



Ultrasonography in obstetrics



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Aim of the ultrasound in the first trimester

- Confirm fetal vitality
- Determine the number of fetuses
- **Accurate dating of pregnancy**
- **Screening for chromosomal aneuploidies**
- **Early detection of fetal anomalies**
- Identification of women at risk of developing preeclampsia
- Assessment of the adnexa

Accurate dating of pregnancy

- **Methods for determining EDD**
 - CRL (crown rump length)

- LMP (last menstruation period)
- Date of embryotransfer (in case of ART)

CRL - crown-rump length

- CRL can objectively estimate the gestational age from 8wk or CRL > 10mm
- The accuracy of pregnancy length determination is ± 3 to 5 days
- Limitations: patient's habitus, correct measurement methodology
- The essential component of combined screening in the first trimester

Am J Obstet Gynecol. 1983 Mar 1;145(3):562-5.
doi: 10.1016/0002-9378(83)91196-1.

A comparison of the reliability of the estimated date of confinement predicted by crown-rump length and biparietal diameter

M M Kopta, R R May, J P Crane

Br J Obstet Gynaecol. 1975 Sep;82(9):702-10. doi: 10.1111/j.1471-0528.1975.tb00710.x.

A critical evaluation of sonar "crown-rump length" measurements

H P Robinson, J E Fleming



Why 11+0 and 13+6

CRL 45-84 mm

- The reason for selecting 11+0
- Screening necessitates the availability of a diagnostic test
- Many major fetal abnormalities can be diagnosed at the NT scan

- The reason for selecting 13+6
- To provide women with affected fetuses the option of 1st termination
- Nuchal fluid in chromosomally abnormal fetuses decreases after 13 weeks.
- After 13 weeks the fetus becomes vertical

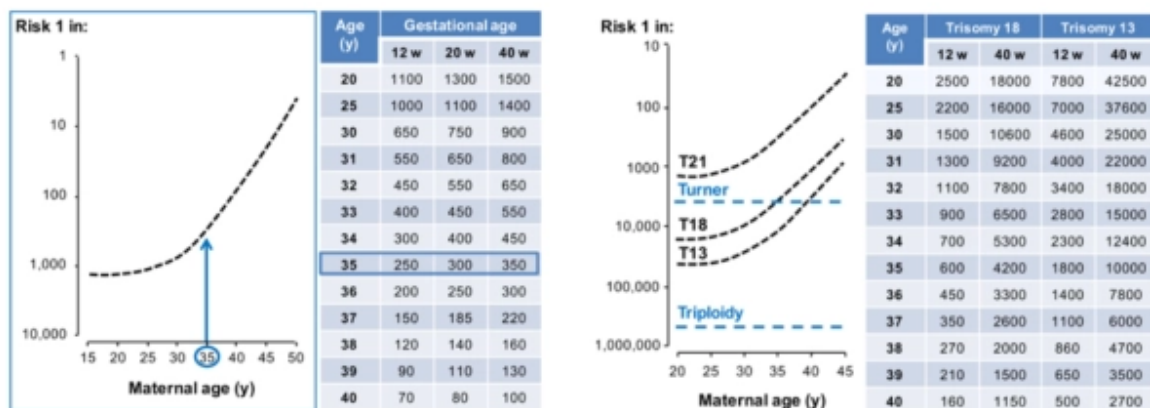
Nuchal translucency

- Nuchal translucency (NT) is the sonographic appearance of a collection of fluid under the skin behind the fetal neck in the first trimester of pregnancy
- The incidence of chromosomal and other abnormalities is related to the size, rather than the appearance of NT.
- 75-80% fetuses with T21 have NT above the 95th percentile



Screening for chromosomal aneuploidies

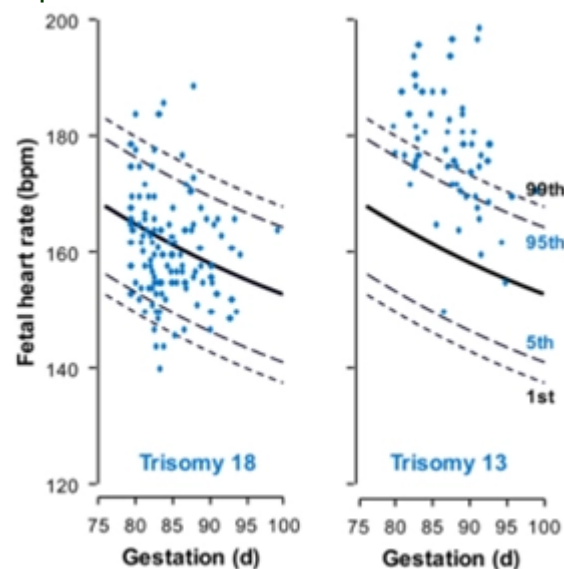
- Depends on maternal age, history and gestational age
- A priori risk is multiplied with the series of LR



Fetal heart rate

- In euploid fetuses
 - about 110 bpm at 5 weeks of gestation to 170 bpm at 10 weeks gradually decreases to 150 bpm by 14 weeks.

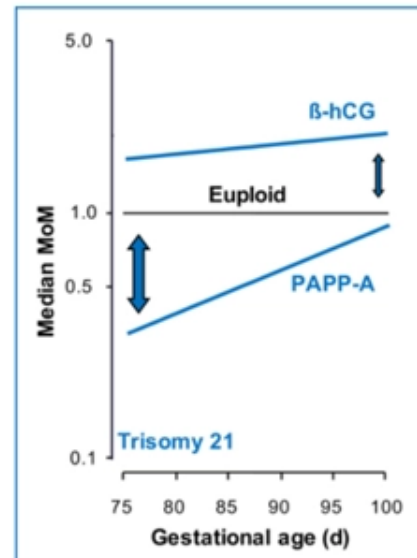
- **In trisomy 21**
 - mildly increased and is above the 95th centile in about 15% of cases.
- **In trisomy 18**
 - mildly decreased and is below the 5th centile in about 15% of cases.
- **In trisomy 13**
 - substantially increased and is above the 95th centile in 85% of cases.
- **Adding FHR to the combined screening**
 - Is of little significance in increasing the DR of T21 and T18 but is essential in increasing the DR of T13
- **Distinguishing between trisomy 18 and 13**
 - Otherwise similar in presenting with increased fetal NT and decreased maternal serum free β -hCG and PAPP-A.



Biochemical parametrs

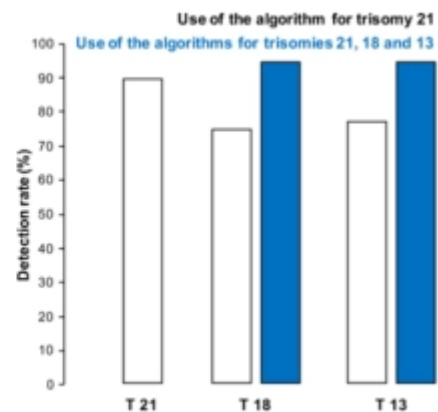
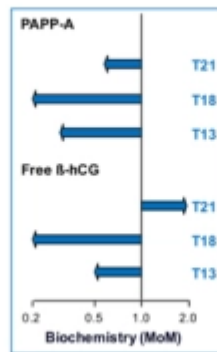
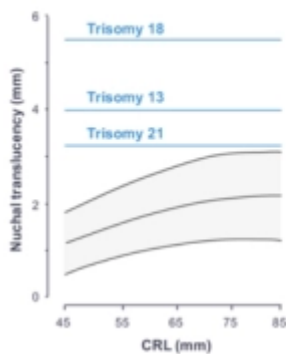
- **In trisomy 21 free β -hCG**
 - is higher than in euploid pregnancies
- **In trisomy 21 PAPP-A**
 - is lower than in euploid pregnancies
- **First trimestr combined screening for T 21**
 - with a combination of matgernal age, NT, FHR and serum free beta HCG a PAPP-A has a DR od 90% for T 21 with a FPR of 3%

	free β -hCG	PAPP-A
Trisomy 21	2.0	0.5
Trisomy 18	0.2	0.2
Trisomy 13	0.3	0.3
Turner	1.2	0.5
Triploidy		
» Digynic	0.2	0.1
» Diandric	9.0	0.7



Combined screening

- A beneficial consequence of screening for T21 is the early diagnosis of T18 and 13.
- At a FPR of 3% the DR of T21 is 90% and of T18 and 13 is about 95%.



Nasal bone

- The nasal bone is considered to be
 - **present** if it is more echogenic than the overlying skin
 - **absent** if it is either not visible or its echogenicity is the same or less than that of the skin.

At 11-13 weeks the nasal bone is considered to be absent in:

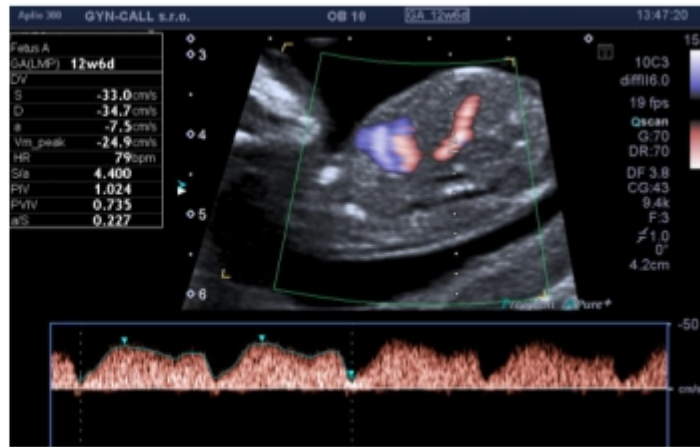
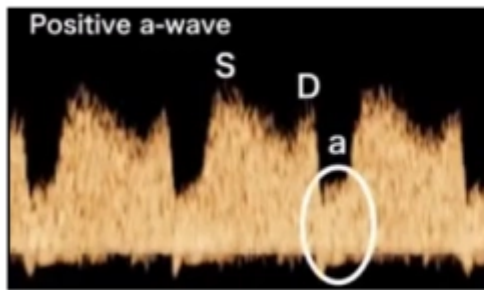
- | | | |
|---------------------------|------|--|
| • Euploid fetuses | 1-3% | Absence of the nasal bone is more common if: <ul style="list-style-type: none">• The gestation is 11 than 13 weeks.• The fetal nuchal translucency is high.• The mother is Black. |
| • Fetuses with trisomy 21 | 60% | |
| • Fetuses with trisomy 18 | 50% | |
| • Fetuses with trisomy 13 | 40% | |

- NB improves the performance of combined first trimester screening increasing the DR of T21 from 90% to 93% and decreasing the FPR from 3% to 2,5%



Ductus venosus

- Short vessel connecting the umbilical vein to the inferior vena cava
- 80% of oxygenated blood from the placenta bypasses the liver and is directed to the heart and then to the fetal brain.



Ductus venosus



Reversed a-wave

At 11-13 weeks reversed a-wave is found in about:

- Euploid fetuses 3%
- Fetuses with trisomy 21 65%
- Fetuses with trisomy 18 55%
- Fetuses with trisomy 13 55%

Reversed a-wave is more common if:

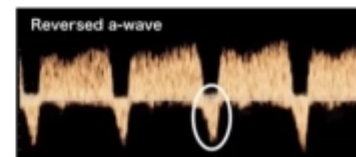
- The gestation is 11 than 13 weeks.
- The fetal nuchal translucency is high.
- The maternal serum PAPP-A is low.
- The mother is Black.



Reversed a-wave is associated with increased risk for:

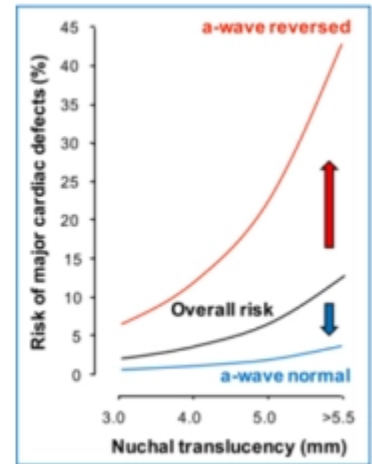
- Chromosomal abnormalities
- Cardiac defects
- Fetal death

However, in about 80% of cases with reversed a-wave the pregnancy outcome is normal.



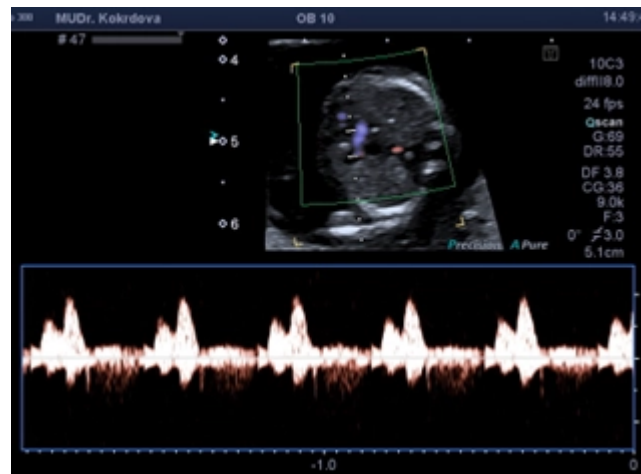
- If the ductus venosus a-wave is reversed - detailed ultrasound examination is carried out to exclude or diagnose major cardiac defect
- **DV improves** the performance of combined first trimester screening increasing the DR of T21 from 90% to 95% and decreasing the FPR from 3% to 2.5%

The prevalence of major cardiac defects in euploid fetuses is about 4 in 1,000.

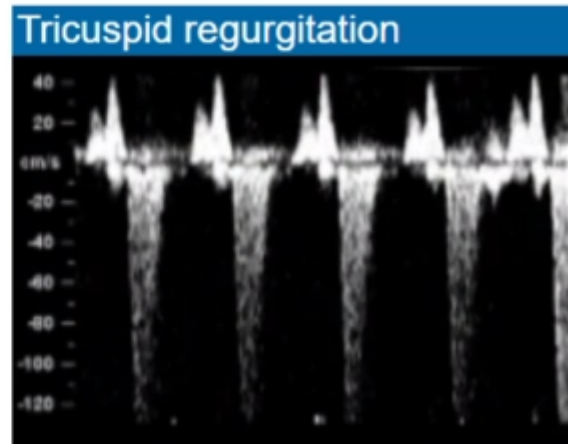
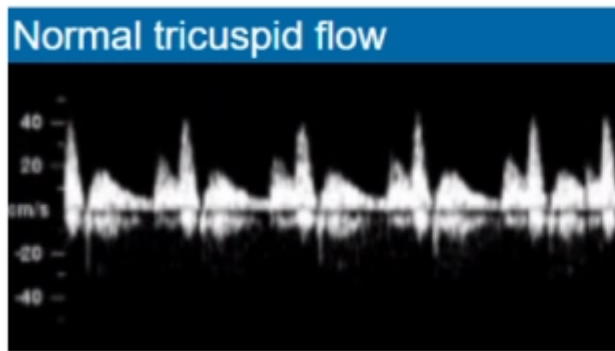


Tricuspid flow

- The fetus should not be moving
- Fetal thorax occupies the whole screen
- An apical four-chamber view of the fetal heart
- The pulsed Doppler sample... 2 to 3 mm
- The insonation angle less than 30 degrees
- The tricuspid valve could be insufficient in one or more of its three cusps
- The sweep speed should be high (2 to 3 cm/s)



- **Normal profile:**
 - with no regurgitation during systole.
- **Regurgitation:**
 - during approximately half of systole and with a velocity more than 60 cm/s.



Tricuspid regurgitation

At 11-13 weeks tricuspid regurgitation is found in about:

- 1% Euploid fetuses
- 55% Fetuses trisomy 21
- 30% Fetuses trisomy 18
- 30% Fetuses trisomy 13

Tricuspid regurgitation is more common if:

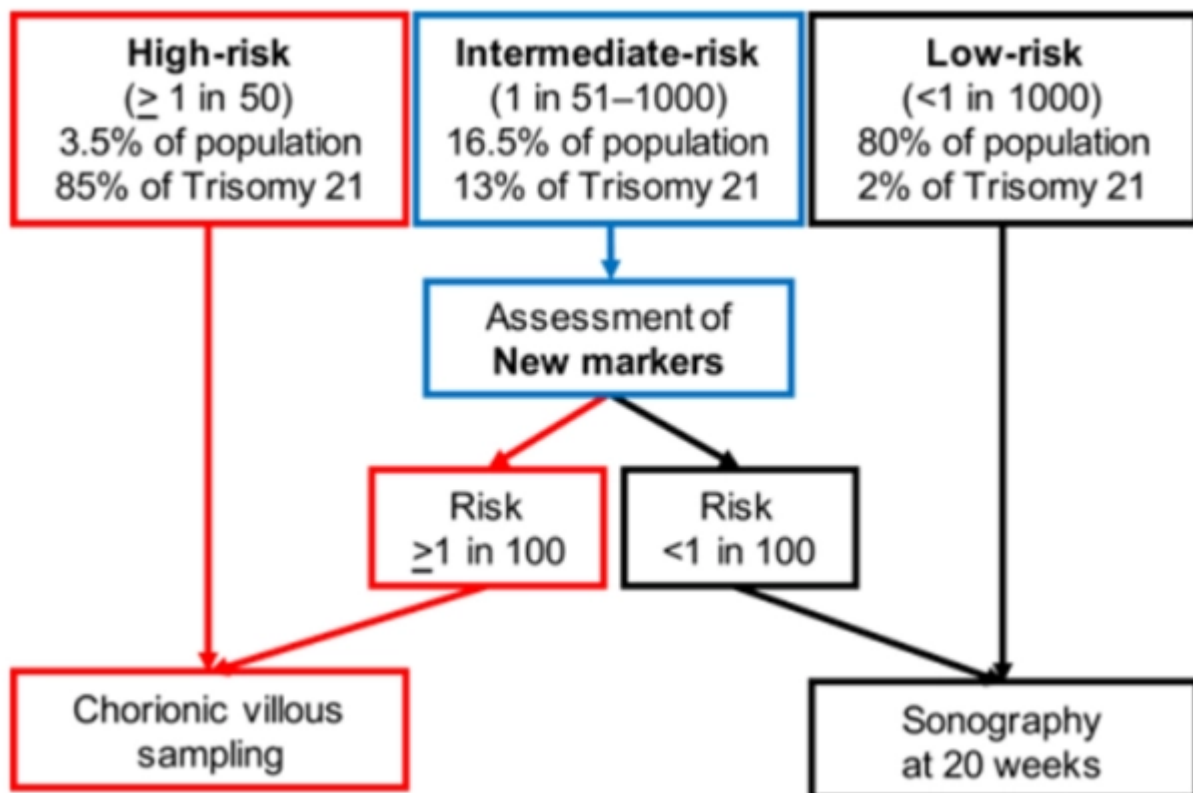
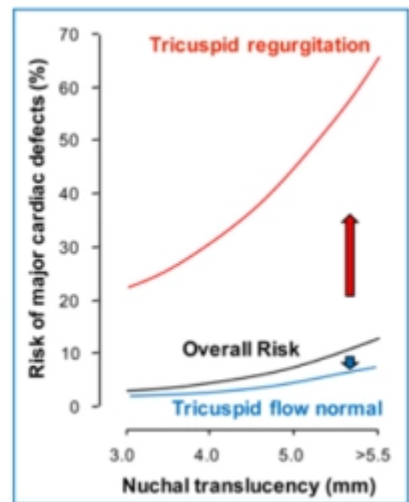
- The gestation is 11 than 13 weeks.
- The fetal nuchal translucency is high.

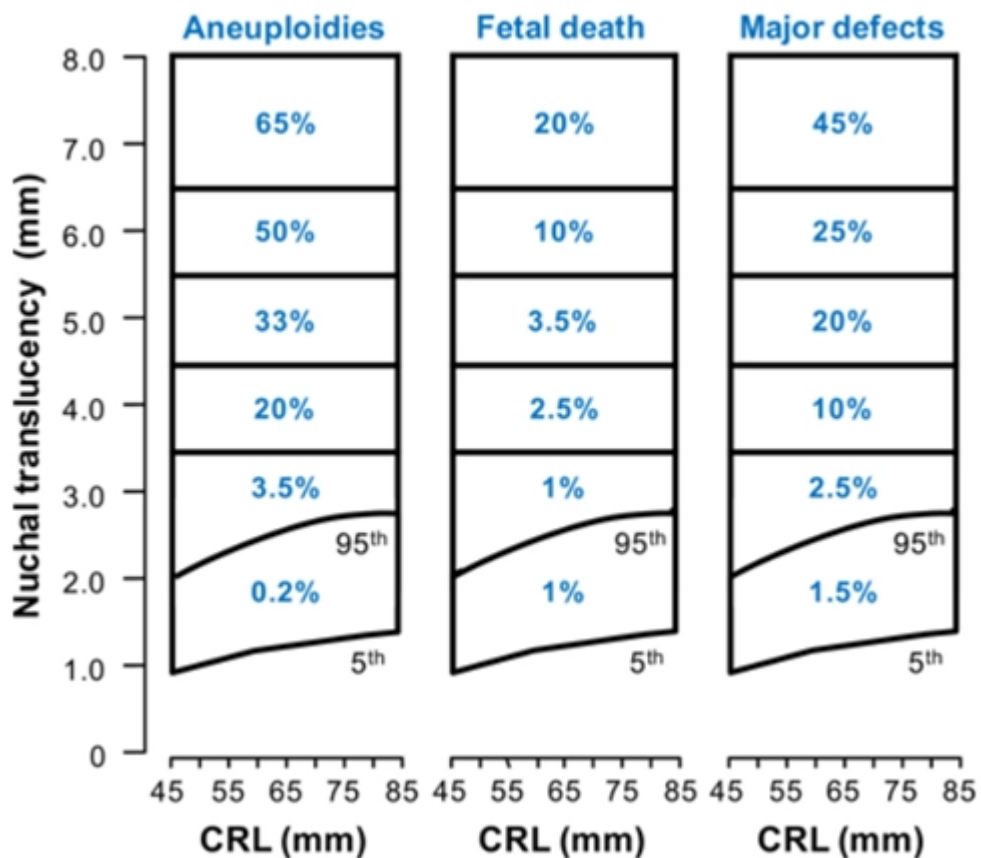
If there is tricuspid regurgitation it is important that detailed ultrasound examination is carried out to diagnose or exclude major cardiac defects.

Tricuspid flow

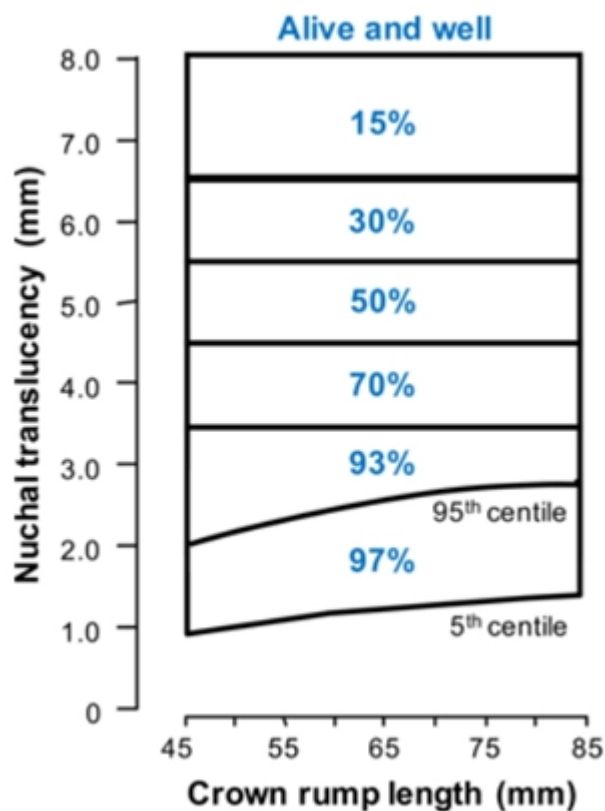
- Assessment of tricuspid flow improves the performance of combined first trimester screening increasing the DR of T21 from 90% to 95% and decreasing the FPR from 3% to 2,5%

If there is **tricuspid regurgitation** it is important that detailed ultrasound examination is carried out to diagnose or exclude major cardiac defects.





In the chromosomally abnormal group, about 50% have trisomy 21, 25% have trisomy 18 or 13, 10% have Turner syndrome, 5% have Triploidy and 10% have other chromosomal defects.



Although increased fetal NT thickness is associated with abnormalities and fetal death the majority of babies survive and develop normally.

Management of increased NT > 3,5mm

- Risk for chromosomal defect – invasive diagnostic test
- In case of positive family history – targeted DNA diagnostic
- Detailed morfological ultrasound to exclude defects at 16-22 weeks
- **Follow up is normal:**
 - risk for serious abnormality or neuro-developmental delay may not be higher than in the general population.

This is found in about 1% of pregnancies.

Persistence of increased of NT

- No obvious anomaly found on detailed US scan
- Maternal blood should be tested for toxoplasmosis, cytomegalovirus and parvovirus B 19
- Consider testing for certain genetic conditions (Noonan syndrome)
- Follow up scans every 4 weeks

There is a 10% risk of perinatal death or a live birth with a genetic sndrome that could not be diagnosed prenatally.

ISUOG Practice Guidelines: performance of first-trimester fetal ultrasound scan



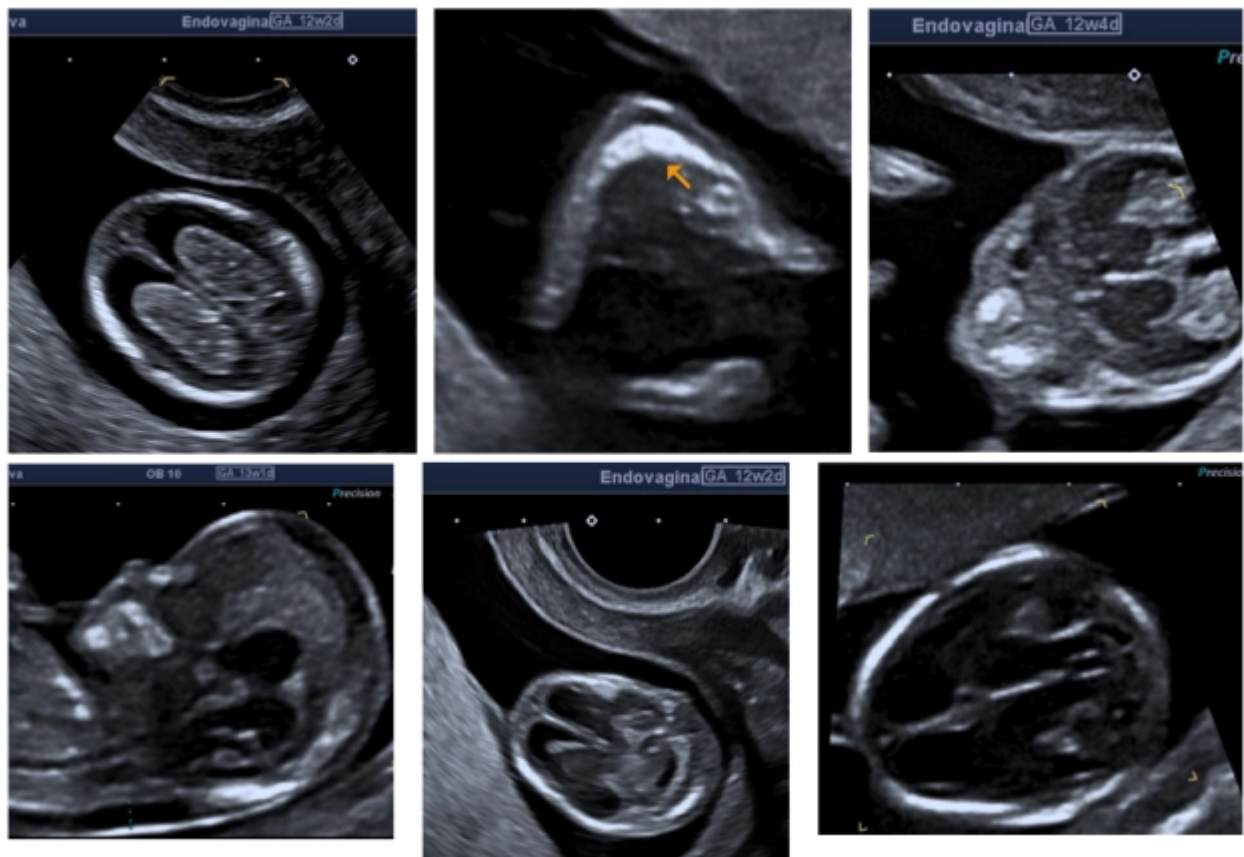
PERINATAL
JOURNAL

Clinical Guidelines

Perinatal Journal 2022;30(2):87–102

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First trimester examination of fetal anatomy: clinical practice guideline by the World Association of Perinatal Medicine (WAPM) and the Perinatal Medicine Foundation (PMF)





Holoprosencephaly - video attached

Polydactyly

- video attached

Congenital diaphragmatic hernia - video attached

Congenital diaphragmatic hernia

2 - video attached

Pentalogy of Cantrell

- video attached

HLHS - video attached

HLHS 2 - video attached

Advantages of early anatomy scan

- Longer time for genetic analysis if necessary
- Earlier detection of associated anomalies
- Earlier termination of pregnancy is safer less traumatic
- Especially in cases where there is high risk of structural abnormality due to a history of a previous affected fetus

Limitations of early anatomy scan

- Small size of anatomical structures
- Some defects do not manifest until later in pregnancy
- Increased BMI, fibroids and scars
- Vaginal probe ...better resolution
- **Fear of false positivity**

Mistakes to avoid in the 2nd and 3rd trimesters measurement

- There are rules to follow in measurements of fetal biometry (BPD, AC, FL)
- Small error in pre-viable fetus is not clinically significant
- Errors are more important at extremes
- Optimize the image
- Use correct planes and correct endpoints

BPD measurement

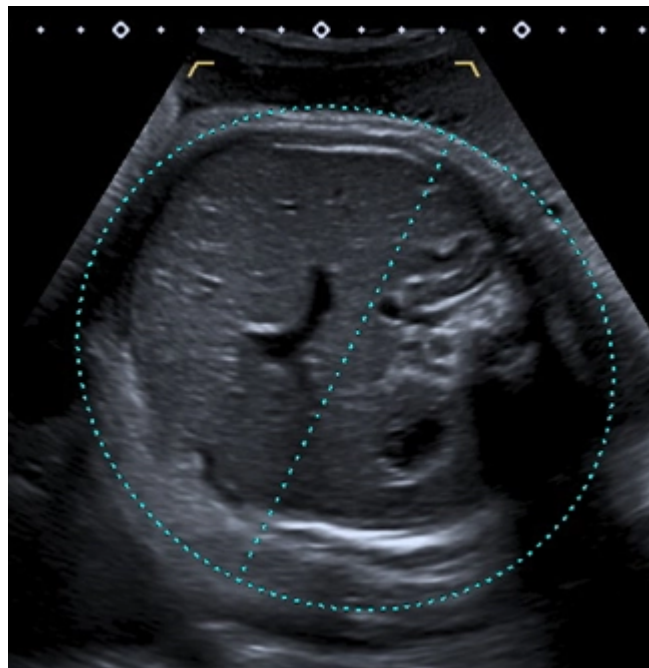
- Head is symmetrically positioned (3rd ventricle, thalami and falx are right in the middle)
- Posterior fossa and orbits should not be on the image
- Cursors are placed correctly (outer to inner)

AC measurement

- At the level of the liver (the largest abdominal organ in the fetus)
- Stomach bubble and the intrahepatic umbilical vein
- Skin edge to skin edge

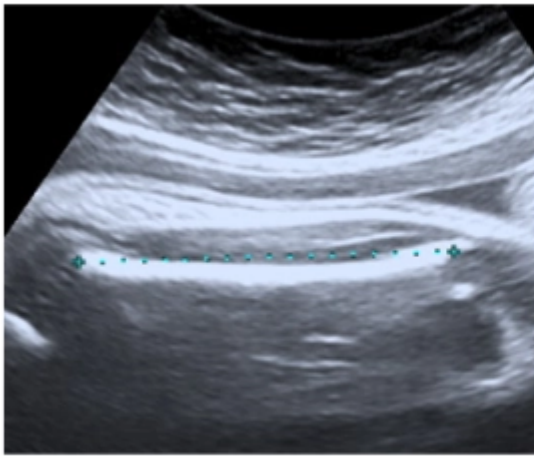
- You can't see the skin edge (placenta, oligohydramnios or fetal parts)
- Abdomen is compressed (don't push so much)
- **Too big**
 - measurement is taken in oblique plane, not axial plane
 - fetus is prone, spine obscures the landmarks
- **Too small**
 - entire abdominal wall is not included
 - rib is mistaken for skin
 - dependent fat is not included
- **When struggling**
 - round is best

TG 11,72 mmol/l



FL measurements

- Long axis of the bone parallel to the transducer
- Only diaphysis and metaphysis are measured, epiphysis is excluded
- Not at the longest echogenic point (the „distal femoral point“ which has no anatomic correlate)



Between 18 and 22 weeks



Practice guidelines for performance of the routine mid-trimester fetal ultrasound scan

L. J. SALOMON, Z. ALFIREVIC, V. BERGHELLA, C. BILARDO, E. HERNANDEZ-ANDRADE, S. L. JOHNSON, K. KALACHE, K.-Y. LEUNG, G. MALINGER, H. MUNOZ, F. PREFUMO, A. TOI and W. LEE on behalf of the ISUOG Clinical Standards Committee

Ultrasound Obstet Gynecol 2011; 37: 116–126

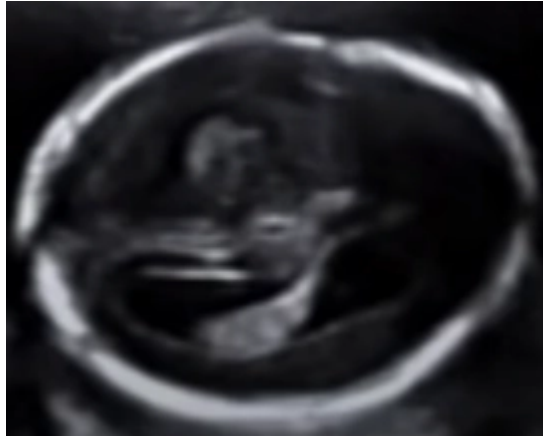
Published online 7 December 2010 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/uog.8831



Mistakes to avoid in the anatomy - lateral ventricles

- Lateral ventricles artificially increased (off axis measurement)
- Inner border of the lateral ventricles
- Dangling choroid (greater than the 3mm space between the wall and choroid)

- Assume symmetry unless asymmetry is visible



Choroid plexus cysts

- < 1% of fetuses
- Associated with trisomy 18 (x transient normal finding)
- Discrete round structures, >2mm, completely within the choroid, seen in 3 planes
- Differential is the spongy choroid



Dandy - Walker Variant

- Absent or hypoplastic cerebellar vermis
- Vermian development not complete until at least 18 weeks
- Overcalled because
 - fetuses are too young
 - images too oblique (semi-coronal)

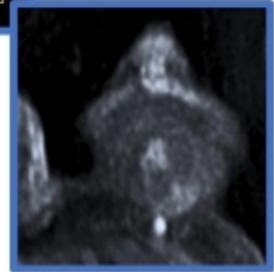
- Stay axial to include vermis



Mega Cisterna Magna

- Overcalled as pathology
- Look for well formed cerebellum in axial plane
- Note normal subarachnoid septa in cisterna magna
- Careful search for other malformations
- If none, good outcome

Face



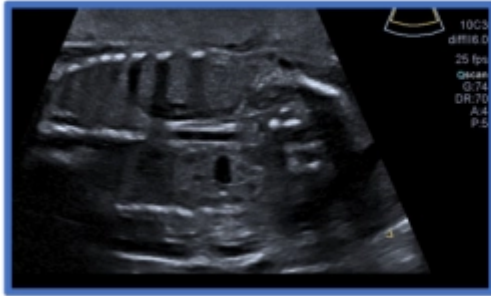
Face

- Nose and lips
- Orbits



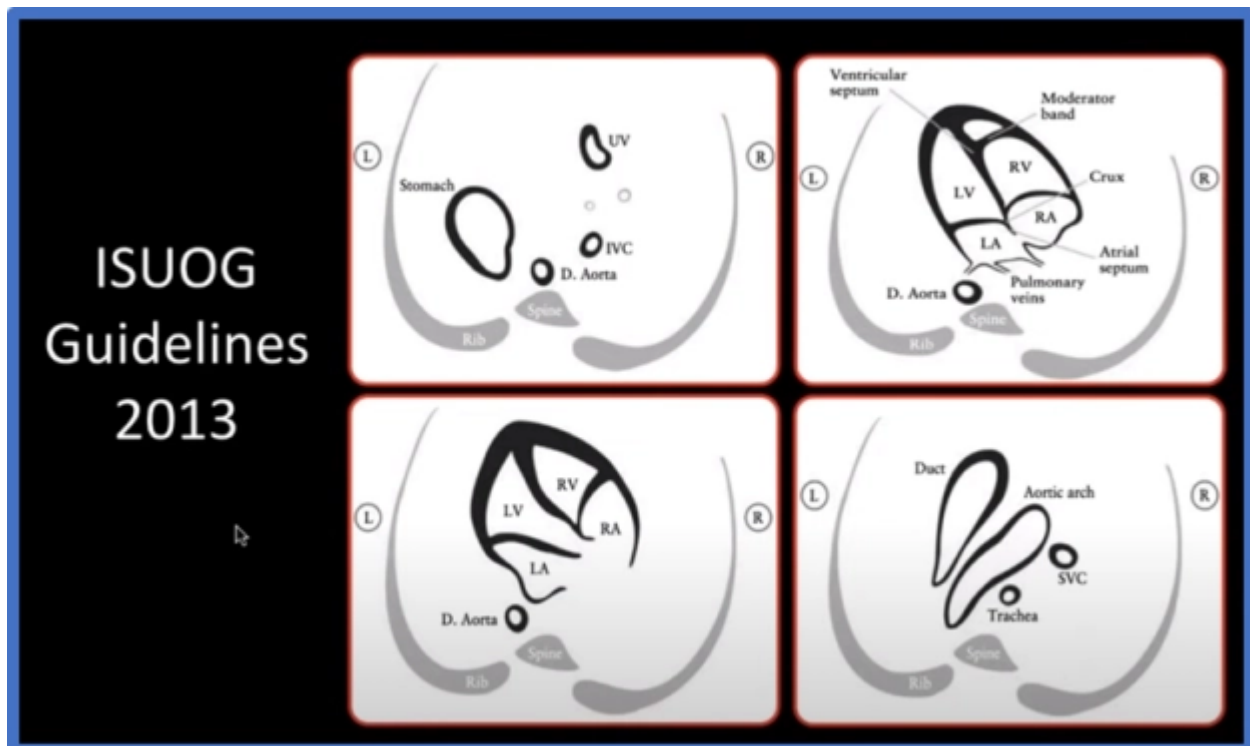
Kidneys

- Adrenal glands are labeled as kidneys
- Stomach on image (higher than the level of the kidneys)
- Adrenals are hypoechoic and easy to see
- Kidneys are isoechoic and not easy to see
- Kidneys have a black slit.....renal pelvis



Pseudo Ascites

- Hypoechoogenic rim along the abdominal wall
- Look elsewhere in the pelvis and abdomen

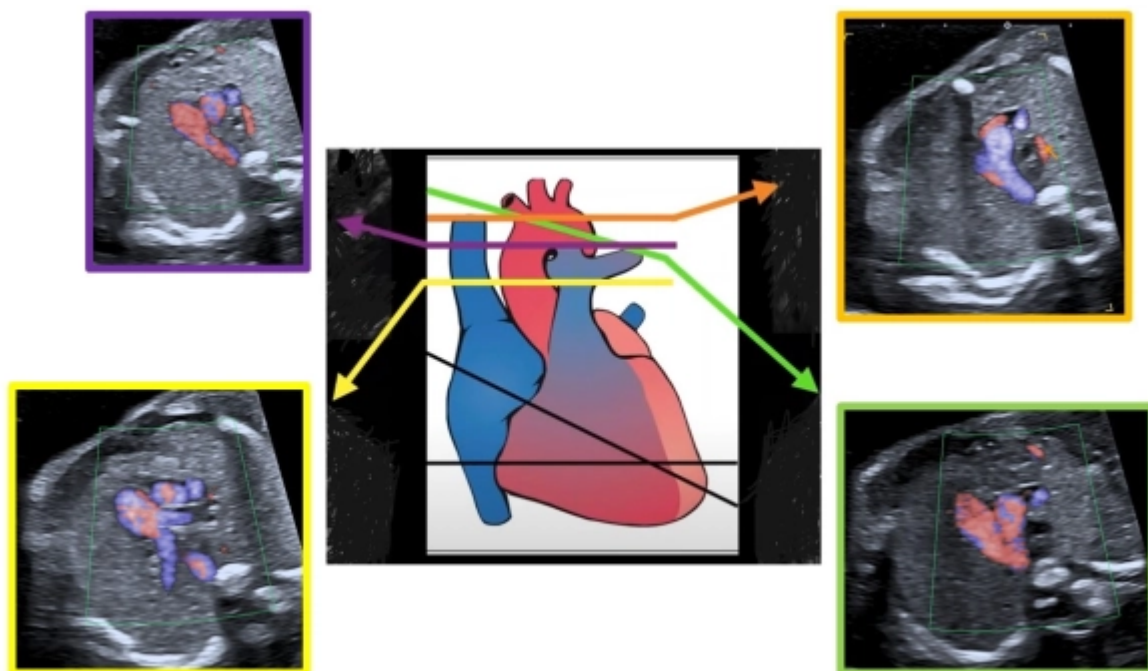
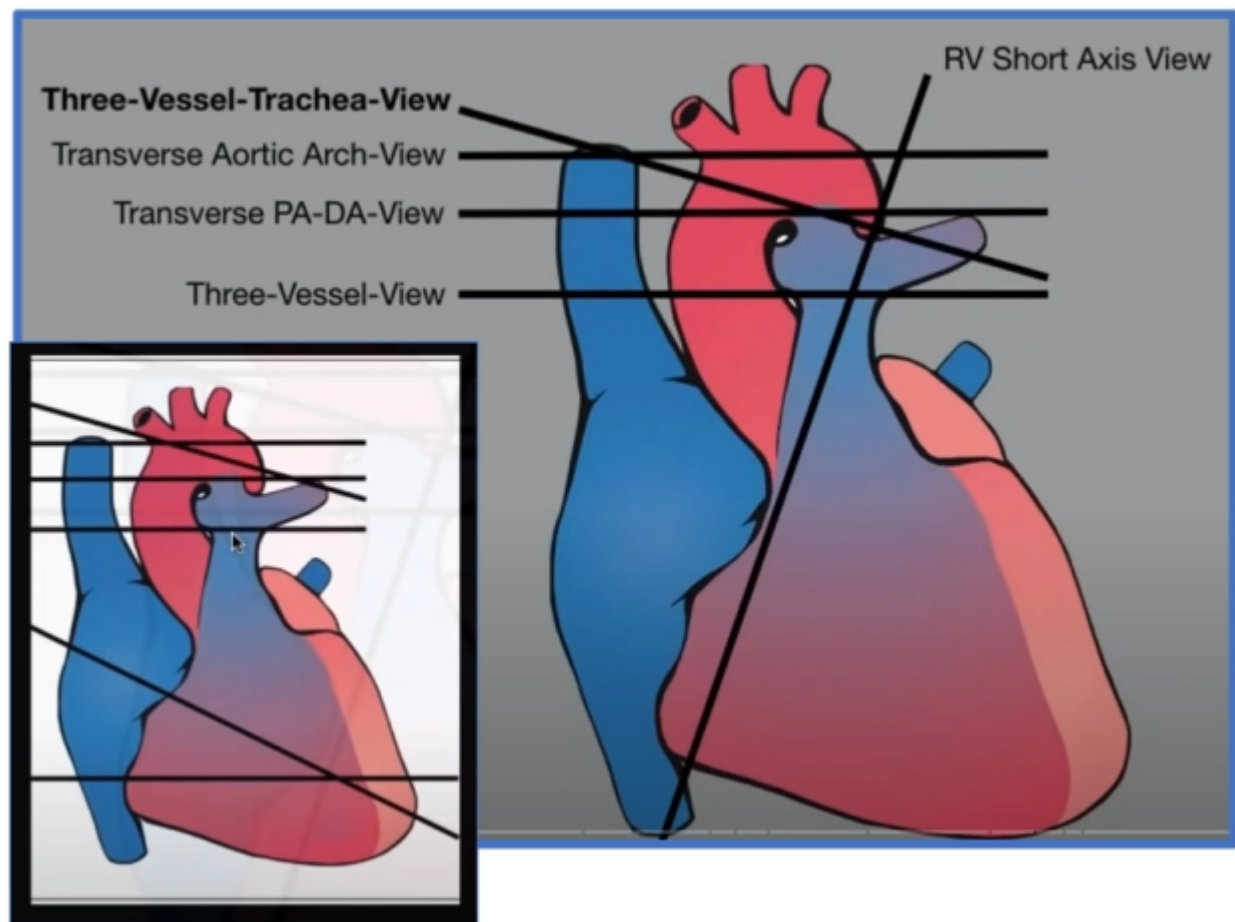


The Three-Vessel-Trachea View



The Three-Vessel-Trachea View

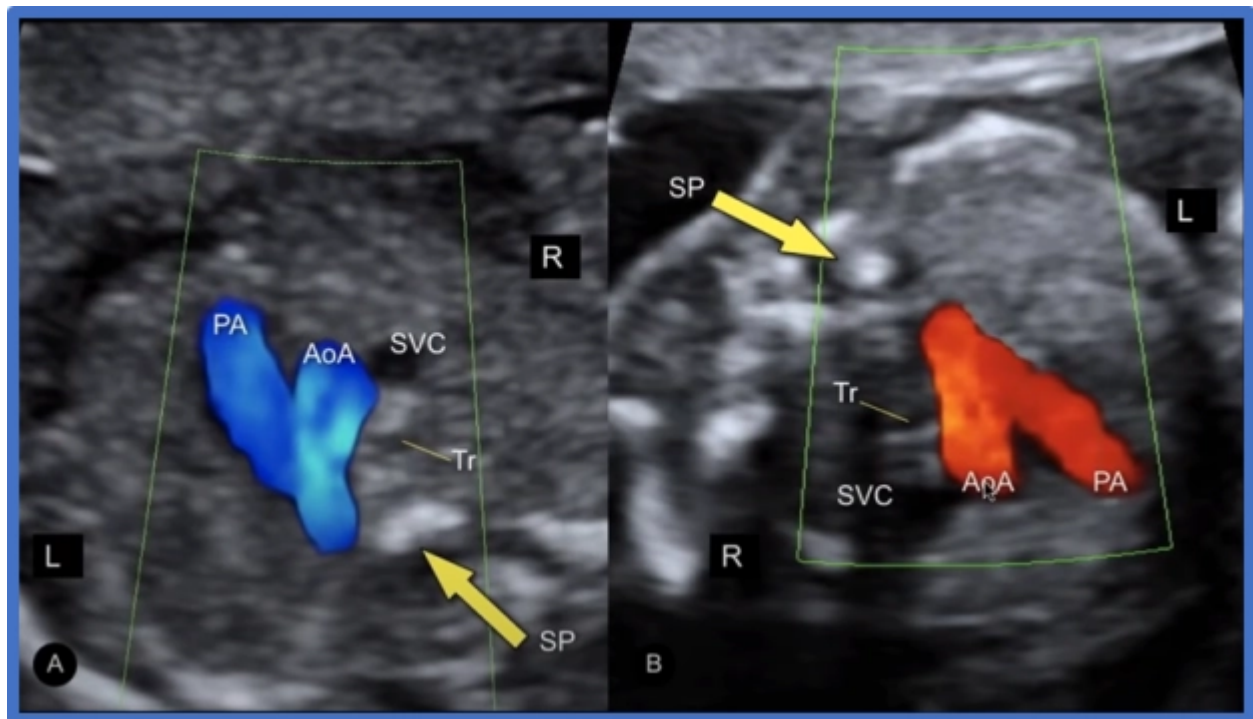




3VT view

- Course and size of PA, Ao and SVC
- Aortic isthmus and the ductus arteriosus

- Aortic arch right or left-sided
- Thymus visualised
- Assessment with colour doppler: „Blue V“ or „Red V“
- Atypical vessels (left persistent SVC, vertical vein)



3VT view in early gestation

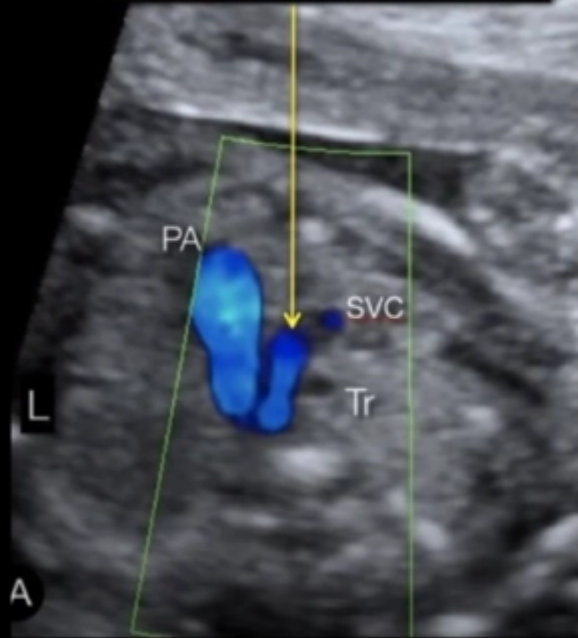
- **Very important view in evaluating great vessels in early gestation**
- **Rule out conotruncal anomalies of very serious consequences**

Abnormal 3VT view (2D and colour)

- Abnormal vessel size (large or small)
- Abnormal vessel number
- Abnormal course and alignment
- Discontinuity of vessels
- Turbulent flow
- Reverse flow

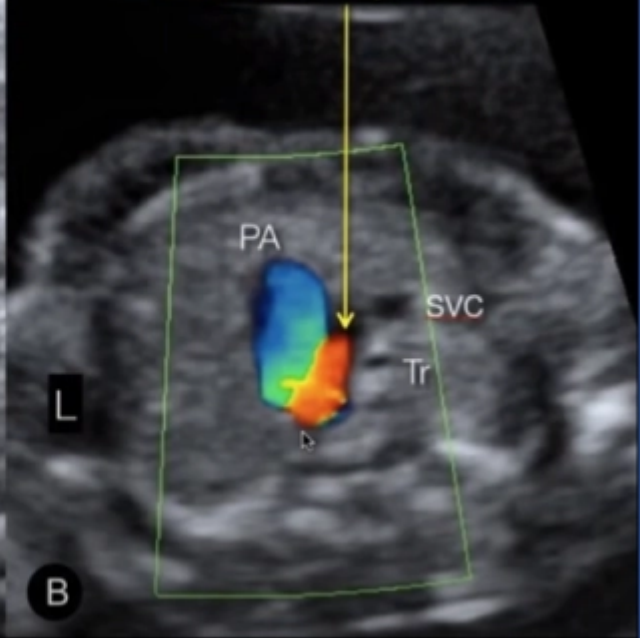
Small Aorta

Narrow AOA, antegrade Flow

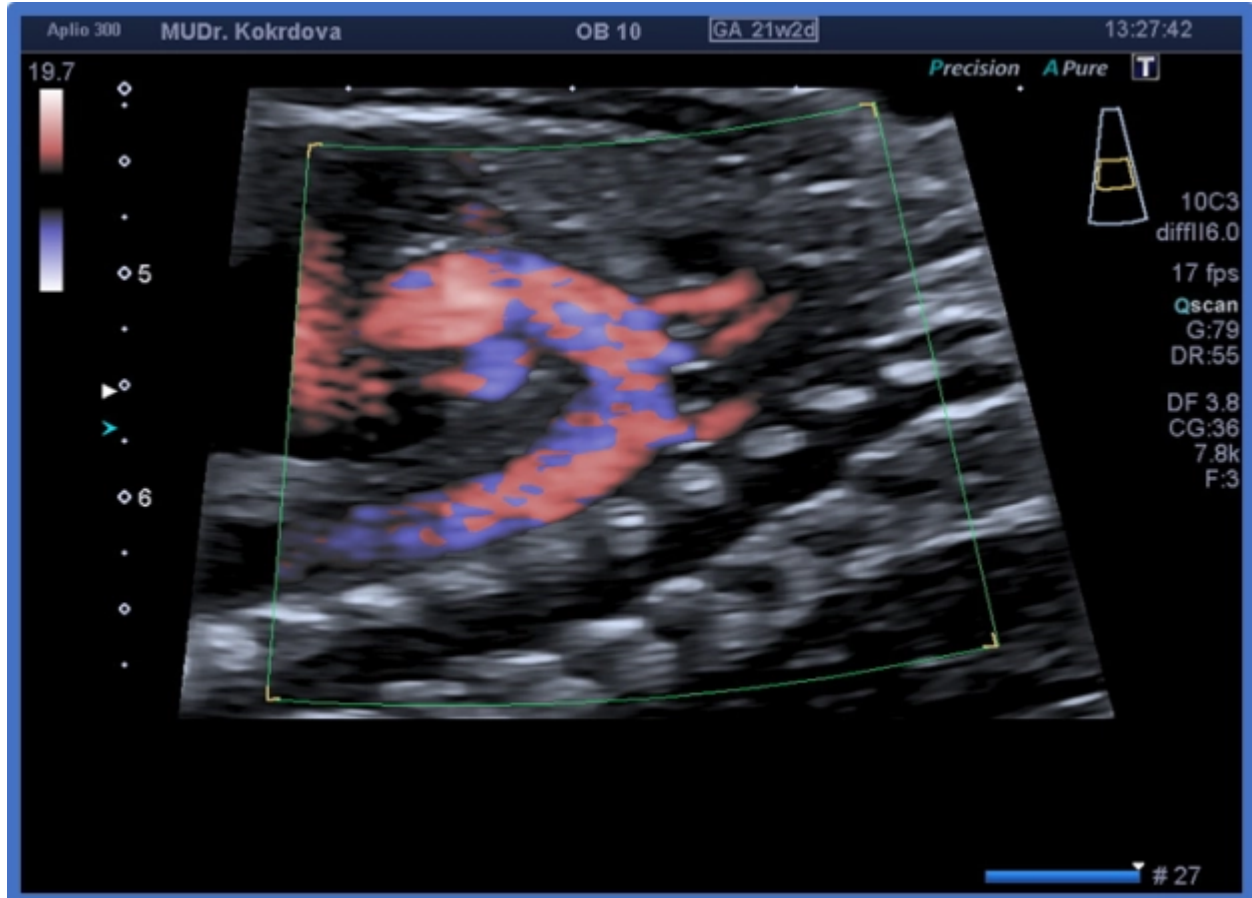


Coarctation of the Aorta

Narrow AOA, retrograde Flow



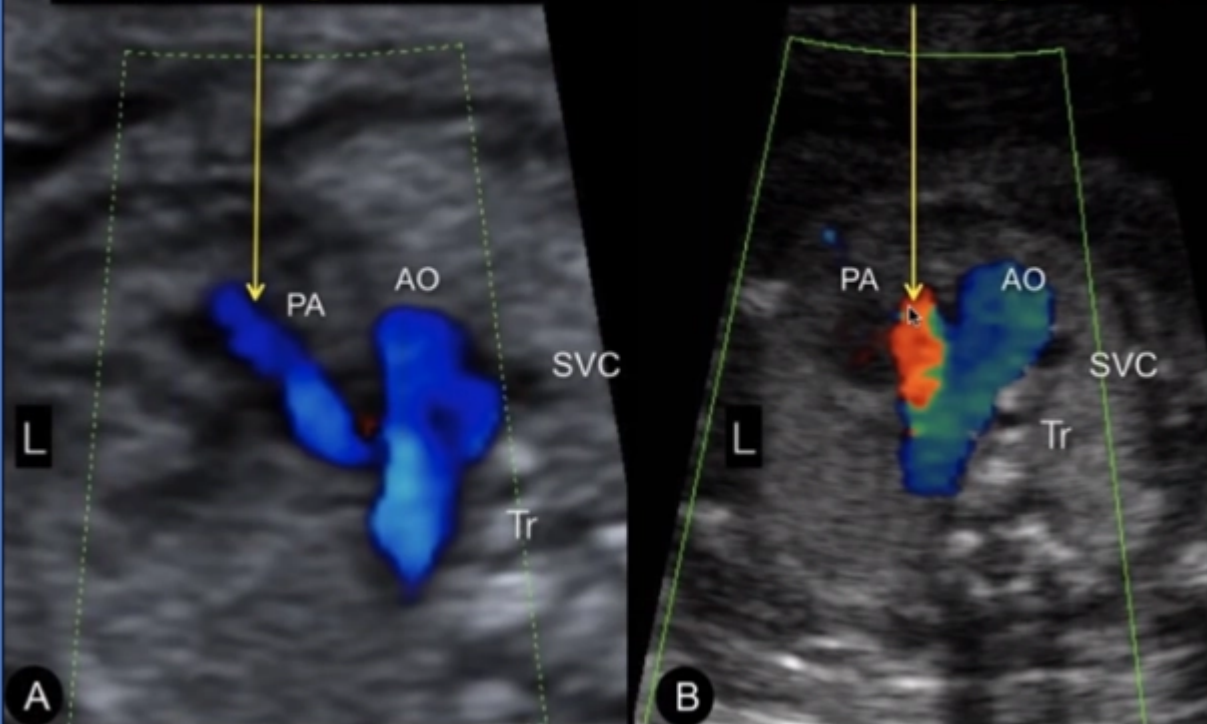
Hypoplastic Left Heart Syndrome



Small PA

Narrow PA, antegrade Flow

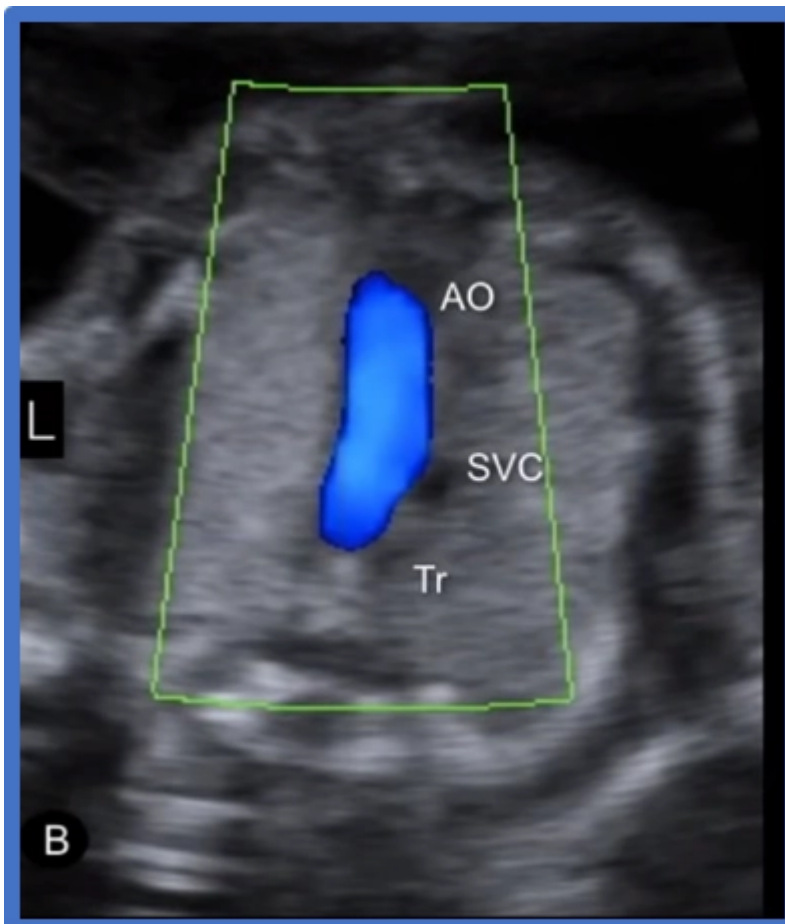
Narrow PA, retrograde Flow



Pulmonary Stenosis - TOF

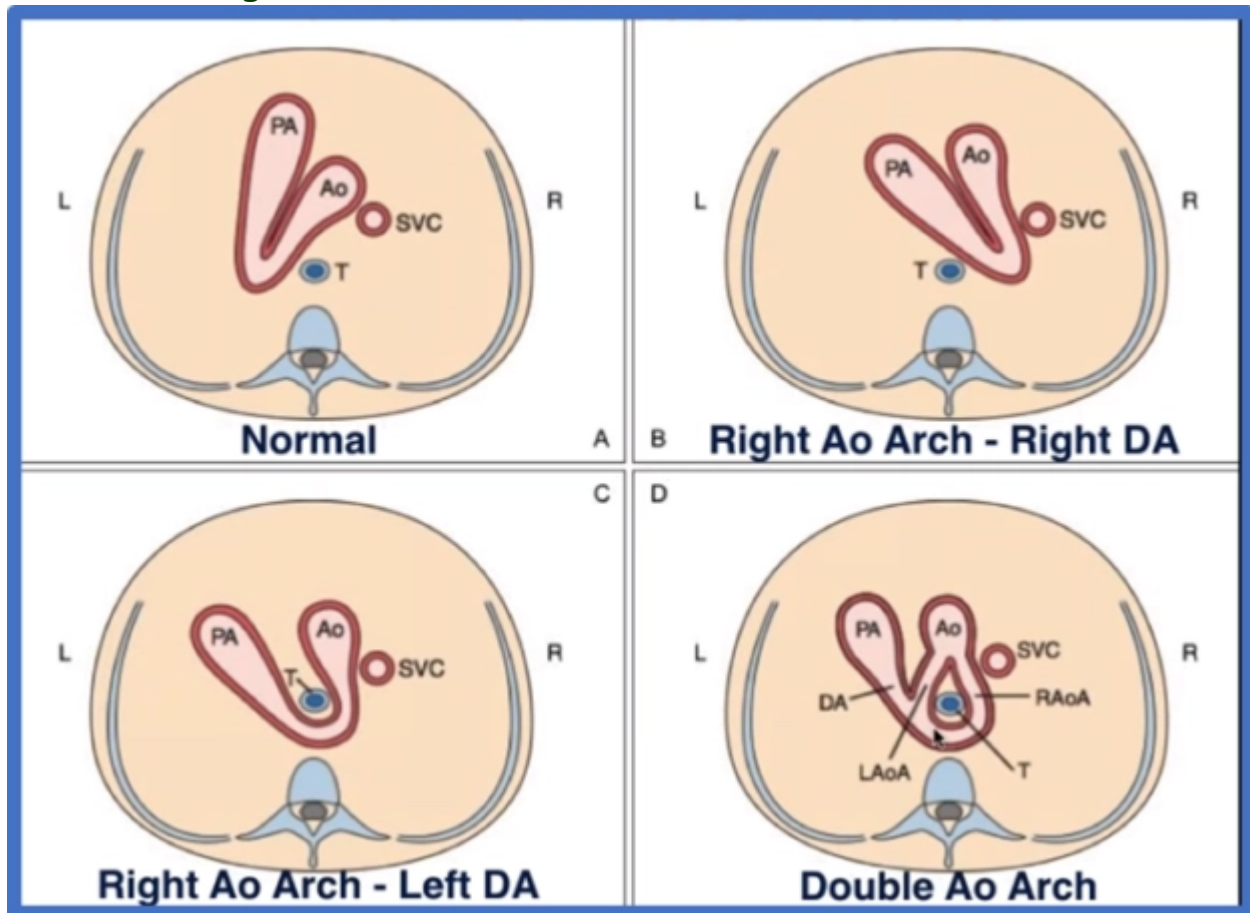
Pulmonary Atresia

32



Normal size great vessel - video attached

Abnormal size great vessel - video attached



3VT view - conclusion

- 3VT view and 4CV are the most important ultrasound views in the fetus
- It is easy to obtain - especially in early gestation
- Anatomic landmarks easy identify and master
- It is affected in most major CHD
- Strong consideration should be given to incorporation in screening (the effort pays off)



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