

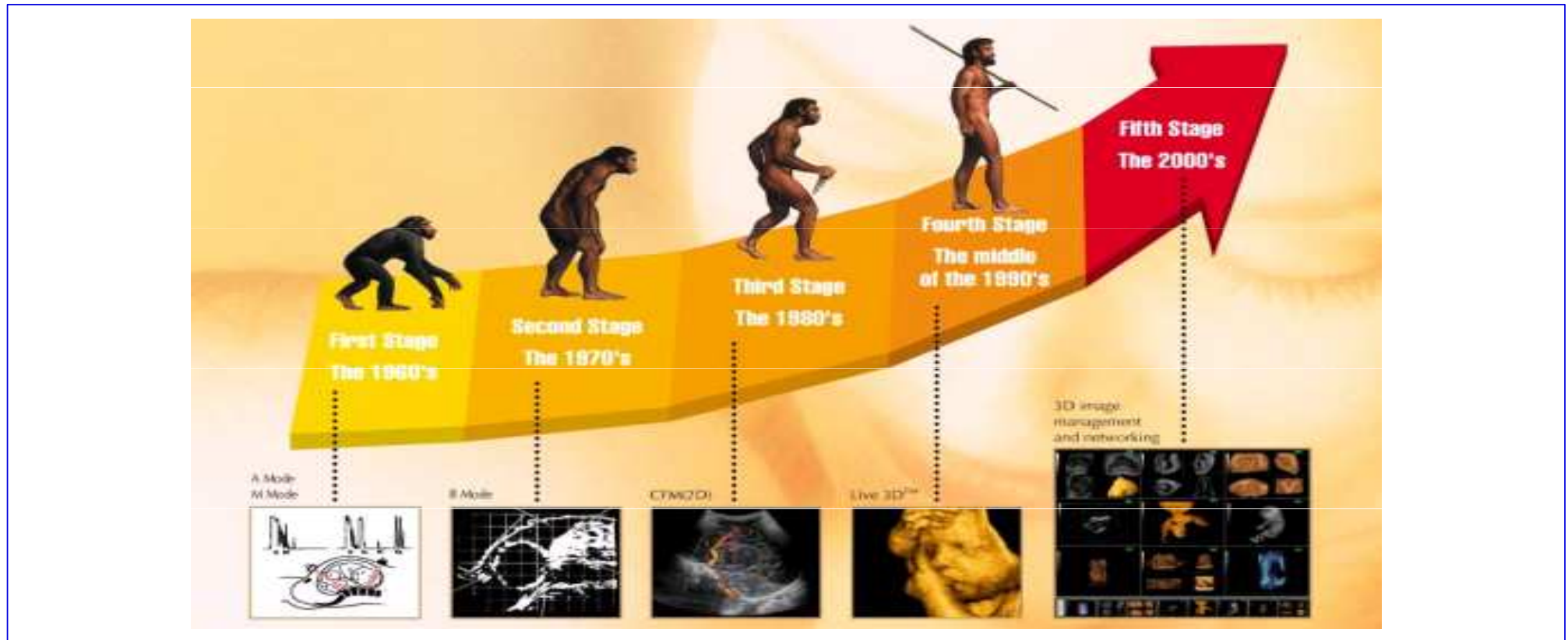
Ultrasound in obstetrics and gynecology

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2019/2020

History

- 1920s – sonar for marine purposes
- 1944 – first therapeutic use of ultrasound (brain tissue disruption)
- UK, Australia, Germany, USA, Japan – leading countries
- 2D, 3D imaging, CFM – color mapping
- 21st century – quality, miniaturisation, intracavitary application

US technology development



Ultrasound diagnostics advantages

- non-invasive method
- method based on mechanical energy (relatively safe)
- examination is carried by obgyn specialists themselves
(direct link between clinical status and objective method results)

Ultrasound diagnostics

2D imaging

— base examination, gold standard

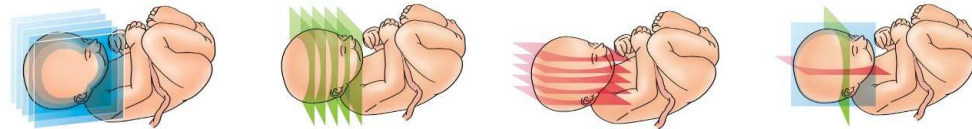
3D/4D imaging

— additional examination

— multiplanar image

— volume CT mode

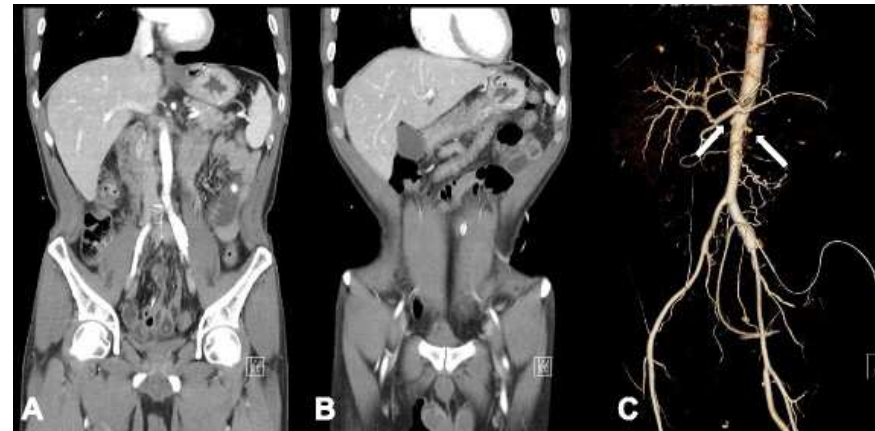
— 3D power Doppler



Contemporary imaging techniques

CT

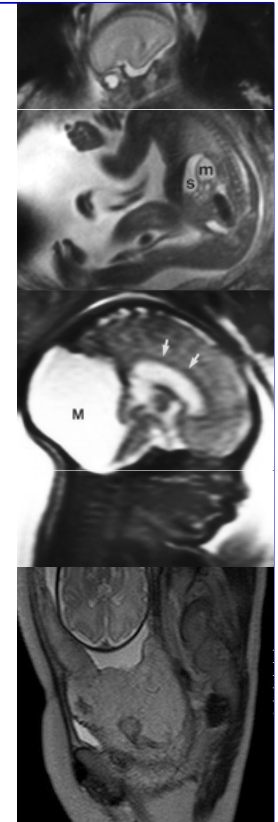
- gynecology (diff.dg. abdominal cavity pathologies)
- exclusion peri/postoperative complications (TEN)
- oncogynecology (staging)



Contemporary imaging techniques

MRI

- gynecology
- obstetrics - fetal anomalies
 - abnormal placentation
 - placental functional examination
 - fetal weight estimation
 - virtual fetal autopsy



Imaging techniques

transabdominal (3,5-5 MHz)

- visualisation abdominal cavity
(gynecology – formation bigger than small pelvis,
obstetrics, pediatric gynecology)
- full bladder



transvaginal (5-7,5 MHz)

- better visualisation (examination distance 8-10cm)
- empty bladder
- hymen, vaginal stricture - impossible



US in obstetrics and gynecology

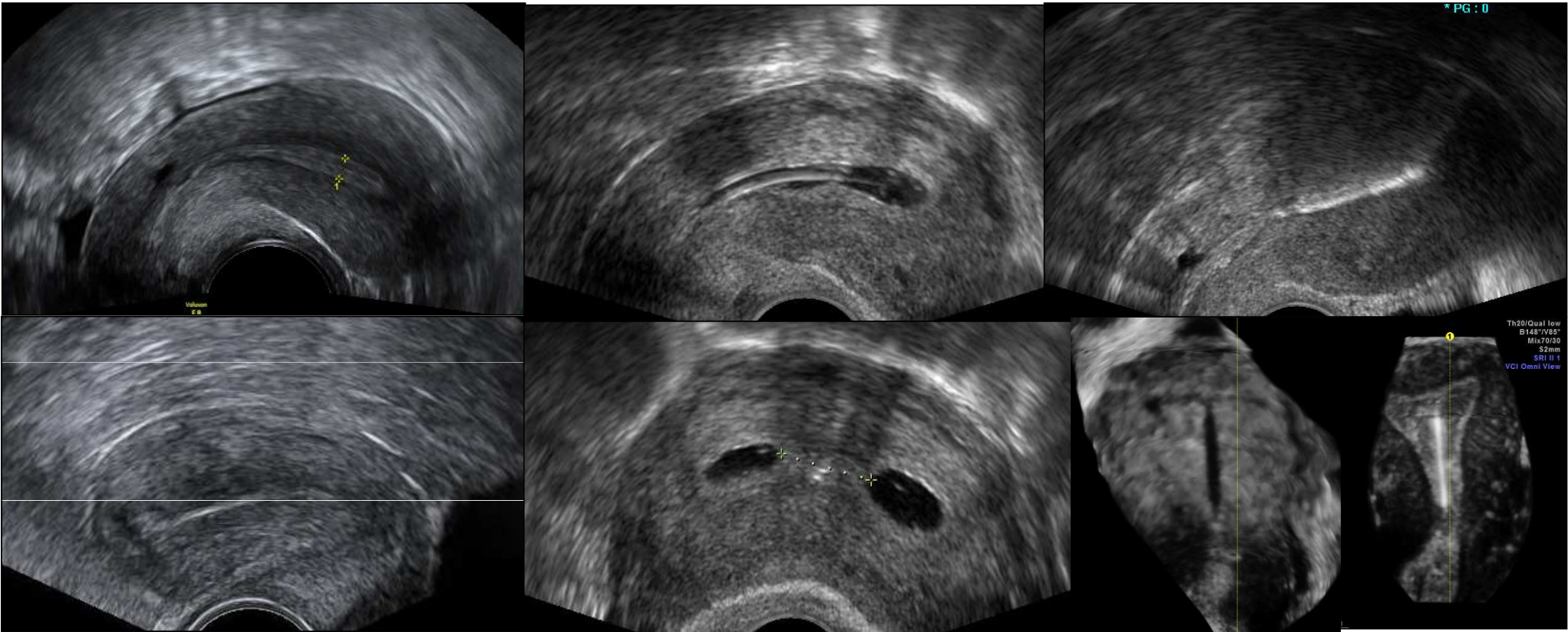
options, limits

- equipment (probe type, frequency,...)
- limitations
 - **not influenced** (e.g.obesity,...)
 - **probably influenced** (e.g.oligohydramnion, multiple pregnancy,..)
 - **influenced** (fetal movement, fetal position, empty bladder,...)

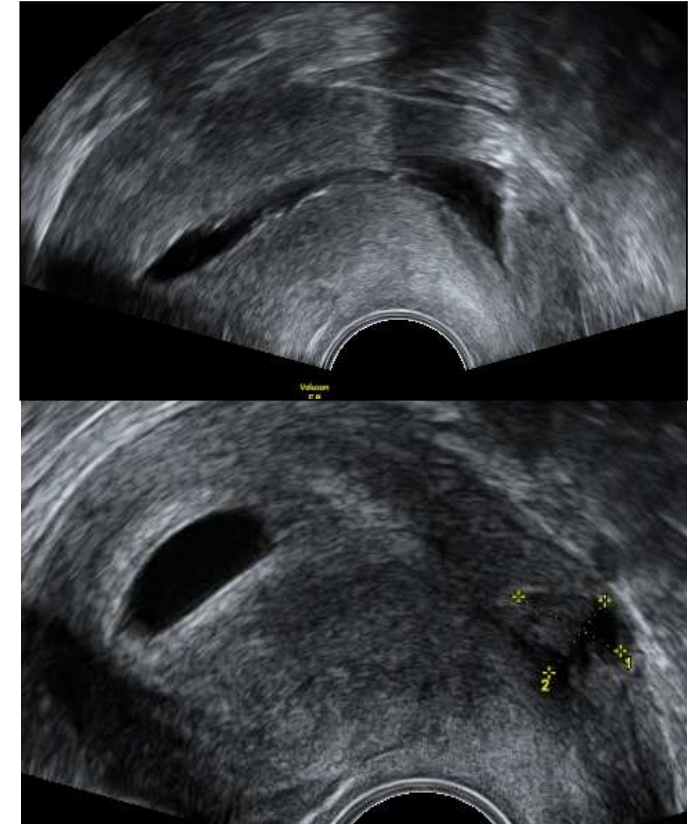
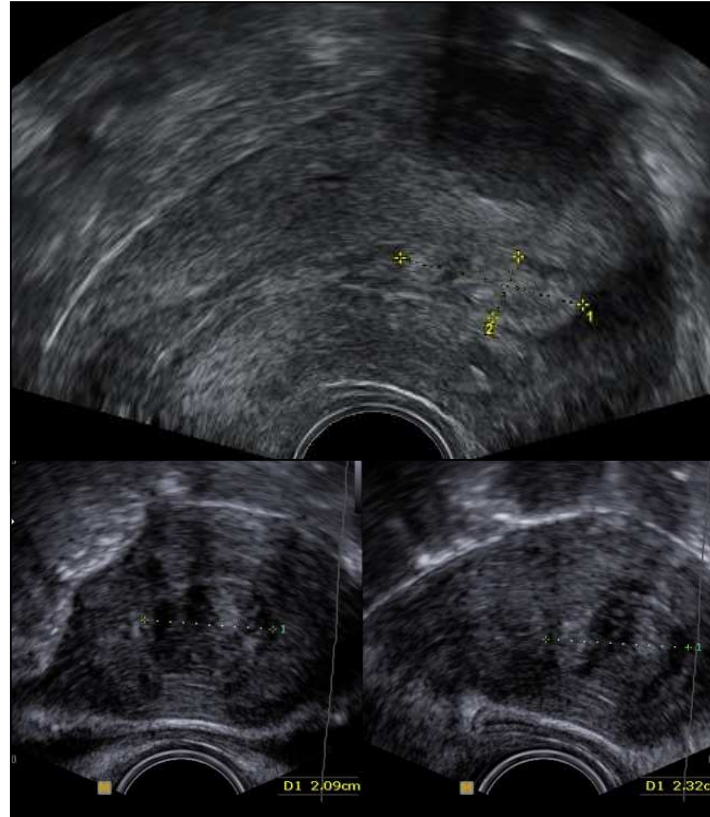
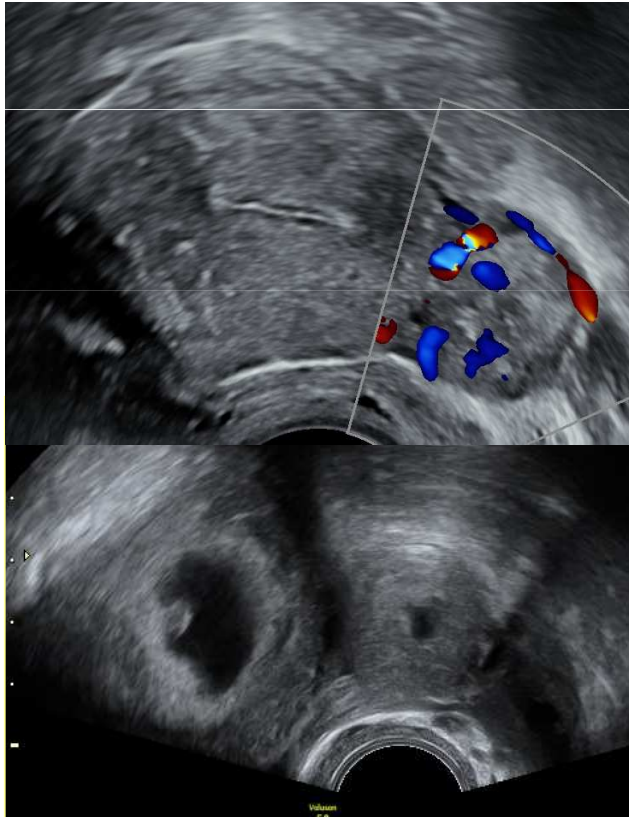
US - gynecology

- congenital anomalies
- dif.-dg amenorrhoe
- diff.-dg pelvic pain, inflammation, tumor
- IUD visualisation
- sterility treatment
- uro/oncogynecology
- peri/postoperative diagnostics

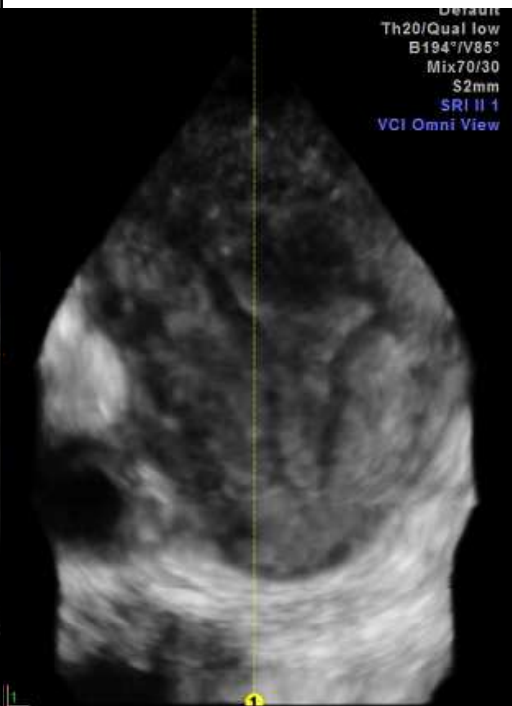
US - gynecology - uterus



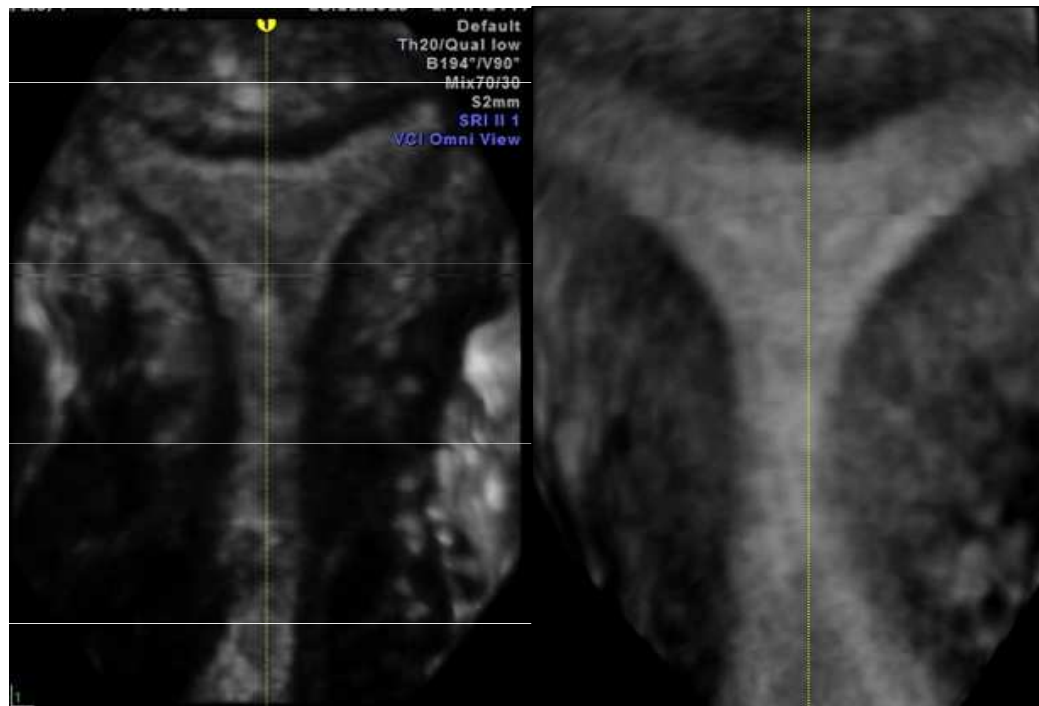
US - gynecology - uterus



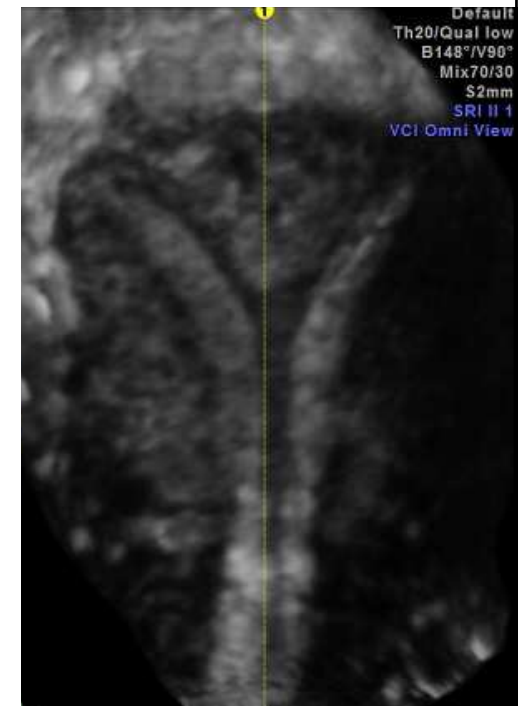
Uterine anomalies - 3D/4D image



uterus arcuatus

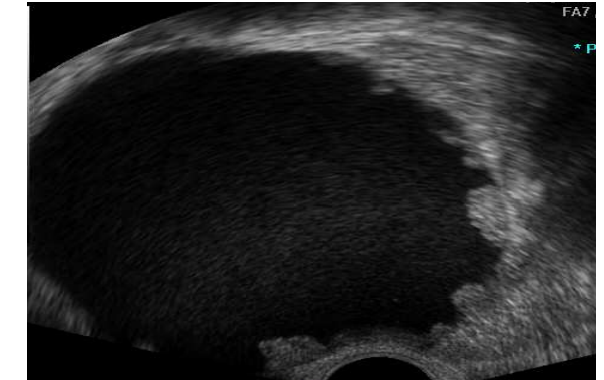
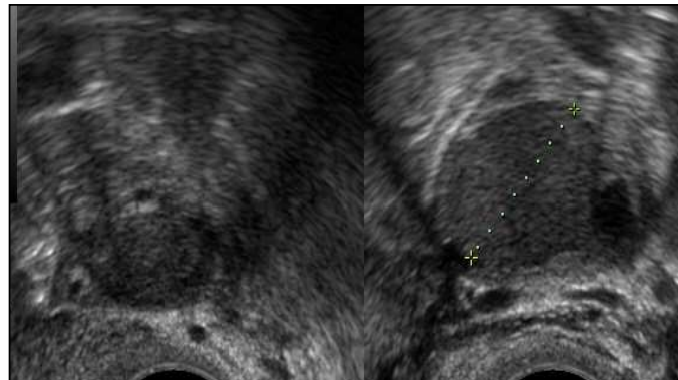
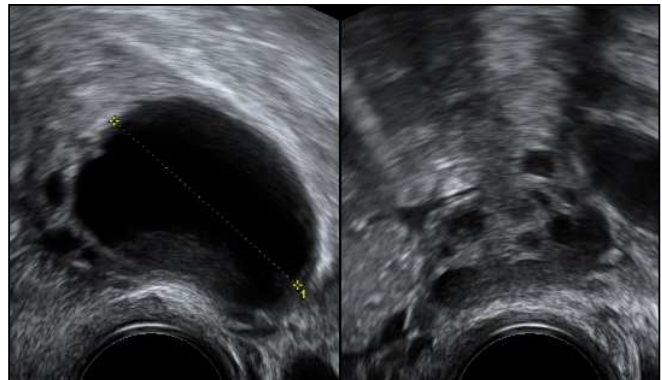
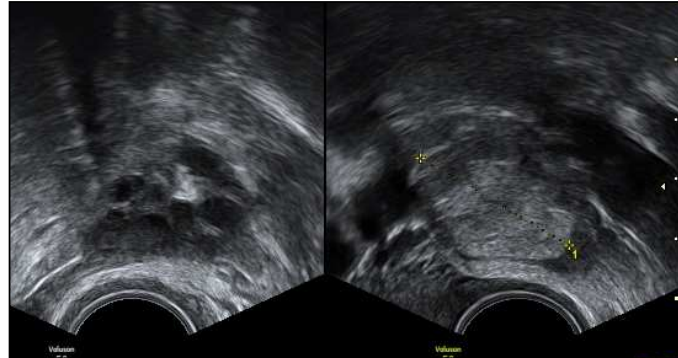
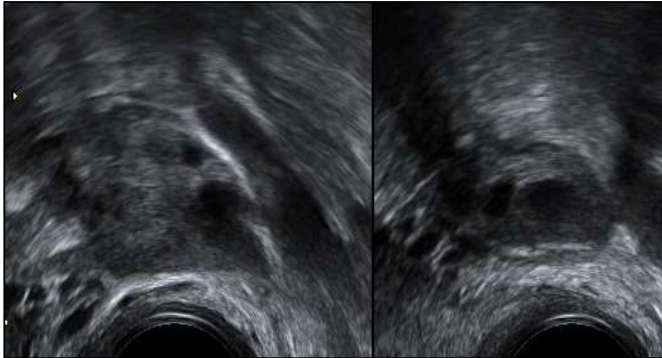


uterus bicornis



uterus duplex

US - gynecology - ovaries



US - obstetrics - sonoembryology



fetal development observation

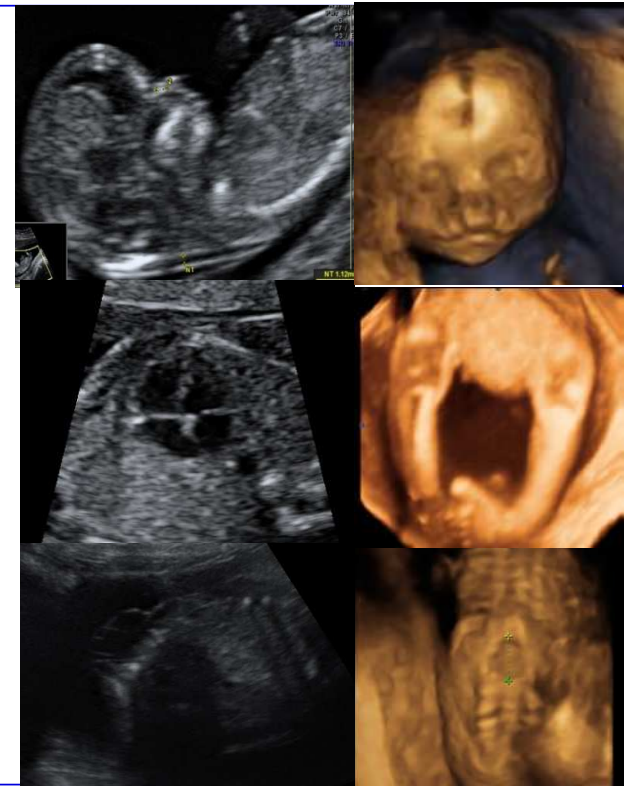


US - obstetrics

anomaly scan

3 – steps screening

- I. trimestr (11-14 wks)
- II. trimestr (20-22 wks)
- III. trimestr (30-32 wks)



I trimestr screening

targets, specifics

- screening for fetal anomalies
- screening for fetal chromosomal anomalies
- better visualisation
- time for genetic counselling
- safer termination of pregnancy
- screening for pregnancy risk (e.g. preeclampsia, placental pathology)

I trimestr screening

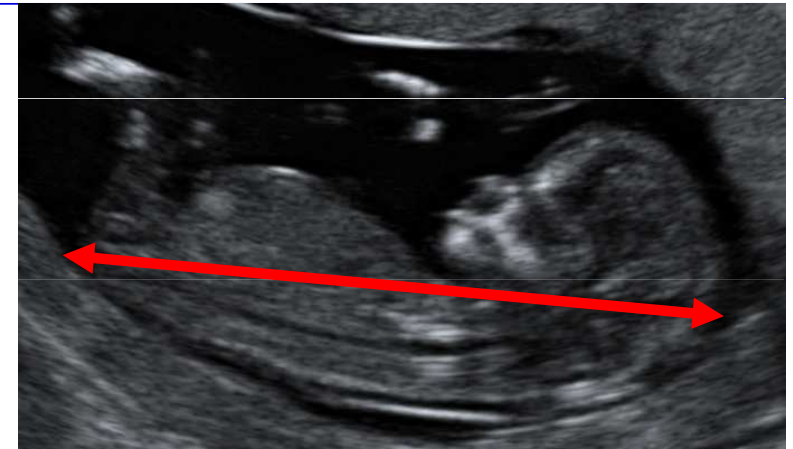
11-14 wks (11+0 - 13+6)

- pregnancy date
- number of fetuses (amnionicity, chorionicity)
- anomaly scan
 - direct (structural anomalies)
 - indirect (chromosomal anomalies)

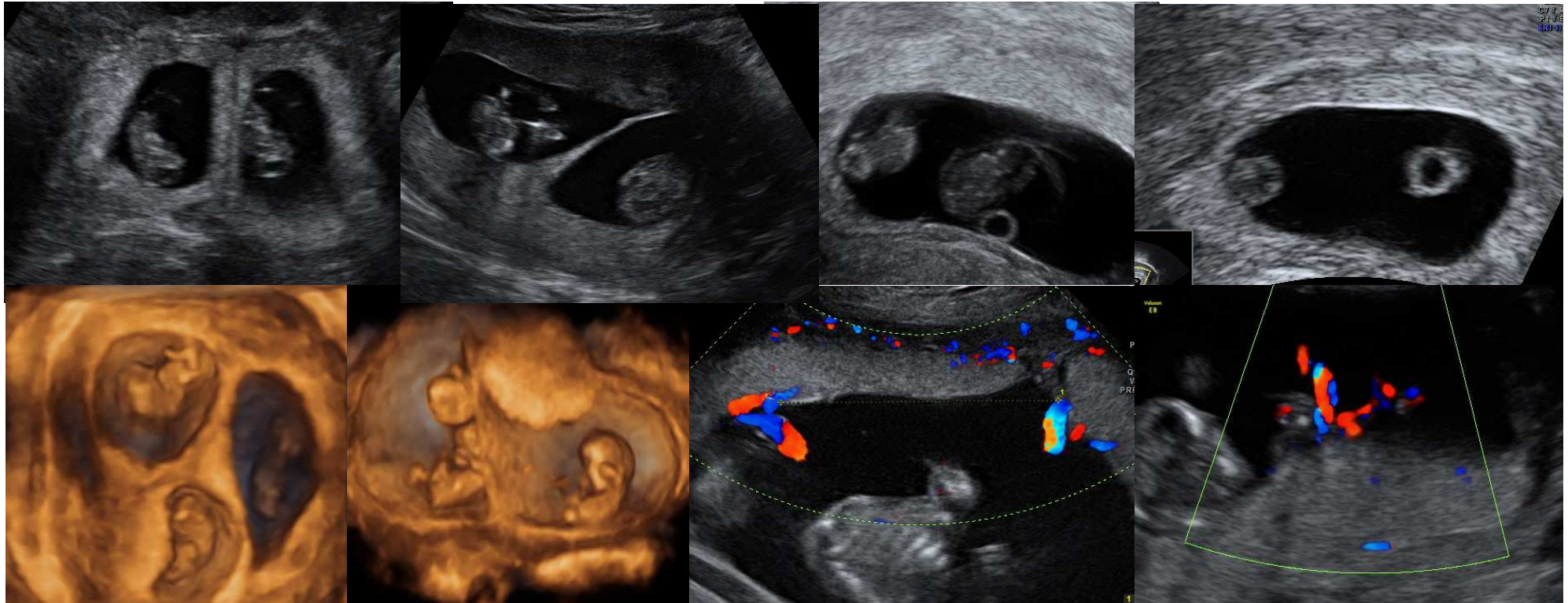
I trimestr screening

pregnancy date

- birth date estimation
- CRL measurement (crown-rump length)
- estimating
 - birth term
 - timing next exams



Amnionicity/chorionicity



I trimestr screening

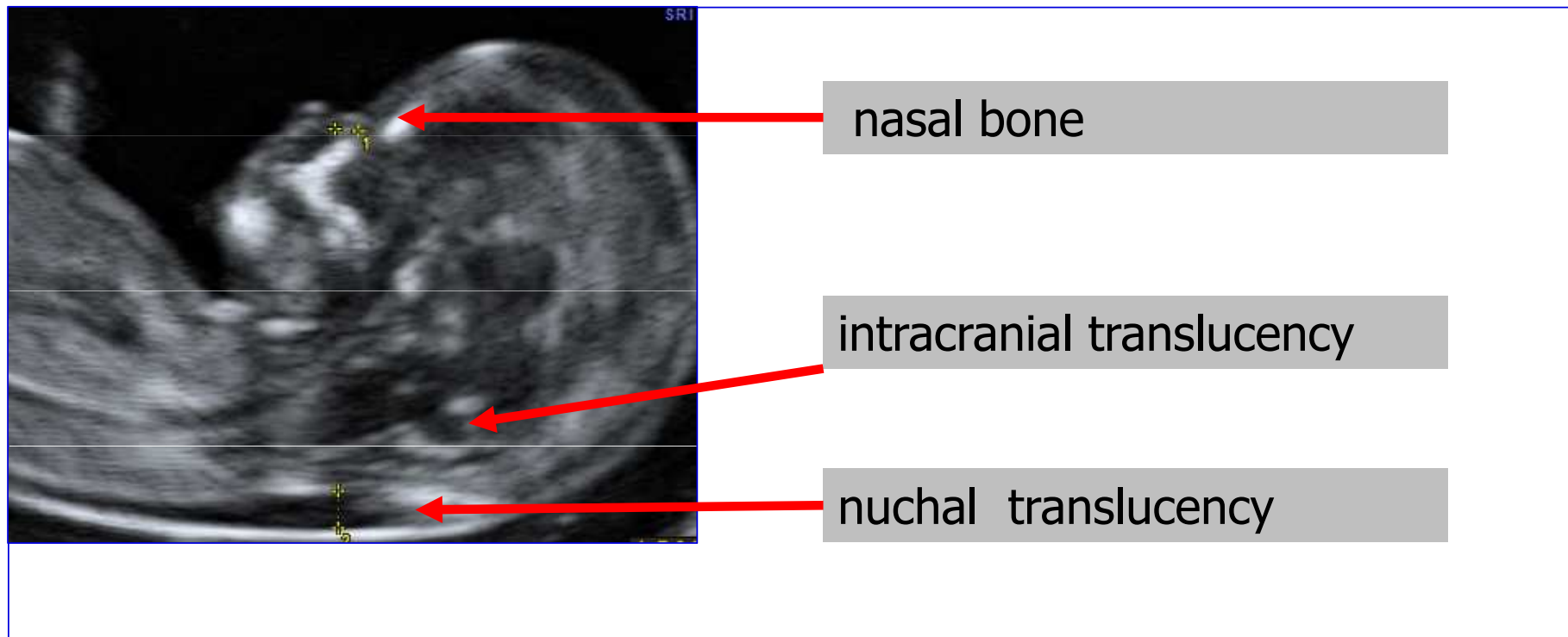
anomaly scan

- morfologic anomalies
- chromosomal anomalies



Fetal chromosomal anomalies screening I

markers



Fetal chromosomal anomalies screening II



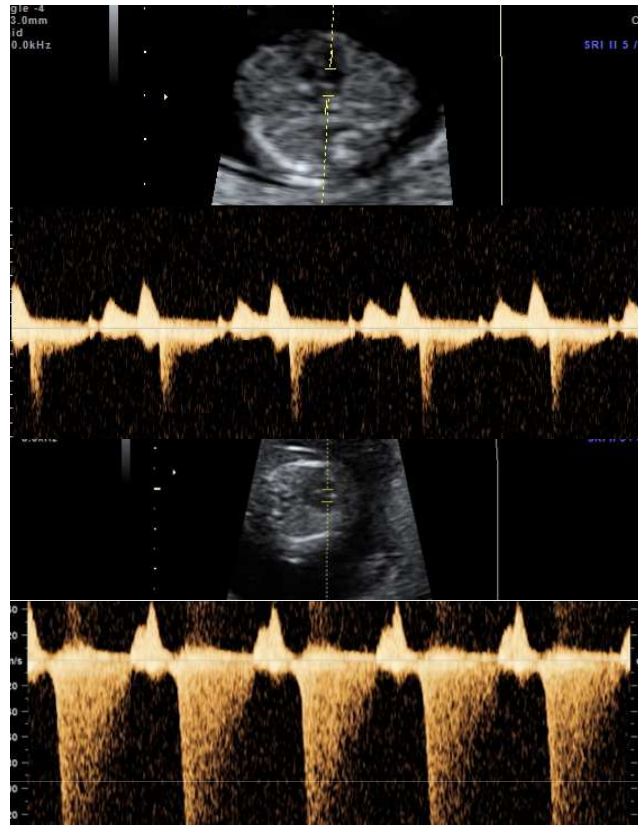
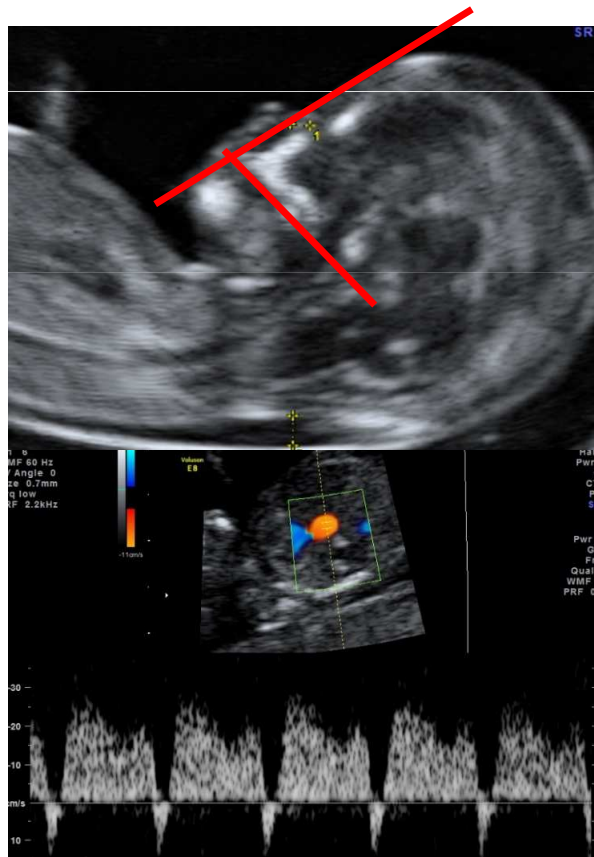
nuchal translucency > 3mm

75% fetal aneuploidy
30% fetal structural anomaly,
genetic syndrome
1% normal fetus

Evans 1999, Nicolaides 2009, Pereira 2011, Kagan 2015, Grande 2015

main marker of fetal abnormality

Fetal chromosomal anomalies screening III



- ductus venosus abnormal flow
- tricuspid valve regurgitation
- facial angle

II trimestr screening

20-22 wks

- fetal structural anomalies detection
- fetal cardiac defect detection
- placental dysfunction detection



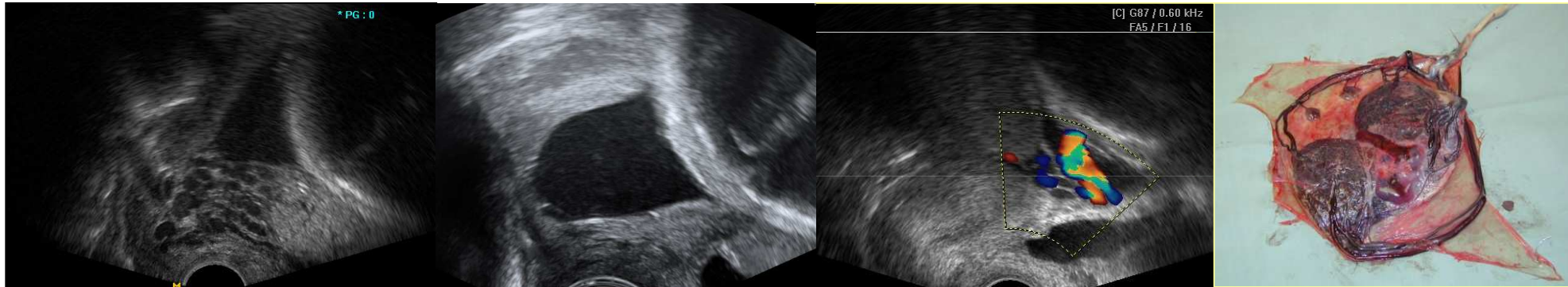
III trimestr screening

30-32wks

- anomaly scan
- fetal growth
- fetal position
- placental position
- birth plan



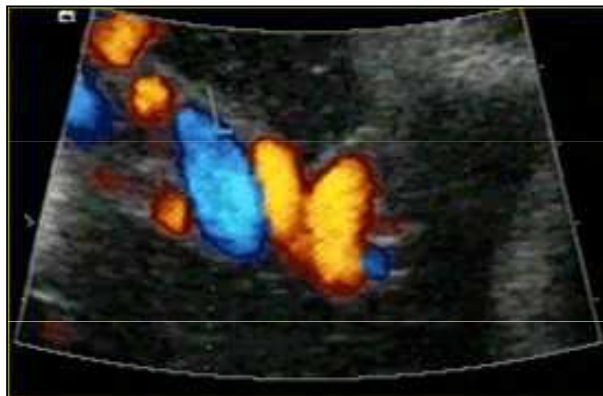
Obstetrics vaginal US



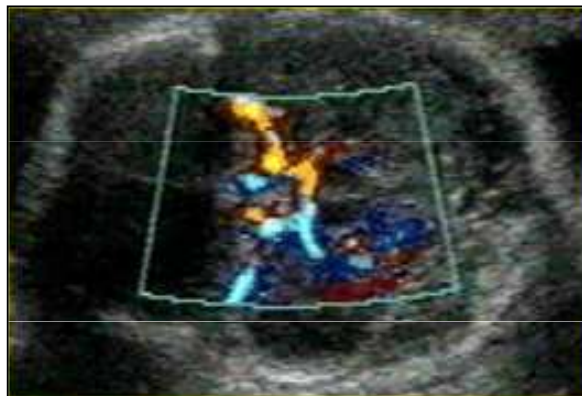
- placental position
- cervical length
- lower uterine segment (*CS scar, fibroma*)
- vasa praevia
- fetal examination (*1 trimestr, head,..*)

Doppler measurement

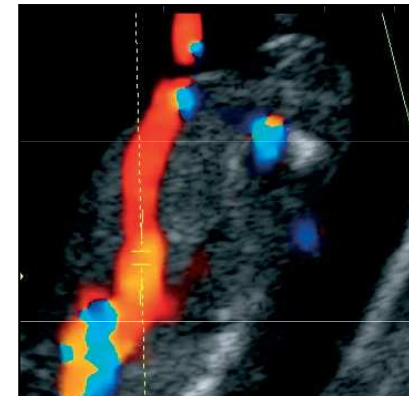
a./v.umbilicalis



a.cerebri media



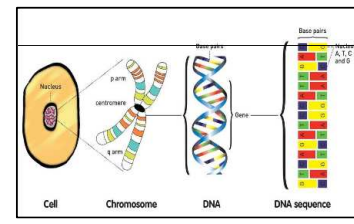
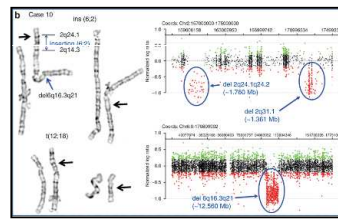
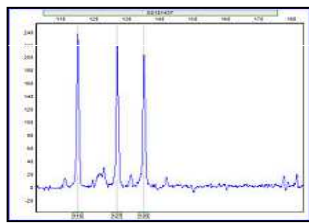
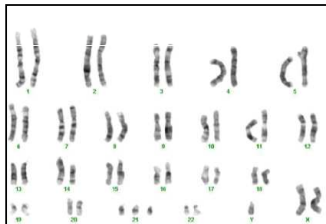
ductus venosus



placental pathology - increasing placental resistance –
decreasing diastolic flow (umbilical cord) – increasing diastolic
flow in the fetal brain vessels – **centralisation of bloodstream**

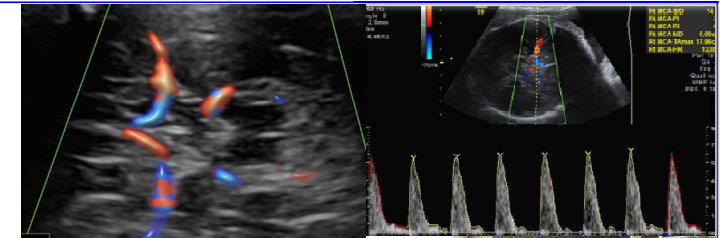
Ultrasound – invasive prenatal diagnostics

- amniocentesis
- chorionic villi sampling
- umbilical cord puncture
- abortion risk 0.8 - 1%
- fetal genetic status examination



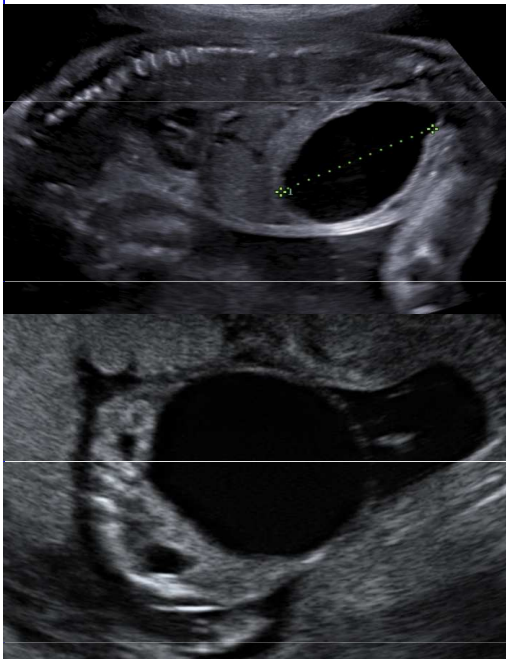
Fetal therapy - intrauterine transfusion

- maternal red blood cells antibodies
fetal hemolytic anemia
- follow up - laboratory - antibody level
 - fetal RhD (cfDNA)
 - ultrasound - MCA Doppler flowmetry
- therapy- intrauterine transfusion



Fetal therapy – vesico-amniotic shunting

fetal obstructive uropathy



Fetal therapy - thoraco-amniotic shunting

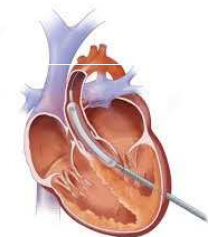
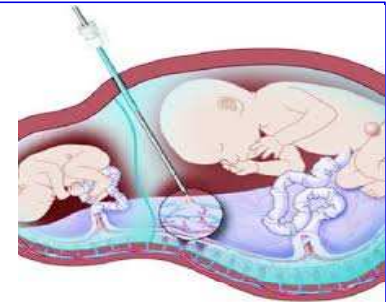
pleural effusion - indications for therapy

- fetal hydrops
- massive effusion ($> \frac{1}{2}$ thoracic cavity volume)
- rapid progression, polyhydramnion



Fetal therapy - next indications

- laser fetoscopy
 - twin-to-twin transfusion sy
 - sIUGR monochorionic twins
 - TRAP sequence
 - sacrococcygeal teratoma
- diafragmatic hernia (endoscopic tracheal occlusion)
- fetal aortal valvuloplasty



Conclusion

- ultrasound - inherent helper of ob-gyn specialist
- theoretical knowledge, practical training
- regular quality audit
- ultrasound of specialist
- subspecialisation for postgradual trainee

