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Basic Rules in Early Pregnancy Ultrasound


Dr. Frederique M. van Dunne, PhD, FRANZCOG

Division of Obstetrics and Prenatal Medicine
 Erasmus Medical University Medical Center
 Rotterdam, The Netherlands

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Indications in 1st trimester

- Dating
- Previous miscarriage / ectopic
- Clinical signs:
 - PV blood loss
 - Pain
 - Anxiety
- Multiple pregnancy: determination of chorionicity
- Early detection of structural fetal abnormalities



6th wks

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Pregnancy dating: consensus?

- LMP and / or CRL
 - Correction?
 - After 3, 5, 7, 10 days?
- Different reference curves

**Various studies have shown that ultrasound-based pregnancy dating is superior
 IF DONE CORRECTLY!**

Perderson 1982; Mongelli 1996; Neilson 2000 (Cochrane); Koster et al 2008 UOG

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New protocol Nov 2009 NVOG: Dating in pregnancy



Pregnancy dating: not based on LM

Ultrasound dating:

- Optimal → 10-12 wks (CRL 20-65 mm)
- CRL > 65 mm → CRL + BPD for dating
- BPD > 23 mm → BPD for dating
- > 18 wks → BPD + TCD for dating

E. Pajkrt, 2009, NVOG modelprotocol 4 10-12-2009

Why is dating important?

- For good risk calculation for chromosomal anomalies

Salomon et al, UOG 2009; Koster et al, UOG 2009; Koster et al UOG 2008

- To interpret growth in 2^e and 3^e trimester
- Border of viability / prematurity
- Post date induction of labour

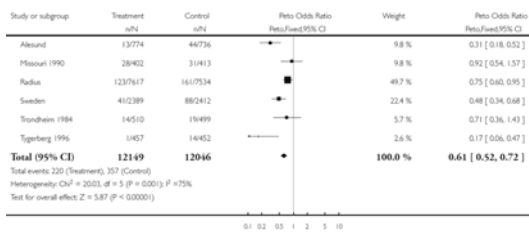
Neilson, Cochrane review 1998

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Induction for post term pregnancy

Analysis 1.55. Comparison 1 Routine versus selective ultrasound in early pregnancy, Outcome 55 Induction for 'post-term' pregnancy.

Review: Ultrasound for fetal assessment in early pregnancy
 Comparison: 1 Routine versus selective ultrasound in early pregnancy
 Outcome: 55 Induction for 'post-term' pregnancy



Neilson, Cochrane review 1998

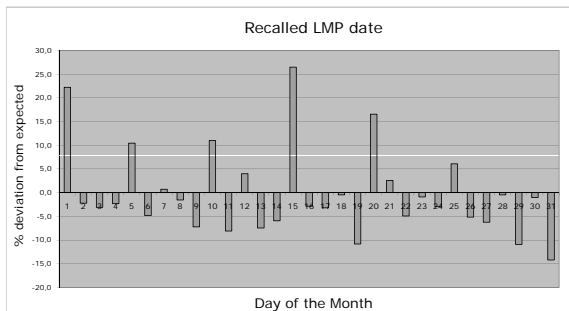
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Pitfalls dating (LMP)

- LMP date unknown
- Irregular cycle
- Use of oral contraception < 3 months
- LMP known & regular cycle, but
 - A 10% discrepancy of > 7 days
 - Ovulation not on 14th day cycle
 - Late implantation (diapause)
 - Preference for LMP on certain days of month (55%)


Geirsson, BJOG 1991 ; Savitz, Am J Obst Gynecol 2002

Recalled LMP date



Rotterdam (2000-2008): 27.916 women

Basic rules for 1st trim ultrasound

- Consider basic hygiene rules (probe cleaning)
- Vaginal scan + abdominal scan
- View uterus, adnexa + possible fluid in pouch of Douglas
- Zoom image 
- Store images in patient files



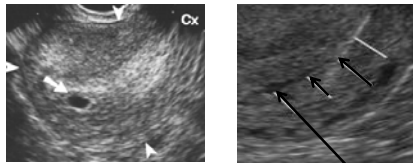
Basic rules

- Early Pregnancy
 - Localization
 - Viability

- Number of gestational sacs
- Number of embryos

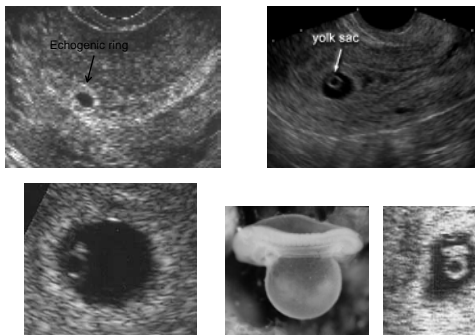
Basic rules in very early 1st trimester

- Thickened endometrium
- Echolucent cavity eccentrically of midline
- Echogenic or trophoblastic ring



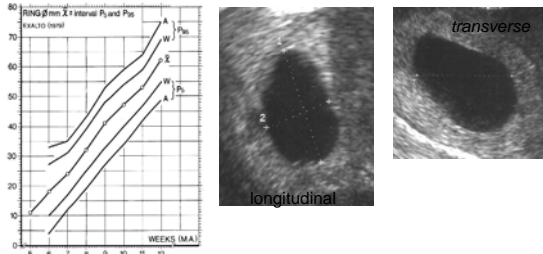
- NOT fluid between two layers without echogenic ring

Echogenic ring

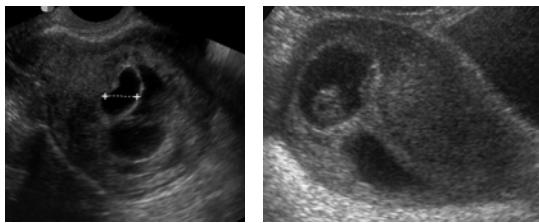


Gestational sac

- Measure the sac itself; do not include the echogenic ring
- Longitudinal and transverse – average 3 measurements



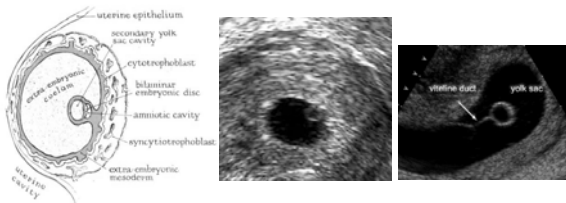
Hematoma



- 'Quivering'
- 'Vanishing twin'

Yolk sac

- Visible at 5 wks
- Echolucent spherical structure with bright outline
- Earliest sign of the developing embryo



Yolk sac

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M.Rousian, BJOG 2009

collaps

normaal

giant

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Amnion

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5⁺³ wk

6⁺³ wk

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Embryo: cardiac activity

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- Evident CRL > 2-4 mm
- Rapid increase between 5-9 wks
- Fetal heart rates: limited prognostic value (if >100 bpm)
- Preferably use M-Mode for visualisation

Heart rate n = 133

central ±1 SD

Menstrual age

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Ectopic pregnancy

- Empty uterus
- 'Pseudo sac'
- Adnexal mass
- Fluid in Pouch of Douglas
- HCG serum > 2000 IU/l

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Ectopic pregnancy

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Robinson

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Basic rules measuring CRL

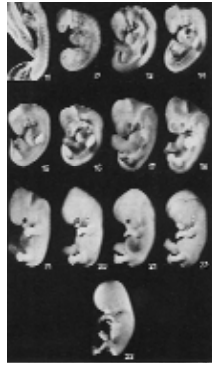
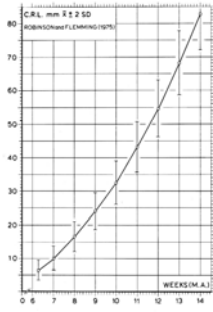
- Longest straight-line measurement
- Midsagittal or Coronal
 - 3rd + 4th ventricle; nose; genital tubercle; neutral position
- Outline fetus clearly visible
- Zoom in!
- Mean of three measurements

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Robinson

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CRL = Greatest Length!

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Pitfalls CRL measurement

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- Operator judgement
 - Incorrect technique
 - 'blinded' measurement
- Movements / positioning fetus
- Structural abnormality fetus →
- Ultrasound machine setting

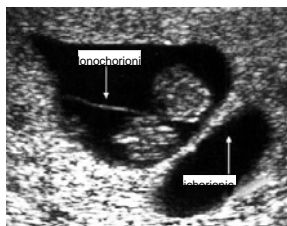


Harkness 1997 Hum Rep Update

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Multiple pregnancies

- Assess amnionicity and chorionicity
- Lambda-sign / T-sign
- Always look for 3rd or 4th pregnancy



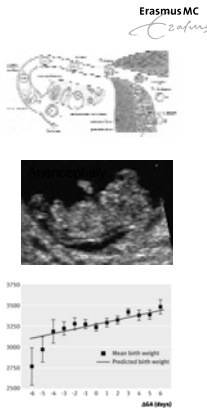
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Small CRL

- Late ovulation (irregular menstrual cycle)
- Late implantation (diapauze = temporary arrest)
- Abnormal embryo
 - ✓ Structural defect and/or
 - ✓ Chromosomal abnormalities
- Basis for growth restriction and VPTD delivery in 2nd & 3rd trimester

Bahado-Singh 1997; Kuhn 1995; Leelapatana 1992; Drugan 1992; Schemmer 1997

Smith 1998; Bukowski 2007; Smith 2002; Leung 2008; Mercer 2008; Thorsell 2008



Small CRL - Aneuploidy

- Association with aneuploidy
 - Trisomy 18 (13, triploidy)
 - Not in: trisomy 21, sexchromosomes

Bahado-Singh 1997; Kuhn 1995; Leelapatana 1992; Drugan 1992; Jaurinaux; Schemmer 1997

Table IV Percentages of fetuses with measurement (CRL and growth rate) less than the 5th percentile for the study groups

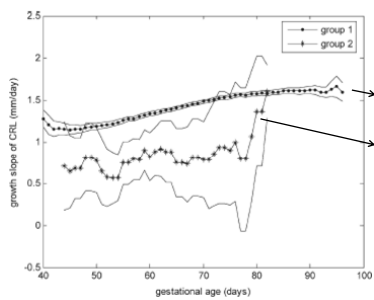
	First scan CRL <5%	Second scan CRL <5%	Growth rate <5%
Control	5.0	5.1	5.0
Trisomy 21	0.0	0.0	0.7
Trisomy 18	10.2	26.4*	49.0*
Trisomy 13	0.0	10.7	31.0*
Triploidy	0.0	17.5	100.0*
42,X	0.0	0.0	23.0
47,XXX,XXX,XXX	0.0	0.0	100

Schemmer Pren Diagn 1997

Fisher's exact test was applied to determine significance of differences between chromosomally abnormal trisomy and normal fetuses.

*P<0.05

Miscarriage: growthrate ↓



493 successful pregnancies
28 miscarriages
Certain dates

Bottomley et al
Hum Reprod 2009

Small CRL → Increased risk miscarriage

Reljic 2001; Choong 2003; Mukri 2008; Bottomley 2009

Small CRL – Birth weight ↓

TABLE 2. RELATIVE RISKS ASSOCIATED WITH A SMALLER-THAN-EXPECTED FIRST-TRIMESTER CROWN-RUMP LENGTH.

OUTCOME	CROWN-RUMP LENGTH*		RELATIVE RISK (95% CII)	P VALUE‡
	SMALLER THAN EXPECTED N=1289 no. with outcome/ no. without outcome	NORMAL OR LARGER THAN EXPECTED N=2108 no. with outcome/ no. without outcome		
Birth weight <2500 g	83/1206	77/2031	1.8 (1.3–2.4)	<0.001
Birth weight <2500 g at ≥37 wk according to last menstrual period	38/1251	27/2081	2.3 (1.4–3.8)	<0.001
Birth weight <2500 g at ≥37 wk according to crown-rump length	33/1256	26/2081	2.1 (1.2–3.5)	0.006
Birth weight <5th percentile according to last menstrual period	65/1224	36/2072	3.0 (2.0–4.4)	<0.001
Birth weight <5th percentile according to crown-rump length	45/1244	42/2066	1.8 (1.2–2.7)	0.01

N= 4229, certain dates

Smith et al, NEJM 1998

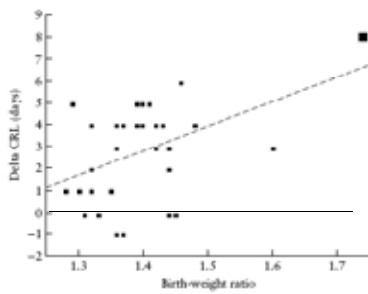
Small CRL - Prematurity

TABLE 2. RELATIVE RISKS ASSOCIATED WITH A SMALLER-THAN-EXPECTED FIRST-TRIMESTER CROWN-RUMP LENGTH.

OUTCOME	CROWN-RUMP LENGTH*		RELATIVE RISK (95% CII)	P VALUE‡
	SMALLER THAN EXPECTED N=1289 no. with outcome/ no. without outcome	NORMAL OR LARGER THAN EXPECTED N=2108 no. with outcome/ no. without outcome		
Delivery at 24–32 wk according to last menstrual period	22/1267	17/2090	2.1 (1.1–4.0)	0.02
Delivery at 24–32 wk according to crown-rump length	23/1266	17/2091	2.2 (1.2–4.1)	0.01
Delivery at 33–36 wk according to last menstrual period	50/1239	78/2029	1.0 (0.7–1.5)	0.78

Smith et al, NEJM 1998

Large CRL

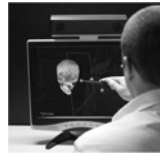
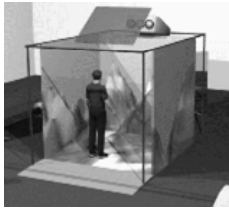


Severe macrosomia:
Larger CRL in 1st
trimester
(US at 11-14 wks)

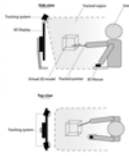
Hackmon 2008 UOG

Cave Concept 1990

- More than one person
- High resolution
- Less "simulation sickness"



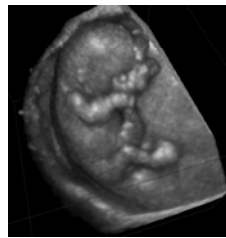
New Tool?

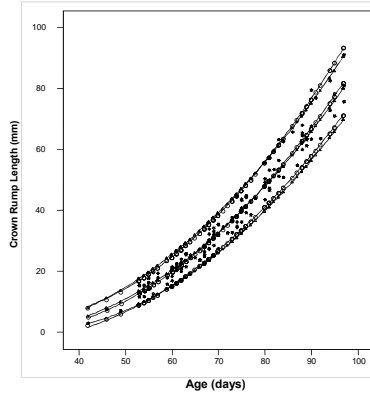


Koning AH, Stud Health Technol Inform. 2009

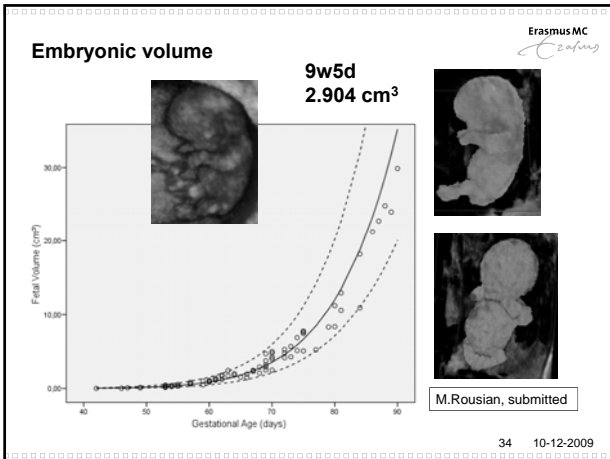
3D ultrasound in the I-Space

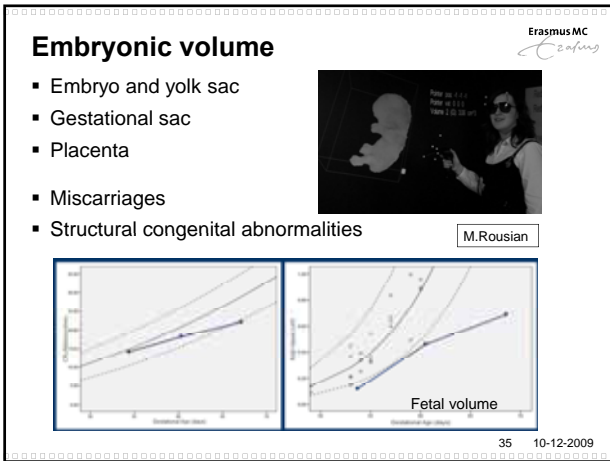
- Ultrasound 3D "volumes"
- Off line evaluation → BARCO I-Space

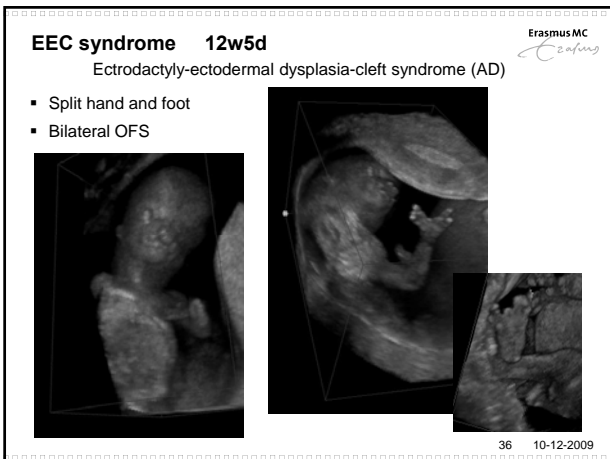




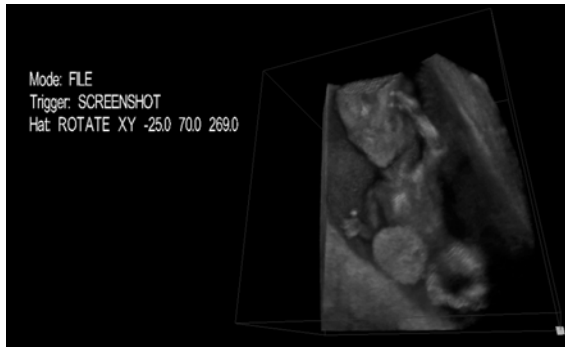
Verwoerd-Dikkeboom
CM, 2009



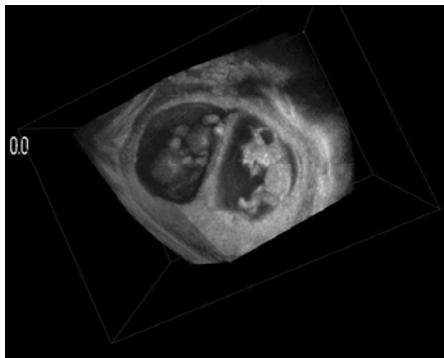




Omphalocele 12w0d



Exencephaly 12w2d



Advantages of 1st trimester ultrasound

- Accurate calculation of gestational age
- Early identification of multiple pregnancies
- Diagnosis of non-viable pregnancies
- Early identification of at risk pregnancies
- Diagnosis of certain fetal malformations

Take home messages

- Routine ultrasound dating:
 - Is recommended in all women at 10 -13 wks
 - Due date always based on ultrasound dating
 - Reduces the rate of post-term pregnancies

- In an ultrasound <10 wks:
 - CRL used for appropriate timing of the 10–13 wk dating scan

- Smaller than expected embryonic size → increased risk of :
 - Miscarriage
 - Triploidy, T18 and T13
 - Fetal growth restriction
 - Preterm delivery

Bottomley C. Best Practice & Research
Clinical Obstetrics and Gynaecology (2009)

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Thank you for your attention
