT Diam [cm]	- Right Ventricular Outflow Tract (RVOT) diameter,
RVOT VTI [cm]	- RVOT Velocity Time Integral,
Qs [ml]	- systemic flow volume,
LVOT Diam [cm]	- Left Ventricular Outflow Tract (LVOT) diameter,
LVOT VTI [cm]	- LVOT Velocity Time Integral.

References:

Sanders S.P., et al. Measurement of systemic and pulmonary blood flow and Qp/Qs ratio using Doppler and two-dimensional echocardiography. Am. J. Cardiology, 51: 952, 1983.

Chow, Chi-Ming. CardioMath Equations Info. St. Michael’s Hospital, University of Toronto. February, 2006.

10.2.10 Proximal Isovelocity Surface Area (PISA)

Proximal Isovelocity Surface Area (PISA) method can be used to measure severity of mitral, aortic, tricuspid and pulmonary regurgitation. This method is available only for ultrasound scanners with Continuous Wave (CW) Doppler mode.

$RFlow = 2 \cdot \pi \cdot R^2 \cdot abs(V_a)$,

$EROA = RFlow / abs(V_{\max})$,

$RVol = EROA \cdot abs(VTI)$,

$\pi = 3.14159265$,

here

RFlow [ml/s]	- Regurgitant Flow,
EROA [cm2]	- Effective Regurgitant Orifice Area,
RVol [ml]	- Regurgitant Volume,
R [cm]	- PISA radius (measured on CFM image),
Va [cm/s]	- aliasing velocity (from CFM image palette),
Vmax [cm/s]	- peak velocity (measured using CW trace),
VTI [cm]	- Velocity Time Integral (measured using CW trace).

References:

J.B. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. Boston: Little, Brown and Company, 1994.

P. Lancellotti, C. Tribouilloy, A. Hagendorff, B.A. Popescu, T. Edvardsen, L.A. Pierard, L. Badano, J.L. Zamorano et al. Recommendations for the echocardiographic assessment of native valvular regurgitation: an executive summary from the European Association of Cardiovascular Imaging. European Heart Journal - Cardiovascular Imaging (2013) 14, 611-644.

11 Canine measurements and calculations

11.1 Canine Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

11.1.1 GA(BD) Nyland95

GA(BD) Nyland95
BD - Body Diameter

Input:

Body Diameter (BD) [mm] BD > 15.71 mm (>40 days)

Result:

Gestational Age (GA) [days]

Equation:

GA = (7 * (BD/10)) + 29

Reference:

T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

BD(mm)	GA(w+d)	BD(mm)	GA(w+d)
15	5+5	34	7+4
16	5+5	35	7+5
17	5+6	36	7+5
18	6+0	37	7+6
19	6+0	38	8+0
20	6+1	39	8+0
21	6+2	40	8+1
22	6+2	41	8+2
23	6+3	42	8+2
24	6+4	43	8+3
25	6+5	44	8+4
26	6+5	45	8+5
27	6+6	46	8+5
28	7+0	47	8+6
29	7+0	48	9+0
30	7+1	49	9+0
31	7+2	50	9+1
32	7+2	51	9+2
33	7+3	52	9+2

11.1.2 GA(BD) Yeager92

GA(BD) Yeager92
BD - Body Diameter (or TD - Trunk Diameter)

Reference:

Yeager AE, Mohammed HO, Meyers-Wallen V, et al. Ultrasonographic appearance of the uterus, placenta, fetus, and fetal membranes throughout accurately timed pregnancy in beagles. Am J Vet Res 1992; 53:342-351.

BD(mm)	GA(w+d)
1	3+3
3	3+5
5	4+0
6	4+2
7	4+4
9	4+6
11	5+1
13	5+3
15	5+5
18	6+0
21	6+2
25	6+4
30	6+6
36	7+1
37	7+3
38	7+5
39	8+0
43	8+2
47	8+4

11.1.3 GA(CRL) Nyland95

GA(CRL) Nyland95
CRL - Crown Rump Length

Input:

Crown Rump Length (CRL) [mm] CRL < 43.33 mm (<40 days)

Result:

Gestational Age (GA) [days]

Equation:

GA = (3 * (CRL/10)) + 27

Reference:

T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

CRL(mm)	GA(w+d)
1	3+6
2	4+0
3	4+0
4	4+0
5	4+1
6	4+1
7	4+1
8	4+1
9	4+2
10	4+2
11	4+2
12	4+3
13	4+3
14	4+3
15	4+4
16	4+4
17	4+4
18	4+4
19	4+5
20	4+5
21	4+5
22	4+6
23	4+6

CRL(mm)	GA(w+d)
24	4+6
25	5+0
26	5+0
27	5+0
28	5+0
29	5+1
30	5+1
31	5+1
32	5+2
33	5+2
34	5+2
35	5+3
36	5+3
37	5+3
38	5+3
39	5+4
40	5+4
41	5+4
42	5+5
43	5+5
44	5+5

11.1.4 GA(CRL) Yeager92

GA(CRL) Yeager92
CRL - Crown Rump Length

Reference:

Yeager AE, Mohammed HO, Meyers-Wallen V, et al. Ultrasonographic appearance of the uterus, placenta, fetus, and fetal membranes throughout accurately timed pregnancy in beagles. Am J Vet Res 1992; 53:342-351.

CRL(mm)	GA(w+d)
2	3+3
8	3+5
10	4+0
12	4+2
16	4+4
20	4+6
28	5+1
46	5+3
50	5+5
60	6+0
68	6+2
80	6+4
91	6+6

11.1.5 GA(GS) Nyland95

GA(GS) Nyland95
GS - Gestational Sac Diameter

Input:

Gestational Sac Diameter (GS) [mm] GS < 33.33 mm (<40 days)

Result:

Gestational Age (GA) [days]

Equation:

GA = (6 * (GS/10)) + 20

Reference:

T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

GS(mm)	GA(w+d)
1	3+0
2	3+0
3	3+1
4	3+1
5	3+2
6	3+3
7	3+3
8	3+4
9	3+4
10	3+5
11	3+6
12	3+6
13	4+0
14	4+0
15	4+1
16	4+2
17	4+2
18	4+3
19	4+3
20	4+4
21	4+5
22	4+5
23	4+6
24	4+6
25	5+0
26	5+1
27	5+1
28	5+2
29	5+2
30	5+3
31	5+4
32	5+4
33	5+5
34	5+5

11.1.6 GA(GS) Yeager92

GA(GS) Yeager92
GS - Gestational Sac Diameter (or CCD - Chorionic Cavity Diameter)

Reference:

Yeager AE, Mohammed HO, Meyers-Wallen V, et al. Ultrasonographic appearance of the uterus, placenta, fetus, and fetal membranes throughout accurately timed pregnancy in beagles. Am J Vet Res 1992; 53:342-351.

GS(mm)	GA(w+d)
2	2+6
4	3+1
6	3+3
10	3+5
12	4+0
15	4+2
17	4+4
20	4+6
25	5+1
28	5+3
33	5+5
34	6+4

11.1.7 GA(HD) Nyland95

GA(HD) Nyland95
HD - Head Diameter

Input:

Head Diameter (HD)	[mm]	HD > 13.33 mm (>40 days)

Result:

Gestational Age (GA)	[days]

Equation:

GA = (15 * (HD/10)) + 20

Reference:

T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

HD(mm)	GA(w+d)
13	5+5
14	5+6
15	6+1
16	6+2
17	6+4
18	6+5
19	7+0
20	7+1
21	7+3
22	7+4
23	7+6
24	8+0
25	8+2
26	8+3
27	8+5
28	8+6
29	9+1
30	9+2

11.1.8 GA(HD) Yeager92

GA(HD) Yeager92
HD - Head Diameter (or BPD - Bi-parietal Head Diameter)

Reference:

Yeager AE, Mohammed HO, Meyers-Wallen V, et al. Ultrasonographic appearance of the uterus, placenta, fetus, and fetal membranes throughout accurately timed pregnancy in beagles. Am J Vet Res 1992; 53:342-351.

HD(mm)	GA(w+d)
10	5+1
11	5+3
13	5+5
14	6+0
15	6+2
17	6+4
18	6+6
19	7+1
20	7+3
21	7+5
22	8+0
24	8+2
26	8+4

11.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

11.3 Canine Estimated Delivery Date (EDD)

Canine gestational period is assumed to be 65 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 65 days - GA;

EDD (AUA) = Exam date + 65 days - AUA.

12 Feline measurements and calculations

12.1 Feline Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

12.1.1 GA(BD) Nyland95

GA(BD) Nyland95
BD - Body Diameter

Input:

Body Diameter (BD) [mm] BD > 17.27 mm (>40 days)

Result:

Gestational Age (GA) [days]

Equation:

GA = (11 * (BD/10)) + 21

Reference:

T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

BD(mm)	GA(w+d)
17	5+5
18	5+6
19	6+0
20	6+1
21	6+2
22	6+3
23	6+4
24	6+5
25	7+0
26	7+1
27	7+2
28	7+3
29	7+4
30	7+5
31	7+6
32	8+0
33	8+1
34	8+2
35	8+4
36	8+5

12.1.2 GA(HD) Nyland95

GA(HD) Nyland95
HD - Head Diameter

Input:
Head Diameter (HD) [mm] HD > 14.8 mm (>40 days)

Result:
Gestational Age (GA) [days]

Equation:

GA = (25 * (HD/10)) + 3

Reference:
T.G. Nyland, J.S. Mattoon. Veterinary Diagnostic Ultrasound. 1995, p. 357.

Using above mentioned equation is derived the following table that is used for GA (w+d) calculations:

HD(mm)	GA(w+d)
14	5+3
15	5+6
16	6+1
17	6+4
18	6+6
19	7+2
20	7+4
21	8+0
22	8+2
23	8+5

12.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

12.3 Feline Estimated Delivery Date (EDD)

Feline gestational period is assumed to be 61 day.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 61 day - GA;

EDD (AUA) = Exam date + 61 day - AUA.

13 Ovine measurements and calculations

13.1 Ovine Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

13.1.1 GA(CRL) Gonzalez98

GA(CRL) Gonzalez98
CRL - Crown Rump Length

Equation:	GA = 14.05 + 1.16*CRL - 0.012*pow(CRL,2).
Equation input:	CRL (mm).
Equation output:	GA (20-40 days).

Reference:

Gonzalez, B. A., Santiago, M. J., Lopez, S. A. 1998. Estimation of fetal development in Manchega dairy ewes by transrectal ultrasonographic measurements. Small Rumin. Res. 27: 243-250.

CRL(mm)	GA(w+d)
5	2+6
6	3+0
7	3+1
8	3+2
9	3+3
10	3+3
11	3+4
12	3+5
13	3+6
14	4+0
15	4+1
16	4+2
17	4+2
18	4+3
19	4+4
20	4+4
21	4+5
22	4+6
23	4+6
24	5+0
25	5+1
26	5+1
27	5+2
28	5+2
29	5+3
30	5+3
31	5+3
32	5+4
33	5+4
34	5+5
35	5+5

13.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

13.3 Ovine Estimated Delivery Date (EDD)

Ovine gestational period is assumed to be 145 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 145 days - GA;

EDD (AUA) = Exam date + 145 days - AUA.

14 Bovine measurements and calculations

14.1 Bovine Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

14.1.1 GA(BD) Wright88

GA(BD) Wright88
BD - Body Diameter (or TD - Trunk Diameter)

Equation:	GA = 37.21*ln(BD) + 39.7; (here ln - natural logarithm).
Equation input:	BD (cm).
Equation output:	GA (50-140 days).

Reference:

Wright, I.A., I.R. White, A.J.F. Russel, T.K. Whyte and A.J. McBean. 1988. Prediction of calving date in beef cows by real-time ultrasonic scanning. Vet. Rec. 123:228.

White, I.R., A.J.F. Russel, I.A. Wright and T.K. Whyte. 1985. Real-time ultrasonic scanning in the diagnosis of pregnancy and the estimation of gestational age in cattle. Vet. Rec. 117:5.

BD(mm)	GA(w+d)	BD(mm)	GA(w+d)
12	6+4	50	14+2
13	7+0	55	14+5
14	7+3	60	15+1
15	7+6	65	15+4
16	8+1	70	16+0
17	8+3	75	16+3
18	8+6	80	16+5
19	9+1	85	17+0
20	9+2	90	17+2
21	9+4	95	17+4
22	9+6	100	17+6
23	10+1	105	18+1
24	10+2	110	18+3
25	10+4	115	18+5
26	10+5	120	18+6
27	11+0	125	19+1
28	11+1	130	19+2
29	11+2	135	19+4
30	11+4	140	19+5
35	12+2	145	19+6
40	13+0	150	20+0
45	13+5	----------------------------	

14.1.2 GA(CRL) EW1

GA(CRL) EW1
CRL - Crown Rump Length

Reference:

CRL(mm)	GA(w+d)
16	5+0
24	6+0
37,5	7+0
56,5	8+0
86	9+0
130,5	10+0
194	11+0

14.1.3 GA(CRL) Wright88

GA(CRL) Wright88
CRL - Crown Rump Length

Equation: GA = 16.73*ln(CRL) + 27.5; (here ln - natural logarithm).
Equation input: CRL (cm).
Equation output: GA (20-50 days).

Reference:

Wright, I.A., I.R. White, A.J.F. Russel, T.K. Whyte and A.J. McBean. 1988. Prediction of calving date in beef cows by real-time ultrasonic scanning. Vet. Rec. 123:228.

White, I.R., A.J.F. Russel, I.A. Wright and T.K. Whyte. 1985. Real-time ultrasonic scanning in the diagnosis of pregnancy and the estimation of gestational age in cattle. Vet. Rec. 117:5.

CRL(mm)	GA(w+d)
6	2+5
7	3+1
8	3+3
9	3+5
10	4+0
11	4+1
12	4+3
13	4+4
14	4+5
15	4+6
16	5+0
17	5+1
18	5+2
19	5+3
20	5+4
21	5+5
22	5+6
23	5+6
24	6+0
25	6+1
26	6+1
27	6+2
28	6+3
29	6+3
30	6+4
31	6+4
32	6+5
33	6+5
34	6+6
35	6+6
36	7+0
37	7+0
38	7+1
39	7+1
40	7+2

14.1.4 GA(HD) Wright88

GA(HD) Wright88
HD - Head Diameter

Equation:	GA = 45.23*ln(HD) + 37.7; (here ln - natural logarithm).
Equation input:	HD (cm).
Equation output:	GA (50-140 days).

Reference:

Wright, I.A., I.R. White, A.J.F. Russel, T.K. Whyte and A.J. McBean. 1988. Prediction of calving date in beef cows by real-time ultrasonic scanning. Vet. Rec. 123:228.

White, I.R., A.J.F. Russel, I.A. Wright and T.K. Whyte. 1985. Real-time ultrasonic scanning in the diagnosis of pregnancy and the estimation of gestational age in cattle. Vet. Rec. 117:5.

HD(mm)	GA(w+d)
12	6+4
13	7+1
14	7+4
15	8+0
16	8+3
17	8+6
18	9+1
19	9+4
20	9+6
21	10+1
22	10+3
23	10+5
24	11+0
25	11+2
26	11+4
27	11+6
28	12+0
29	12+2
30	12+3
35	13+3
40	14+2
45	15+1
50	15+5
55	16+3
60	17+0
65	17+3
70	18+0
75	18+3
80	18+6
85	19+1
90	19+4
95	20+0
100	20+2

14.1.5 GA(UD) Hansen2005

GA(UD) Hansen2005
UD - Uterine Diameter

Reference:

P.J. Hansen, F. Moreira. Pregnancy Diagnosis in the Cow. Dept. of Animal Sciences, University of Florida, 2005.
B. Broaddus1, A. de Vries. A Comparison of Methods for Early Pregnancy Diagnosis. 2005.

UD(mm)	GA(w+d)
50	6+3
65	7+1
70	8+4
80	12+6
100	12+6
120	17+1
180	21+3

14.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

14.3 Bovine Estimated Delivery Date (EDD)

Bovine gestational period is assumed to be 280 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 280 days - GA;

EDD (AUA) = Exam date + 280 days - AUA.

15 Equine measurements and calculations

15.1 Equine Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where $Val1 \leq Val \leq Val2$. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

$$GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).$$

15.1.1 GA(AOD) Ven2004

GA(AOD) Ven2004
AOD - Aorta Diameter

Reference:

Peter van der Ven. Ultrasonographic evaluation of fetal and placental growth in Dutch Warmblood mares. University of Utrecht. Netherlands. 2004.

AOD(mm)	GA(d)
3.7	100
16.8	280

15.1.2 GA(BPD) Ven2004

GA(BPD) Ven2004
BPD - Biparietal Diameter (Skull Diameter)

Reference:
Peter van der Ven. Ultrasonographic evaluation of fetal and placental growth in Dutch Warmblood mares. University of Utrecht. Netherlands. 2004.

BPD(mm)	GA(d)
28.8	100
85.9	280

15.1.3 GA(CRL) Limerick2006

GA(CRL) Limerick2006
CRL - Crown Rump Length

Reference:
Equine Reproduction and Management of Mares and Stallions. University of Limerick. 2006.

CRL(mm)	GA(w+d)
10	4+2
70	8+4
200	17+1
600	25+5
800	34+2
1200	42+6
1500	48+4

15.1.4 GA(EOD) Ven2004

GA(EOD) Ven2004
EOD - Eye Orbit Diameter

Reference:

Peter van der Ven. Ultrasonographic evaluation of fetal and placental growth in Dutch Warmblood mares. University of Utrecht. Netherlands. 2004.

EOD(mm)	GA(d)
14	100
32	280

15.1.5 GA(GS) EW1

GA(GS) EW1
GS - Gestational Sac Diameter

Reference:

GS(mm)	GA(w+d)
14	2+0
28	3+0
34	4+0
44,5	5+0
65	6+0
86	7+0

15.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

15.3 Equine Estimated Delivery Date (EDD)

Equine gestational period is assumed to be 340 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 340 days - GA;

EDD (AUA) = Exam date + 340 days - AUA.

16 Llama measurements and calculations

16.1 Llama Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

16.1.1 GA(BPD) Haibel89

GA(BPD) Haibel89
BPD - Biparietal Diameter

Equation:	GA = 18.8 + 3.79 BPD.
Equation input:	BPD (mm).
Equation output:	GA (66-235 days).

Reference:

G. K. Haibel, E. D. Fung . (1989). Real-time ultrasonic biparietal diameter measurement for the prediction of gestational age in llamas. Theriogenology 32, 1989 Nov., pp. 863-9.

BPD(mm)	GA(w+d)
10	8+1
15	10+6
20	13+4
25	16+2
30	18+6
35	21+4
40	24+2
45	27+0
50	29+5
55	32+3
60	35+1

16.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N.$

For averaging are used only GA>0 values.

16.3 Llama Estimated Delivery Date (EDD)

Llama gestational period is assumed to be 330 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 330 days - GA;

EDD (AUA) = Exam date + 330 days - AUA.

17 Goat measurements and calculations

17.1 Goat Gestational Age (GA) tables

Gestational Age is determined using look-up tables that are presented in this chapter or any other user-defined tables. software allows to enter any number of tables and select which tables should be used for calculations. Used tables depend on selections in software Options and also on selections in OB parameters View dialog.

If some measured value Val is not inside table, but is between smallest and largest table's values, then for Gestational Age determination is used linear interpolation.

At first inside selected table are found values Val1 and Val2 that are nearest to the measured value Val, and where Val1≤Val≤Val2. Table values Val1 and Val2 correspond to Gestational Ages GA1 and GA2. Gestational Age GA that corresponds to measured value Val is calculated using the following equation:

GA = GA1 + (Val - Val1)*(GA2 - GA1) / (Val2 - Val1).

17.1.1 GA(BPD) Haibel90 (Angora)

GA(BPD) Haibel90 (Angora)
BPD - Biparietal Diameter

Equation:	GA = 28.6 + 1.77 BPD.
Equation input:	BPD (mm).
Equation output:	GA (40-100 days).

Reference:

Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
5	5+2
10	6+4
15	7+6
20	9+1
25	10+3
30	11+5
35	13+0
40	14+1
45	15+3

17.1.2 GA(BPD) Haibel90 (Finn)

GA(BPD) Haibel90 (Finn)
BPD - Biparietal Diameter

Equation:	GA = 21.4 + 1.85 BPD.
Equation input:	BPD (mm).
Equation output:	GA (35-96 days).

Reference:

Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
5	4+3
10	5+5
15	7+0
20	8+2
25	9+5
30	11+0
35	12+2
40	13+4
45	15+0

17.1.3 GA(BPD) Haibel90 (Nubian)

GA(BPD) Haibel90 (Nubian)
BPD - Biparietal Diameter

Equation: GA = 26.8 + 1.74 BPD.
Equation input: BPD (mm).
Equation output: GA (40-100 days).

Reference:

Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
5	5+1
10	6+2
15	7+4
20	8+6
25	10+0
30	11+2
35	12+4
40	13+5
45	15+0

17.1.4 GA(BPD) Haibel90 (Pigmy)

GA(BPD) Haibel90 (Pigmy)
BPD - Biparietal Diameter

Equation: GA = 23.2 + 2.08 BPD.
Equation input: BPD (mm).
Equation output: GA (36-102 days).

Reference:
Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
5	4+6
10	6+2
15	7+5
20	9+2
25	10+5
30	12+2
35	13+5
40	15+1

17.1.5 GA(BPD) Haibel90 (Suffolk)

GA(BPD) Haibel90 (Suffolk)
BPD - Biparietal Diameter

Equation:	GA = 22.5 + 1.81 BPD.
Equation input:	BPD (mm).
Equation output:	GA (43-96 days).

Reference:

Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
10	5+6
15	7+1
20	8+3
25	9+5
30	11+0
35	12+2
40	13+4
45	14+6

17.1.6 GA(BPD) Haibel90 (Toggenburg)

GA(BPD) Haibel90 (Toggenburg)
BPD - Biparietal Diameter

Equation:	GA = 27.9 + 1.64 BPD.
Equation input:	BPD (mm).
Equation output:	GA (40-100 days).

Reference:

Haibel, G.K., et al. Real-time ultrasonic measurement of fetal biparietal diameter (BPD) for the prediction of gestational age (GA) in small domestic ungulates. Society for Theriogenology Newsletter. Vol. 13, No. 5, 1990.

BPD(mm)	GA(w+d)
5	5+1
10	6+2
15	7+3
20	8+5
25	9+6
30	11+0
35	12+1
40	13+3
45	14+4

17.2 Average Ultrasound Age (AUA)

Average Ultrasound Age (AUA) is calculated by averaging selected Gestational Ages (GA):

$AUA = (GA_1 + GA_2 + GA_3 + ... + GA_N) / N$.

For averaging are used only GA>0 values.

17.3 Goat Estimated Delivery Date (EDD)

Goat gestational period is assumed to be 150 days.

Estimated Delivery Date (EDD) (or EDC - Estimated Date of Confinement) is calculated using the following formulas:

EDD (GA) = Exam date + 150 days - GA;

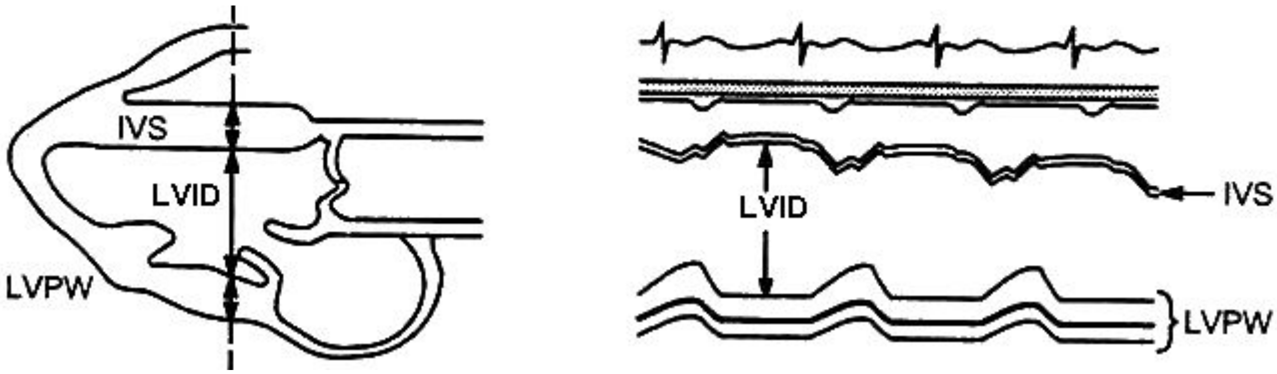
EDD (AUA) = Exam date + 150 days - AUA.

18 Veterinary Cardiology exam measurements and calculations

18.1 Left Ventricle, Aortic Valve, Left Atrial (PLAX, Parasternal Long Axis) measurements and calculations in B and M modes

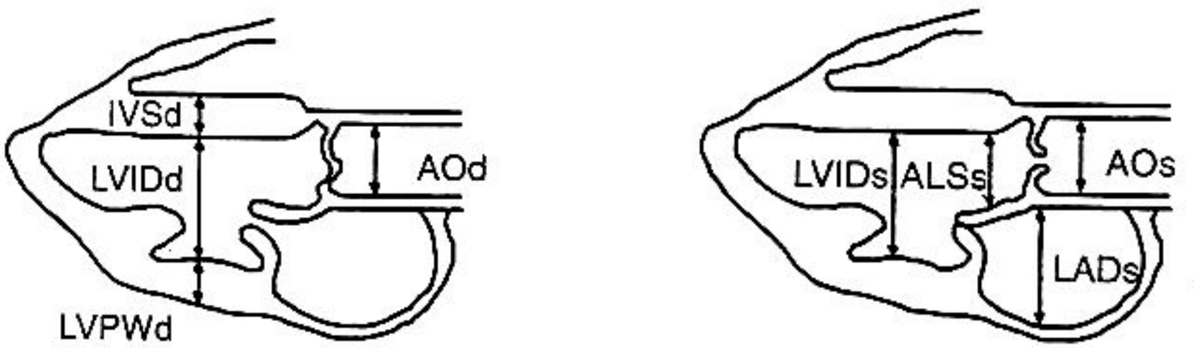
Measurements:

Abbreviation	Item description	Units	Meas. tool
IVSd	Interventricular Septal Thickness, diastole	[cm]	distance
LVIDd	Left Ventricle Internal Diameter, diastole	[cm]	distance
LVPWd	Left Ventricle Posterior Wall Thickness, diastole	[cm]	distance
AOd	Aortic Root Dimension, diastole	[cm]	distance
IVSs	Interventricular Septal Thickness, systole	[cm]	distance
LVIDs	Left Ventricle Internal Diameter, systole	[cm]	distance
LVPWs	Left Ventricle Posterior Wall Thickness, systole	[cm]	distance
LADs	Left Atrial Dimension, systole	[cm]	distance
ET	Ejection Time	[s]	distance



(a) B mode (b) M mode

Fig. 1. Left Ventricle



(a) Diastole (b) Systole

Fig. 2. Left Ventricle, Aortic Valve, Left Atrial; B mode

18.1.1 Heart Rate

Input:
HR2BT (two heart beats time) [s]
Result:
HR2B (Heart Rate calculated using 2 beats) [beats/min]
Equation:
HR2B = 120 / HR2BT

18.1.2 Left ventricle volume (Cubed method; LVID)

Input:
LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]
Result:
EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]
Equation:
EDV = pow (LVIDd, 3)
ESV = pow (LVIDs, 3)
Reference:
Dodge, HT, Sandler, DW, et al. The Use of Biplane Angiography for the Measurement of Left Ventricular Volume in Man. American Heart Journal, 1960, Vol. 60, pp. 762-776.
Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

18.1.3 Left ventricle volume (Teichholz method; LVID)

Input:
LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]
Result:
EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]
Equation:
EDV = pow (LVIDd, 3) * 7 / (2.4 + LVIDd)
ESV = pow (LVIDs, 3) * 7 / (2.4 + LVIDs)
Reference:
L.E. Teichholz, T. Kreulen, M.V. Herman, et al. Problems in echocardiographic volume determinations: echocardiographic-angiographic correlations in the presence or absence of asynergy. American Journal of Cardiology, (1976), vol. 37, pp. 7-11.

18.1.4 Left ventricle volume (Gibson method; LVID)

Input:

LVIDd (Left ventricle internal diameter, diastole) [cm]
LVIDs (Left ventricle internal diameter, systole) [cm]

Result:

EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]

Equation:

EDV = (pi / 6) * pow (LVIDd, 2) * (0.98 * LVIDd + 0.59)
ESV = (pi / 6) * pow (LVIDs, 2) * (1.14 * LVIDs + 4.18)
here pi = 3.14159265

18.1.5 Stroke Volume

Input:

EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]

Result:

SV (Stroke Volume) [ml]

Equation:

SV = EDV - ESV

Reference:

Gorge G, et al. High Resolution Two-dimensional Echocardiography Improves the Quantification of Left Ventricular Function. J Am Soc Echo, 1992; 5: 125-34.

Roelandt, Joseph. Practical Echocardiology. Ultrasound in Medicine Series, Vol. 1, ed., Denis White, Research Studies Press, 1977, p. 124.

18.1.6 Ejection Fraction

Input:
EDV (End diastolic volume) [ml]
ESV (End systolic volume) [ml]
Result:
EF (Ejection Fraction) [%]
Equation:
EF = ((EDV - ESV) / EDV) * 100%
Reference:
J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, 1999.
Pombo, J.F. Left Ventricular Volumes and Ejection by Echocardiography. Circulation, 1971, Vol. 43, pp. 480-490.
Laurenceau J.L., Malergue M.C., The Essentials of Echocardiography. Le Hague:Martinus Nijhoff, 1981.

18.1.7 Cardiac Output

Input:
SV (Stroke Volume) [ml]
HR (Heart Rate) [beats/min]
Result:
CO (Cardiac Output) [l/min]
Equation:
CO = SV * HR / 1000
Reference:
J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 59.
Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

18.1.8 Interventricular Shortening

Input:

IVSd (Interventricular Septal Thickness, diastole) [cm]
IVSs (Interventricular Septal Thickness, systole) [cm]

Result:

STIVS (Interventricular Shortening) [%]

Equation:

STIVS = ((IVSs / IVSd) - 1) * 100%

Reference:

Belenkie, Israel, et al., Assessment of Left Ventricular Dimensions and Function by Echocardiography.American Journal of Cardiology, June 1973, Vol. 31.

J.L. Laurenceau, M.C. Malergue. The Essentials of Echocardiography. Le Hague: Martinus Nijhoff, (1981), p. 71.

18.1.9 Left Ventricle Internal Dimension Fractional Shortening

Input:

LVIDd (Left Ventricle Internal Diameter, diastole) [cm]
LVIDs (Left Ventricle Internal Diameter, systole) [cm]

Result:

FS (Fractional Shortening) [%]

Equation:

FS = (1 - (LVIDs / LVIDd)) * 100%

Reference:

J.K. Oh, J.B. Seward, A.J. Tajik. The Echo Manual. 2nd ed., Lippincott, Williams, and Wilkins, (1999), p. 59.

Harvey Feigenbaum. Echocardiography. 1995.

18.1.10 Left Ventricle Posterior Wall Shortening

Input:

LVPWd (Left Ventricle Posterior Wall Thickness, diastole) [cm]
LVPWs (Left Ventricle Posterior Wall Thickness, systole) [cm]

Result:

STPW (Posterior Wall Shortening) [%]

Equation:

STPW = ((LVPWs / LVPWd) - 1) * 100%

Reference:

J.L. Laurenceau, M.C. Malergue. The Essentials of Echocardiography. Le Hague: Martinus Nijhoff, (1981), p. 71.

18.1.11 Mean Velocity of Circumferential Fibre Shortening

Input:

FS (Fractional Shortening) [%]

ET (Ejection Time) [s]

Result:

VCF (Mean Velocity of Circumferential Fibre shortening) [s^{-1}]

Equation:

VCF = FS / ET

Reference:

Goddard, P.J., Veterinary Ultrasonography. CAB International, (1995), p. 329.

18.1.12 LA/AO Ratio

Input:

LADs (Left Atrium Dimension, systole) [cm]

AOd (Aortic Root Dimension, diastole) [cm]

Result:

LADs_AOd_Ratio (LA/AO Ratio) [%]

Equation:

LADs_AOd_Ratio = (LADs / AOd) * 100%

References:

Feigenbaum, H. Echocardiography. Philadelphia: Lea and Febiger, (1994), p. 206.

Roelandt, Joseph, Practical Echocardiology, Ultrasound in Medicine Series, Vol. 1, Denis White, ed., Research Studies Press, 1977, p. 270.

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19 Revision History

Revision	Revision Date	Description of Revision	Revision Author
1.0.0	2006.06.09	Initial Release	V.Perlibakas
1.0.1	2006.07.18	Added Urological, Gynecological measurements and calculations	V.Perlibakas
1.0.2	2006.08.03	Added Endocrinology calculations	V.Perlibakas
1.0.3	2006.08.24	Added Canine OB and Feline OB calculations	V.Perlibakas
1.0.4	2006.09.21	Added Cardiology measurements and calculations	V.Perlibakas
1.0.5	2006.11.16	Added Overview section and Human Fetal Growth tables	V.Perlibakas
1.0.6	2006.11.22	Added Ovine, Bovine, Equine, Llama, Goat OB tables	V.Perlibakas
1.0.7	2007.06.12	Added information about B mode length measurement	V.Perlibakas
1.0.8	2007.06.13	Added sections about general M mode and PW mode measurements and calculations	V.Perlibakas
1.0.9	2007.06.18	Added section about PW mode Human General exam measurements and calculations	V.Perlibakas
1.1.0	2007.10.10	Updated equations of PW mode measurements and calculations.	V.Perlibakas
1.1.1	2007.11.13	Added Veterinary Cardiology measurements and calculations.	V.Perlibakas
1.2.0	2008.04.14	Added section "PW mode Human Cardiology measurements and calculations".	V.Perlibakas
1.3.0	2008.04.24	Added section "Human Vascular exam measurements and calculations".	V.Perlibakas
1.4.0	2008.04.29	Added section "Human Abdominal exam measurements and calculations".	V.Perlibakas
1.4.1	2009.10.19	Abbreviations "EdV", "EsV" changed to "EDV", "ESV".	V.Perlibakas
1.4.2	2010.10.08	Changed equation of PW Resistivity Index (RI), updated information about PW Pulsatility Index (PI).	V.Perlibakas
1.5.0	2010.11.16	Added OB AFI equation and AFI(GA) Moore90, AFI(GA) Magann00 growth tables.	V.Perlibakas
1.6.0	2011.03.07	To Veterinary Cardiology added ET and VCF.	V.Perlibakas
1.7.0	2011.11.03	To Human Cardiology added MPAP.	V.Perlibakas
1.8.0	2011.11.18	To B mode General measurements added volume calculation using trace(s), to Human Cardiology added more Left Ventricle Volume calculation methods.	V.Perlibakas
1.9.0	2012.03.27	To human General exam measurements added information about hip angles.	V.Perlibakas
2.0.0	2012.04.24	To human General exam measurements added information about FHC calculation.	V.Perlibakas
2.1.0	2012.12.05	To Human OB/GYN exam added more EFW calculation methods, added information about FHR measurement and FHR(GA) table.	V.Perlibakas
2.2.0	2013.12.02	To Human Cardiology exam added Proximal Isovelocity Surface Area (PISA) method. Updated information about PW measurements and calculations in order to reflect that they are also available in CW mode.	V.Perlibakas
2.3.0	2014.01.09	Added Human OB exam Nuchal Translucency (NT) measurement and NT(CRL) growth estimation tables.	V.Perlibakas
2.4.0	2014.02.24	Added Human OB Doppler measurements, calculations, growth tables.	V.Perlibakas
2.5.0	2014.03.18	Added Human Musculoskeletal exam.	V.Perlibakas

Revision	Revision Date	Description of Revision	Revision Author
2.6.0	2014.10.16	To Urology exam added Prostate Specific Antigen Density calculation.	V.Perlibakas
2.6.1	2015.09.09	Added section “Vascular puncture measurements and calculations”.	V.Perlibakas
2.6.2	2016.12.07	Added sections "Average Gray Value" and "Standard Deviation of Gray Values".	V.Perlibakas
2.6.3	2018.02.07	Added information about measured hand and leg vessels in Vascular exam.	V.Perlibakas
2.6.4	2018.12.07	To document header added “Echo Wave II” release version.	V.Perlibakas
2.6.5	2022.12.08	Updated company information.	V.Perlibakas
2.6.6	2023.05.17	Updated information about ellipse calculations, added section “Liver to Kidney Ratio (LKR)”	V.Perlibakas
2.6.7	2023.12.07	Added information about histogram.	V.Perlibakas
2.7.0	2023.12.15	Added section “Elastography mode Human General exam measurements and calculations”.	V.Perlibakas
2.7.1	2024.03.05	Changed names of Elastography measurements.	V.Perlibakas

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