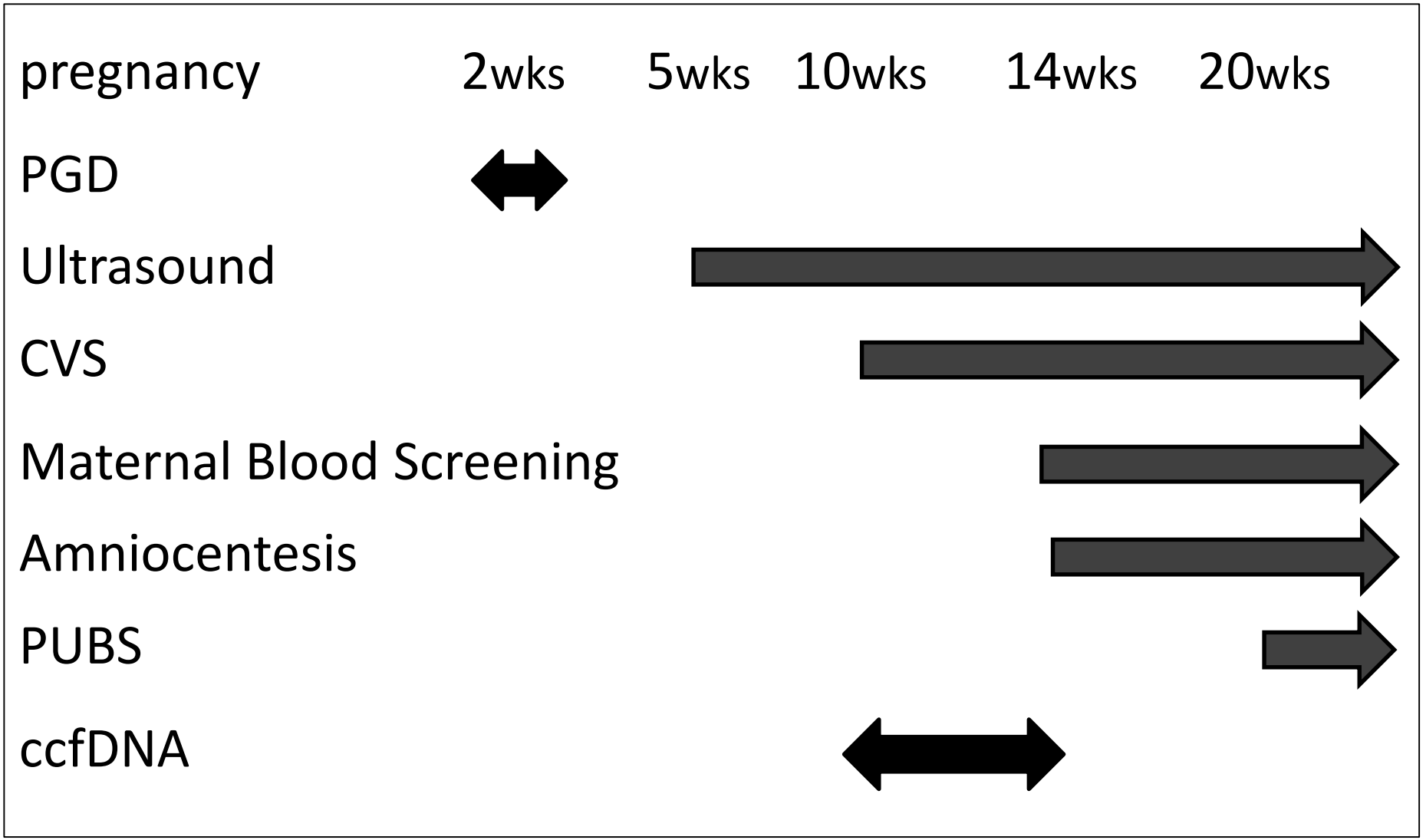
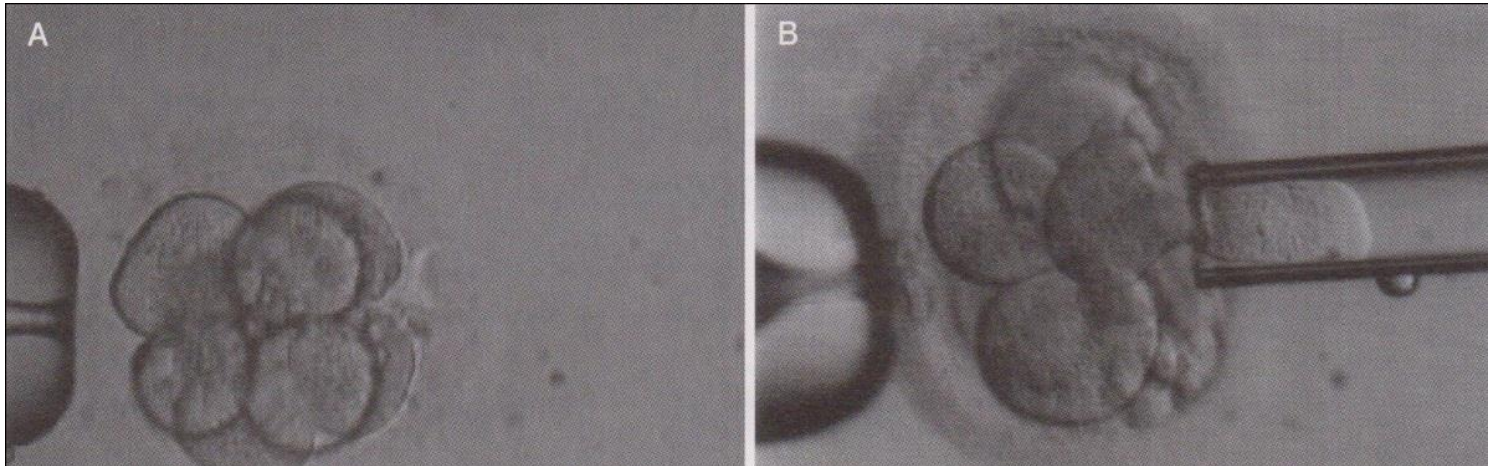
Prenatal Diagnosis

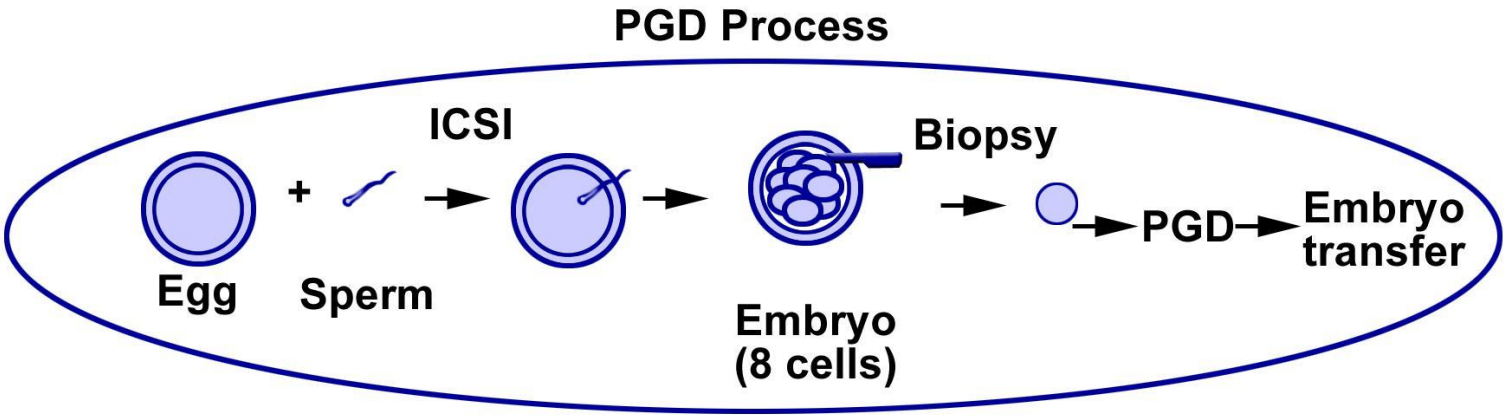
① Preimplantation Genetic Diagnosis(PGD)
② Ultrasound
③ Chorionic Villi Sampling (CVS)
④ Amniocentesis
⑤ Percutaneous Umbilical Blood Sampling (PUBS)
⑥ Maternal Blood Screening Test
　　Triple marker test, Quatro test
⑦ Circulating cell –free fetal DNA (ccfDNA)

Prenatal diagnosis , type & Timing



Preimplantation Genetic Diagnosis





Preimplantation genetic testing is a technique used to identify genetic defects in embryos created through in Assisted reproductive technology (ART) before pregnancy.

PGD revolved around determination of gender as an indirect means of avoiding an X-linked disorder. In 1989 in London

Ultrasound diagnosis

pregnancy ≧8 weeks

Head: ventriculomegaly, hydrocephaly, neural tube defect (anencephaly, encephalocele), holoprosencephaly

Heart: hypoplastic left ventricle, Situs Inversus, endocardial cushion defect(EDC), Ebstein's Anomaly, Fallot tetralogy, transposition of great vessels(TGA), arrythmia

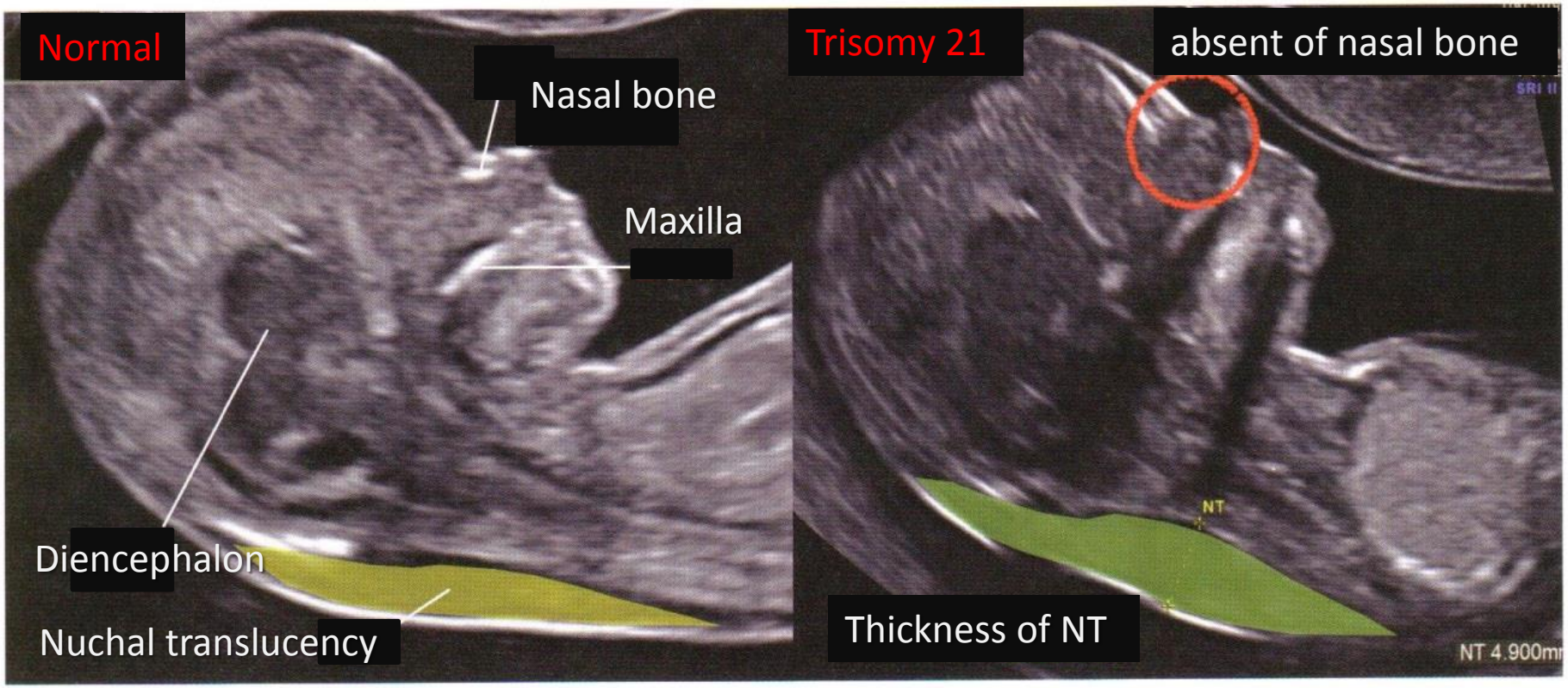
Chest: congenital cystic adenomatoid malformation(CCAM), diaphragmatic hernia

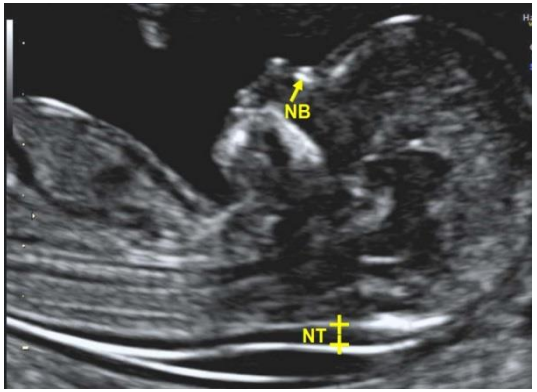
Gastrointestinal tract: esophageal atresia, duodenal atresia, meconium ileus, umbilical hernia, gastroschisis

Urogenital: hydronephrosis, multicystis dysplastic kidney, ureteropelvic junction (UPJ) obstruction, ovarian tumor

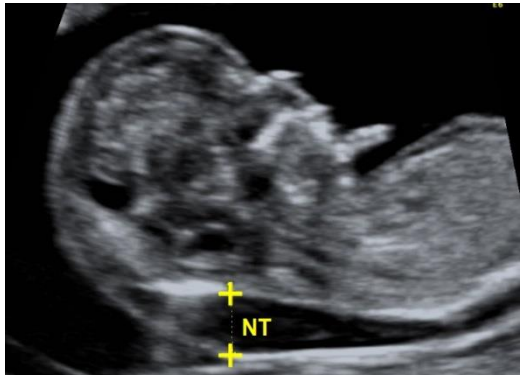
others: myelomeningocele, skeletal dysplasia, osteogenesis imperfecta

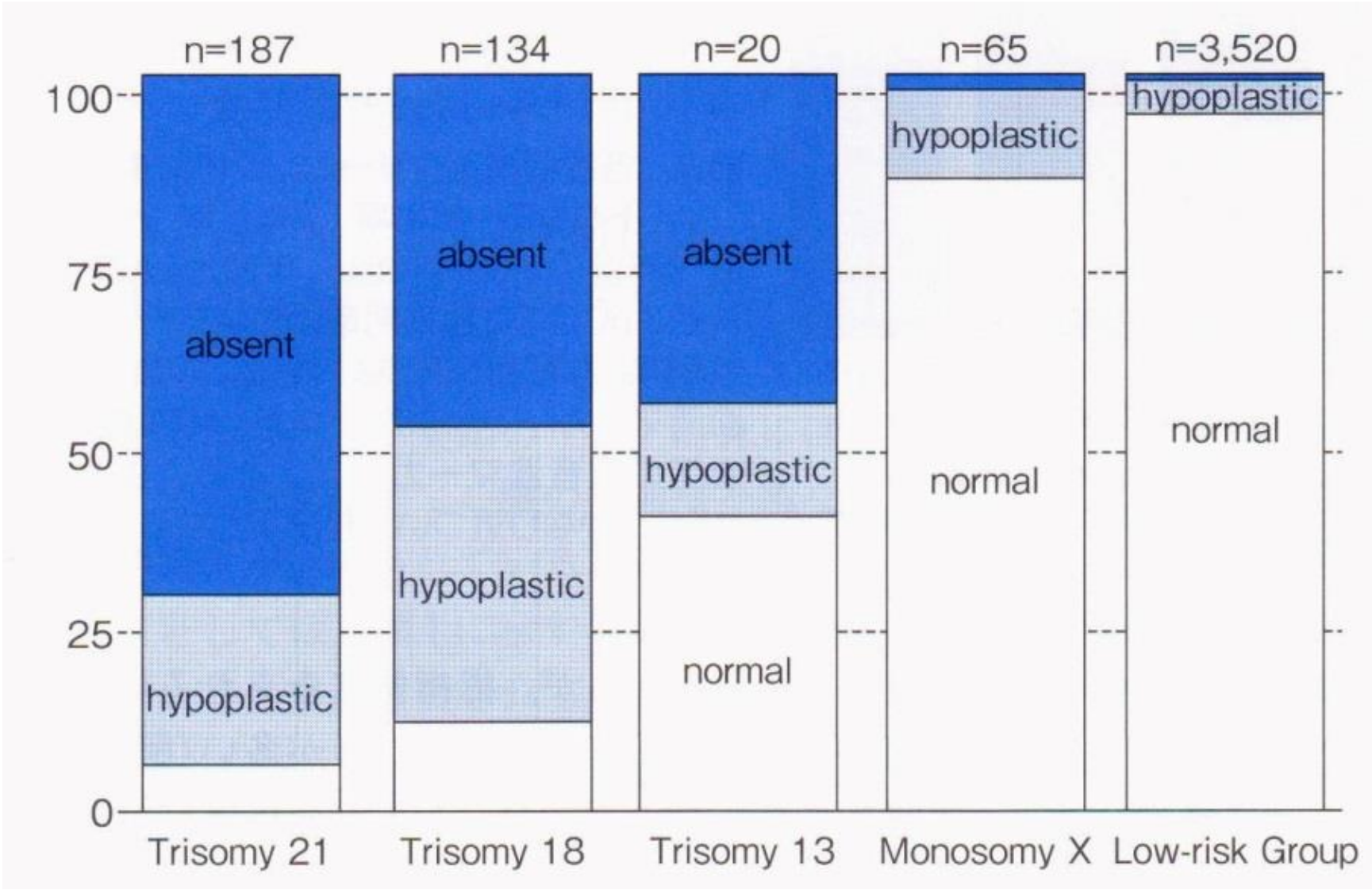
Nuchal translusency (NT) & Nasal bone

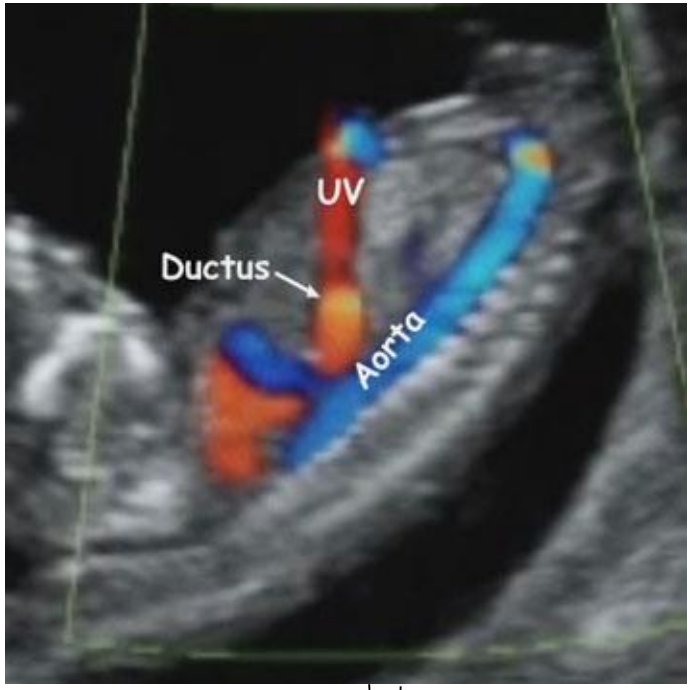


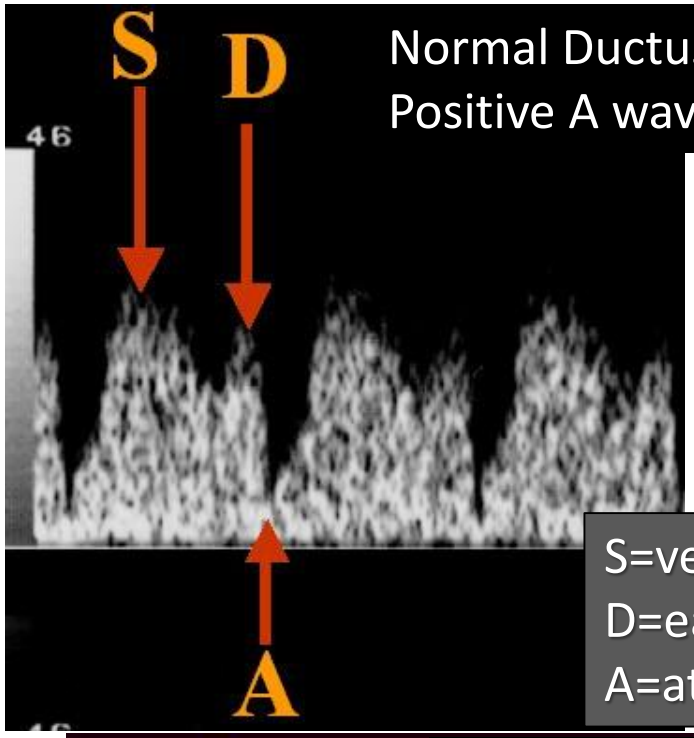


The gestational period must be 11 to 13 weeks and six days.



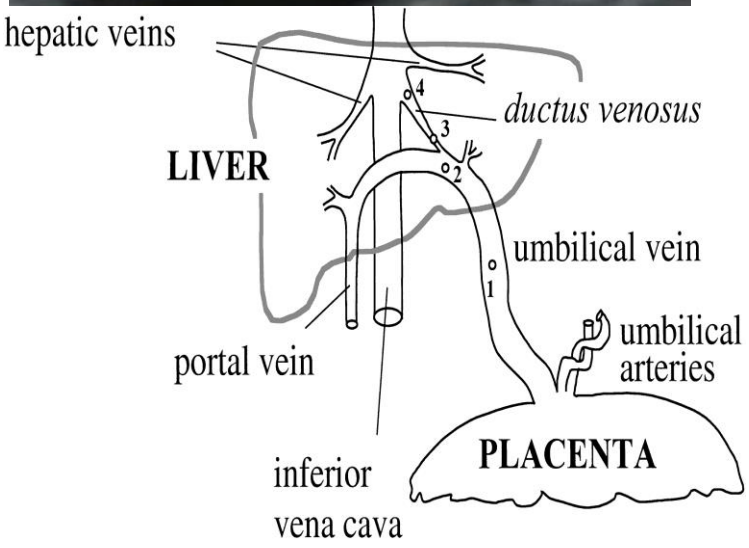

n=187
n=134
n=20
n=65
n=3,520
100
75
50
25
0
absent
hypoplastic
absent
hypoplastic
absent
hypoplastic
normal
hypoplastic
normal
normal
Trisomy 21
Trisomy 18
Trisomy 13
Monosomy X
Low-risk Group

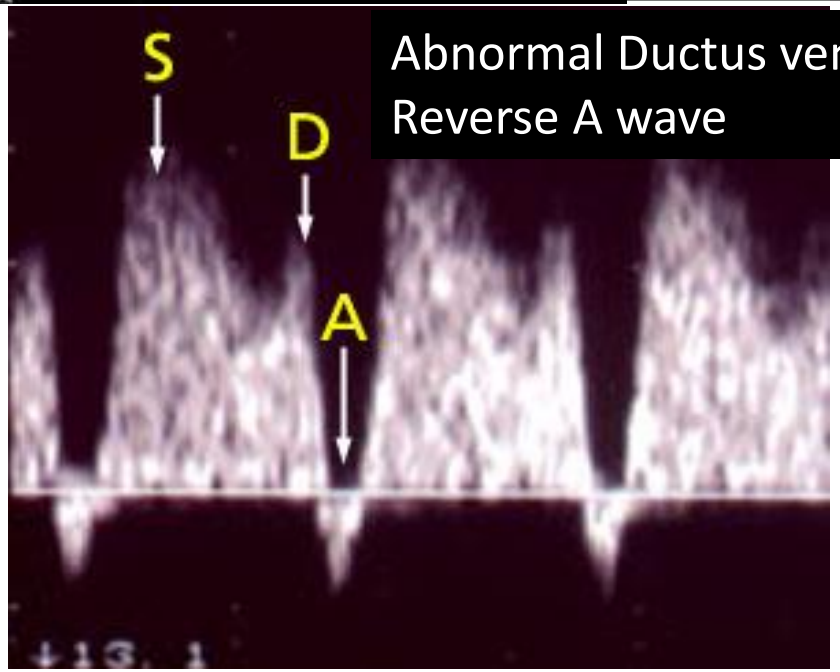




Normal Ductus venous
Positive A wave

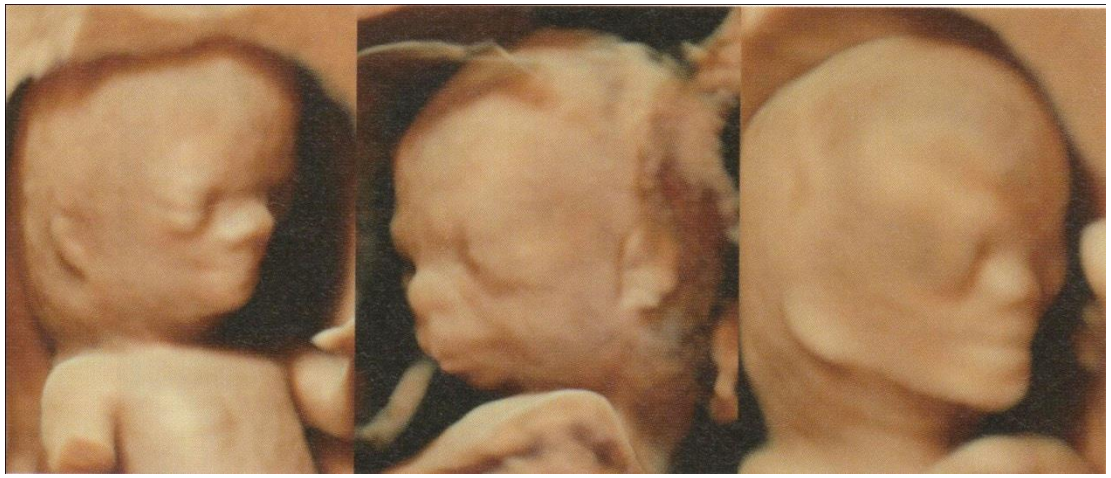
S=ventricular systole
D=early diastole
A=atrial contraction





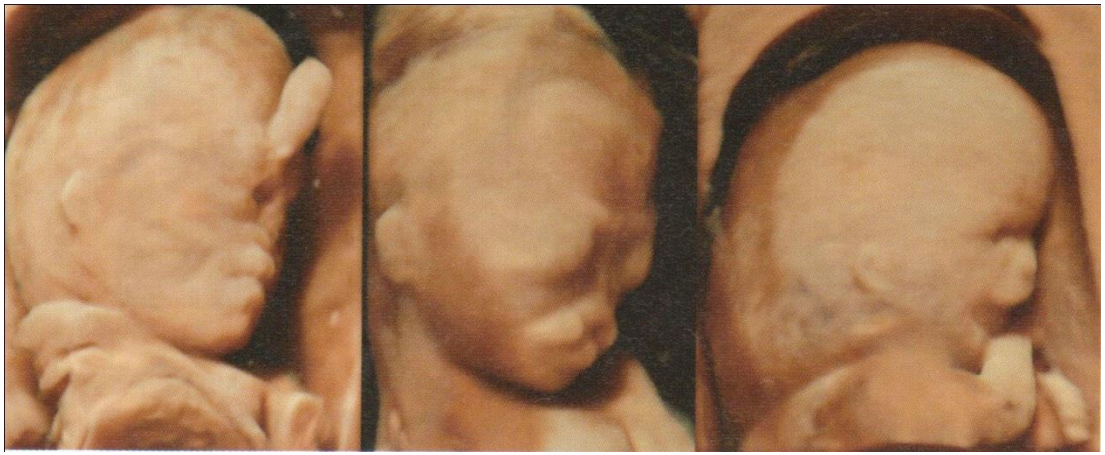
Abnormal Ductus venous
Reverse A wave

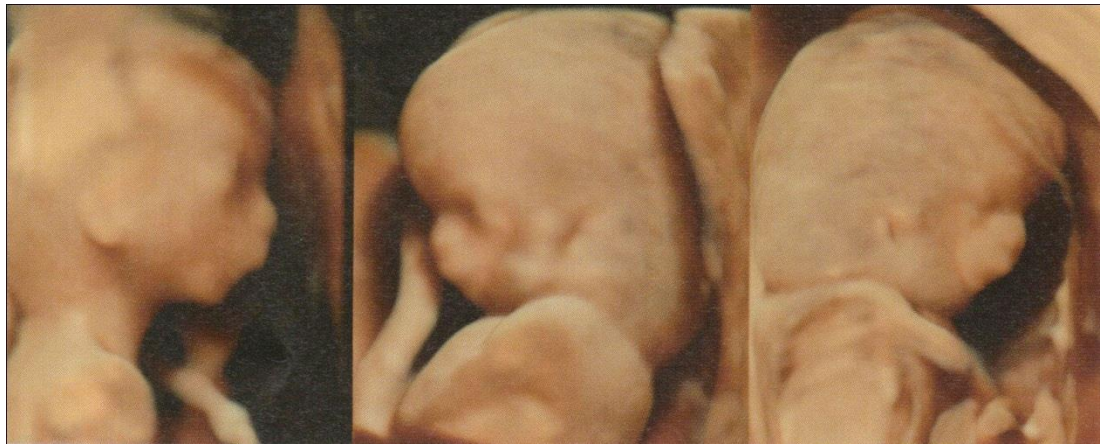
The gestational period must be 11 to 13 weeks and six days.



Trisomy 21

Trisomy 13





Trisomy 18

Chromosome analysis

Chorionic villi

⇒Chorionic Villi Sampling

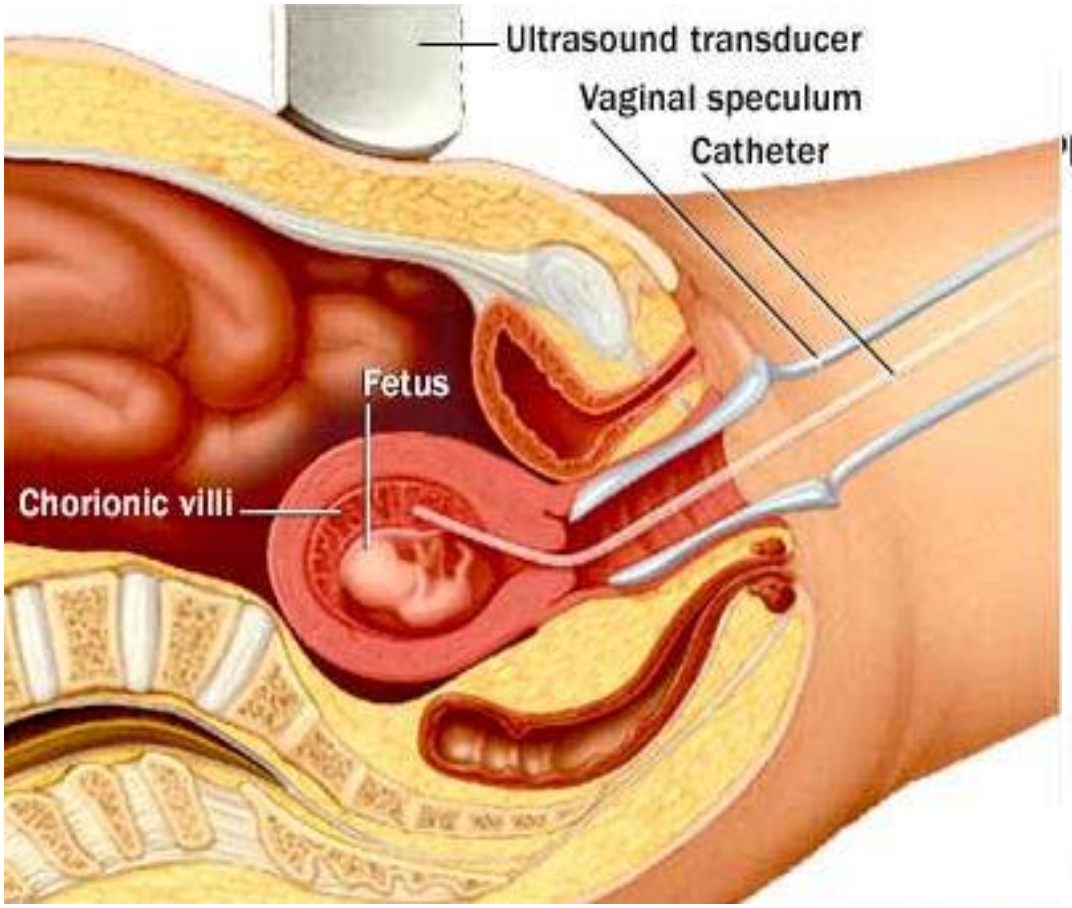
Amnitoic fluid

⇒Amniocentesis

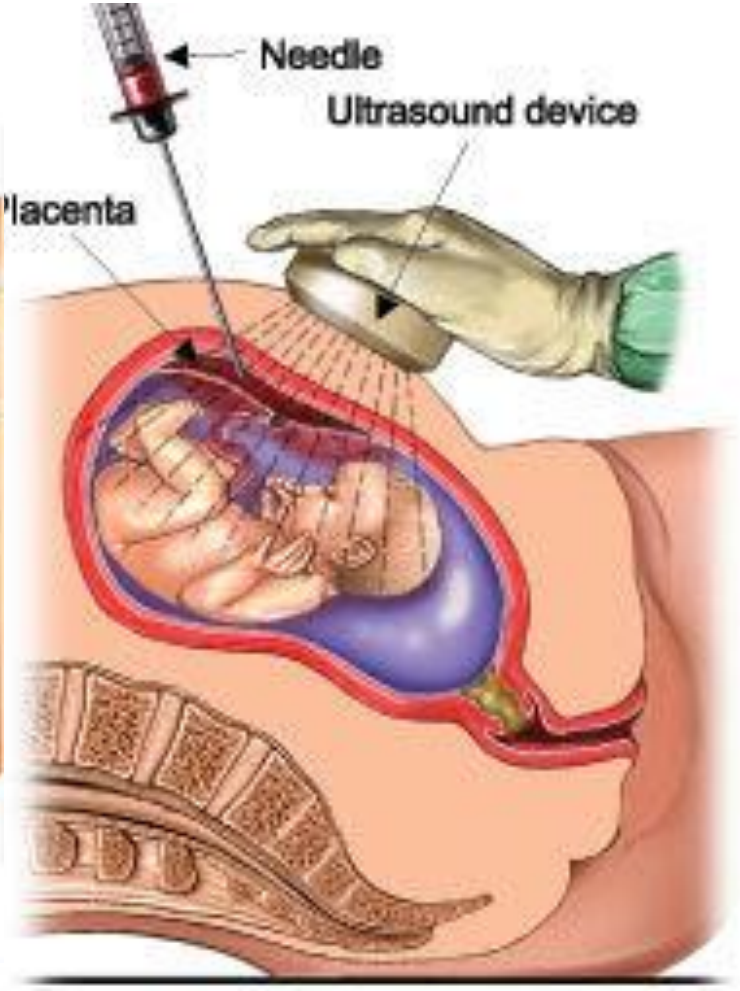
Fetal cord blood

⇒Percutaneous umbilical blood sampling

CVS: Chorionic Villi Sampling



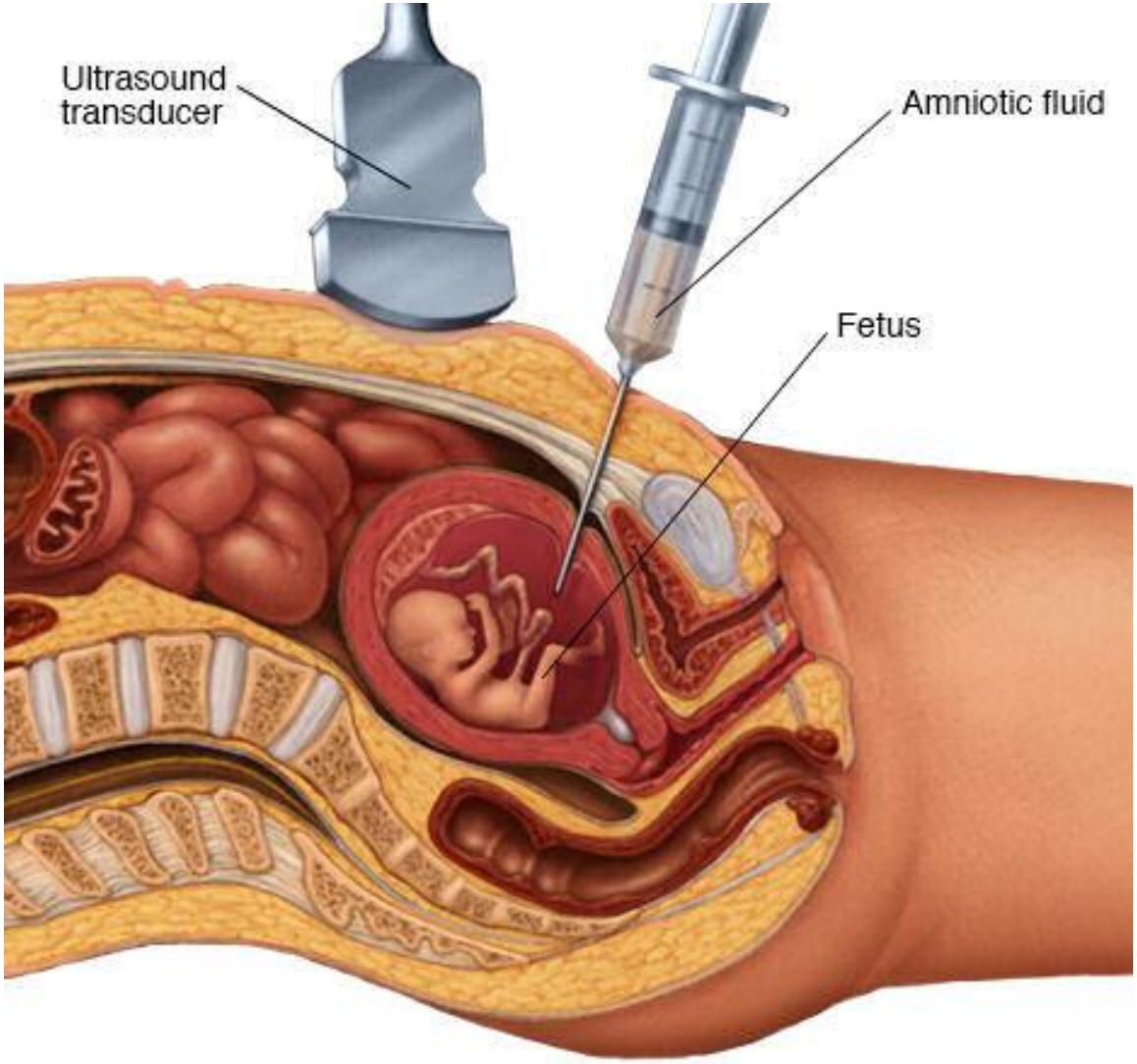
trancervical



transabdominal

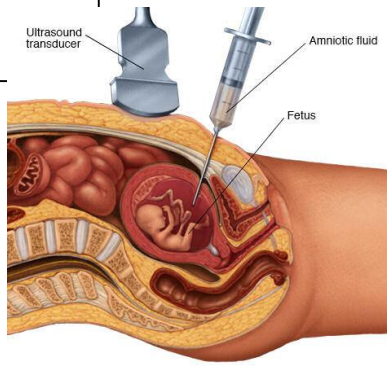
CVS is usually offered after 10 completed weeks of pregnancy.

Amniocentesis



Amniocentesis is usually offered after 15 completed weeks of pregnancy (usually between 14-18 weeks).

PUBS:
Percutaneous umbilical blood sampling
（preg.18wks～）



1）Chromosome：anomaly・Hydrops fetalis

2）hereditary disease：Hemophillia・muscular dystrophy

3）Assessment of fetal blood: Rh incompatibility・
idiopathic thrombocytopenic purpura（ITP)

4）Fetal infection：Rubella・ParvoB19・Cytomegalo virus・
Herpes virus

5） Assessment of fetal well-being：PH・PO2・PCO2・Hb

Maternal Blood Screening Test

Triple marker test, Quatro test

Triple marker test : AFP+hCG+Estriol+maternal age

Quatro test: AFP+hCG+Estriol+inhibin A+maternal age

AFP: alpha-fetoprotein is a protein that is produced by the fetus
hCG: human chorionic gonadotropin is a hormone produced within the placenta
Estriol: estriol is an estrogen produced by both the fetus and the placenta
Inhibin-A: inhibin-A is a protein produced by the placenta and ovaries

Assuracy of Quatro test

Trisomy 21: 87%（39/45）

	Trisomy 21(+)	Trisomy 21(-)	total
positive	39	1718	1763
negative	6	17343	17349
total	45	19061	19112

Sensitivity=86.7%
Specificity=91.0%
PPV=2.2%
NPV=99.9

Trisomy 18: 77%（34/44）

	Trisomy 18(+)	Trisomy 18(-)	total
positive	34	242	276
negative	10	55461	55471
44	44	55703	55747

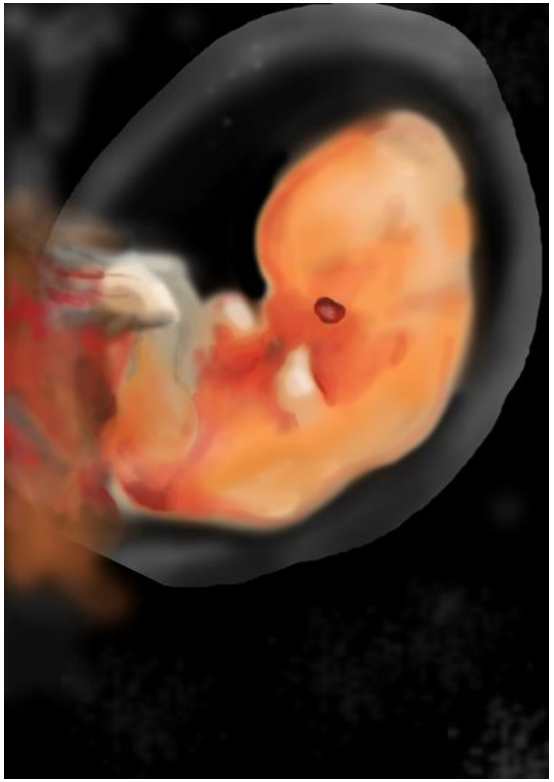
Sensitivity=77.3%
Specificity=99.6%
PPV=5.0%
NPV=99.5%

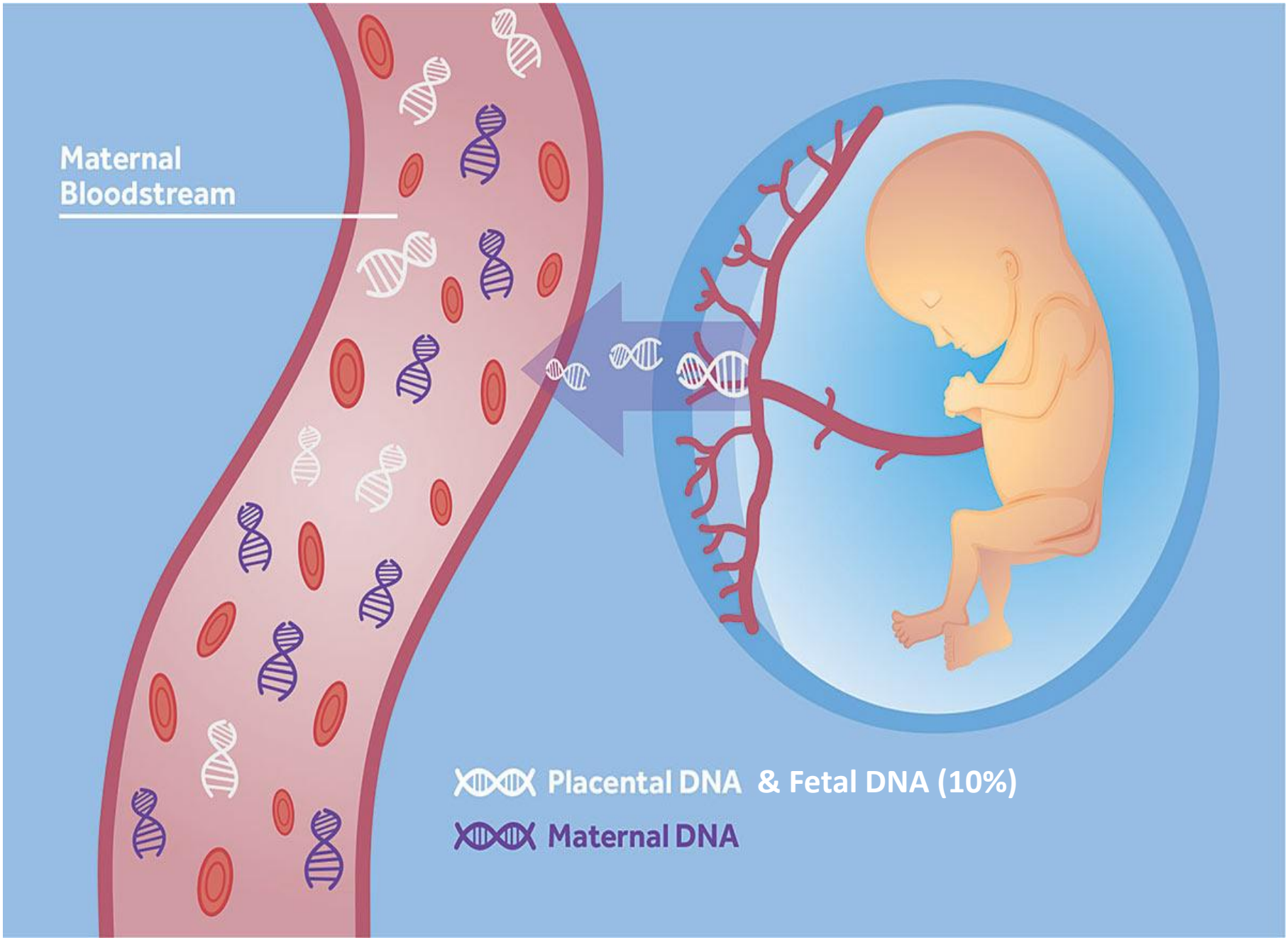
Neural tube defect: 83%（39/47）

	NTD (+)	NTD (-)	total
positive	39	221	260
negative	8	55479	55487
total	47	55700	55747

Sensitivity=82.3%
Specificity=99.6%
PPV=15.0%
NPV=99.9%

ccfDNA: Circulating cell –free DNA




Maternal
Bloodstream
Placental DNA & Fetal DNA (10%)
Maternal DNA

NIPT: Noninvasive prenatal genetic testing

NIPT is a DNA test on maternal blood to screen pregnancies for the most common fetal chromosome anomalies: trisomy 21, trisomy 18, trisomy 13.

Sample: 20ml blood
Timing: from gestation week 10

Indication:
Although NIPT can be performed in every pregnancy, it is especially indicated

- Advanced maternal age (over35 years)
- If the quatro test or 1st trimester screening indicates an increased risk for trisomy 21, trisomy 18, trisomy 13
- Past history that became pregnant in children with a chromosome anomalies

Contraindications: NIPT is not the test of choice when there is fetal anomalies on Ultrasound

NIPT: Noninvasive prenatal testing

TCCGCCCAGGCCATGAGGGACCTGGAAATGGCTGAT	chr21
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
GACACGGTGGAGCTCGGCCACACCAGGCCCAGCTGG	chr14
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
ACAGTGGTGGGGCCCATCCCTGGGTGAGGCTCAGTT	chr21
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
TCCGCCCAGGCCATGAGGGACCTGGAAATGGCTGAT	chr21
GACACGGTGGAGCTCGGCCACACCAGGCCCAGCTGG	chr14
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10
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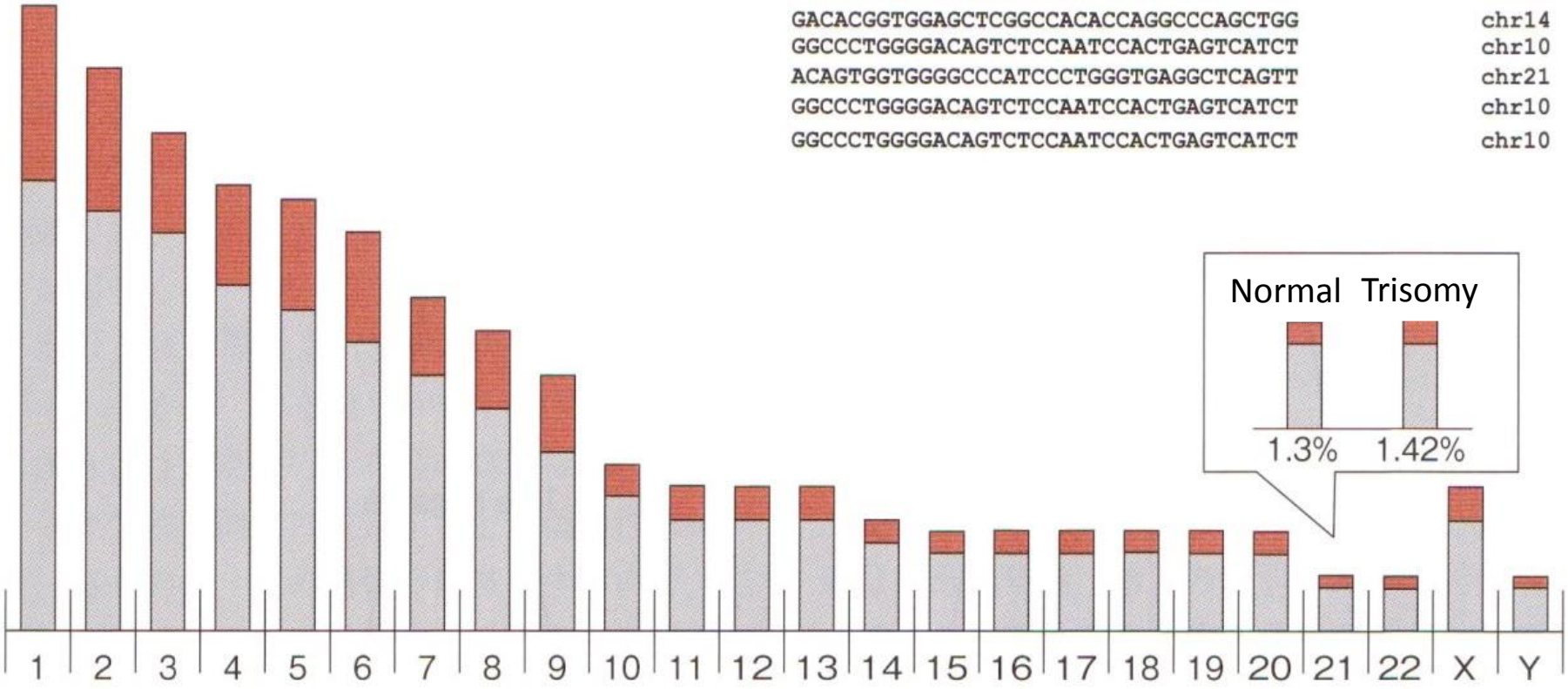
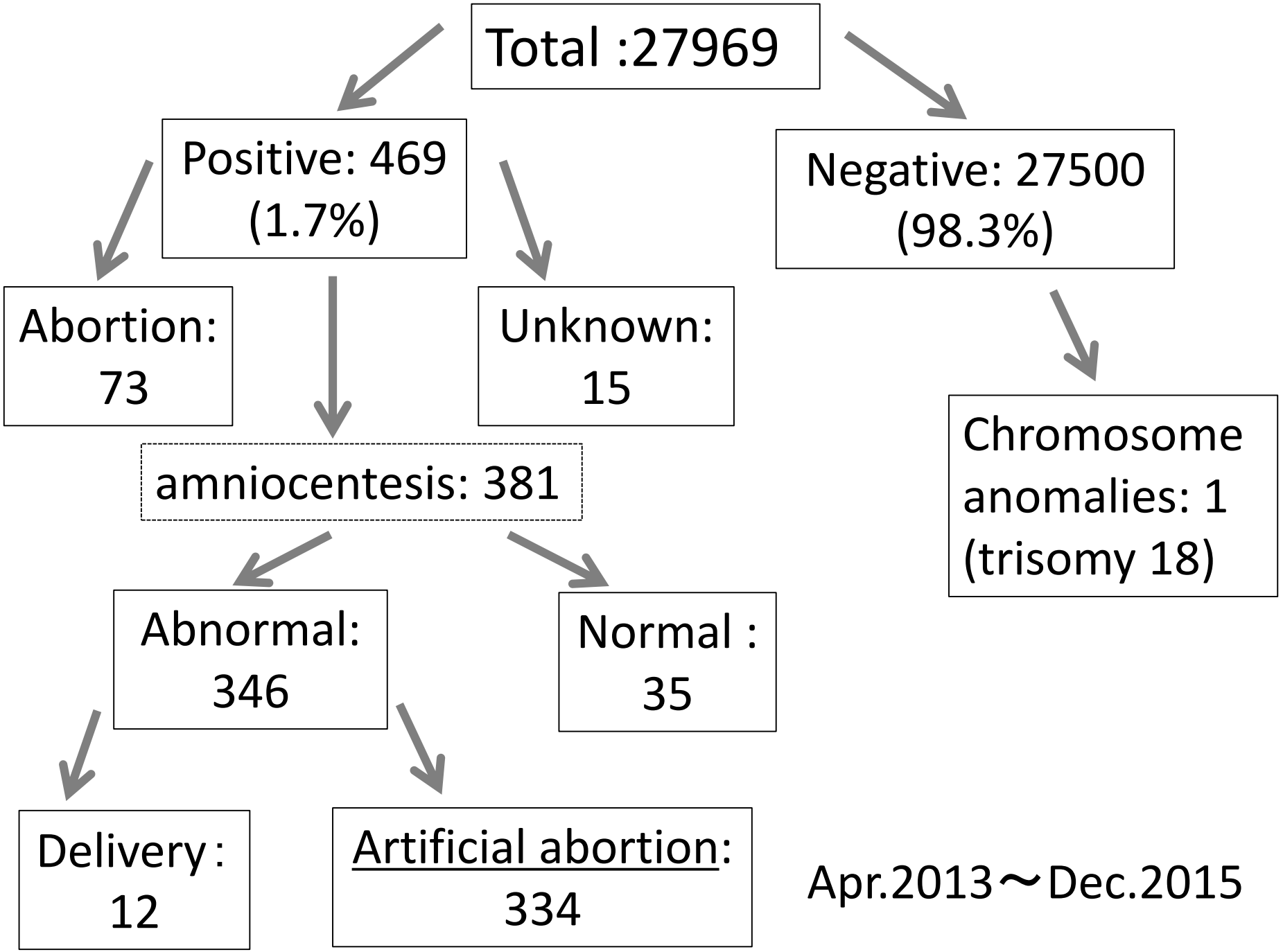
GGCCCTGGGGACAGTCTCCAATCCACTGAGTCATCT	chr10



Chromosome NO.


Total :27969
Positive: 469
(1.7%)
Negative: 27500
(98.3%)
Abortion:
73
Unknown:
15
Chromosome
anomalies: 1
(trisomy 18)
amniocentesis: 381
Abnormal:
346
Normal :
35
Delivery :
12
Artificial abortion:
334
Apr.2013～Dec.2015