**ESHRE Special Interest Group for Early Pregnancy (SIGEP)**
**Winter Symposium**

**Palazzo Delle Stelline, Milan, Italy**
***18-19th December 2008***

# Clinical impact of high definition 3D-scanning in early pregnancy

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## I trimester — CRL (crown-rump-length)

### Transabdominal US approach

**Robinson HP**, Fleming JEE. **1975**
A critical evaluation of sonar "crown-rump-length" measurement.
Br J Obstet Gynaecol

### Transvaginal US approach

**Hadlock FP**, et al.. **1992**
Fetal crown-rump-length: re-evaluation of relation to menstrual age (5-18 weeks) with high-resolution real-time US.
Radiology

**Wisser J**, et al.. **1994**
Estimation of gestational age by transvaginal sonographic measurement of the greatest embryonic length in dated human embryos.
Ultrasound Obstet Gynecol

## I trimester

CRL
(crown-rump-length)

*Ultrasound Obstet. Gynecol. 3 (1993) 36-41*

**Miscarriage diagnosis and gestational age estimation in the early first trimester of pregnancy: transabdominal versus transvaginal sonography**

*E. Ferrazzi, S. Garbo, P. Sulpizio, L. Ghisoni, P. Levi Setti and M. Buscaglia*

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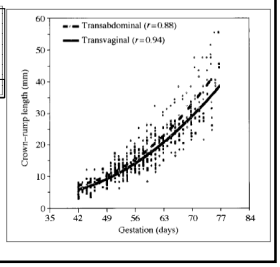
Transvaginal sonography proved to be unquestionably better compared with transabdominal scanning before 42 days of gestation and when the chorionic sac and embryo are at the lower limits for sonographic diagnosis of miscarriage.




- Transabdominal ≈ transvaginal CRL
- TV-US: anatomy of the embryo

I trimestre

CRL (crown-rump-length)

'90s → high resolution TV probes

**Fetal Crown-Rump Length: Reevaluation of Relation to Menstrual Age (5–18 weeks) with High-Resolution Real-Time US'**



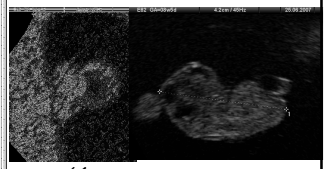
5.6 w 9 w

5-18w: error ± 8%

CRL 20 mm ≈ 8.6 ± 5 days

CRL 80 mm ≈ 14.1 ± 8 days

Nowadays → 3D high resolution TV probes

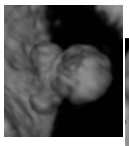


6.1 w 8.5 w

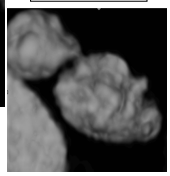
I trimester - Fetal biometry and volumetry

Why should we use 3D approach to study embryo/fetal biometry in early pregnancy?

$6^{+1}$ weeks



$6^{+6}$ weeks

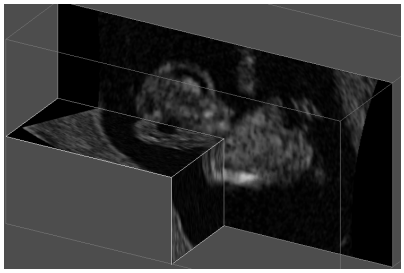


$8^{+1}$ weeks

$9^{+1}$ weeks

*Not only for baby-watching!!*

Why should we use 3D approach to study embryo/fetal biometry in early pregnancy?



Ultrasound Obstet Gynecol 2006; 27: 440–446
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/uog.2794

Three-dimensional ultrasound volume calculations of human embryos and young fetuses: a study on the volumetry of compound structures and its reproducibility

H.-G. K. BLAAS*, P. TAIPALE†, H. TORP‡ and S. H. EIK-NES*
*National Center for Fetal Medicine, St Olav's Hospital, Trondheim University Hospital, †Department of Obstetrics & Gynecology, Hyvinkää Hospital, Hyvinkää, Finland and ‡Department of Physiology and Biomedical Engineering, University of Trondheim, Norway

3D approach and volumetry LIMITS

- 2D image optimization
- Fetal/maternal/probe movements
- Embryo size/gestational age
- Volumetry: interindividual variability of the manual assessment of body contour

Ultrasound Obstet Gynecol 2001; 18: 471–480

Comparison between two- and three-dimensional ultrasound measurements of nuchal translucency

G. CLEMENTSCHITSCH, G. HASENÖHRL, H. SCHÄFFER and H. STEINER
Department of Obstetrics and Gynecology, Prenatal Diagnosis and Therapy Unit, St. Johannespital Salzburg, Salzburg, Austria

Fetal movements →
**2D gain**

Fetal position →
**3D gain**

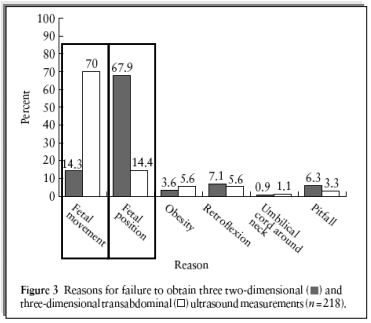
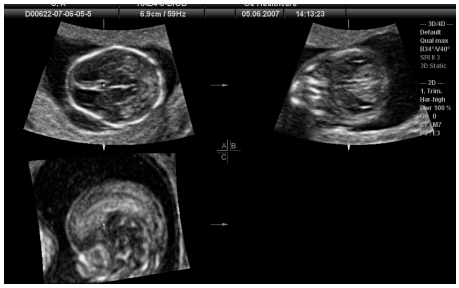



Figure 3 Reasons for failure to obtain three two-dimensional (■) and three-dimensional transabdominal (□) ultrasound measurements ($n = 218$).

## I trimester - CRL

8+1 weeks

## I trimester - BPD




## I trimester

## VOLUMETRY

Ultrasound Obstet Gynecol 2006; 27: 640–646
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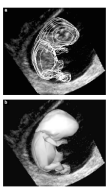
Total embryo-fetal body volume estimation



I trimester

VOLUMETRY

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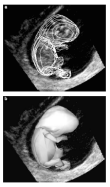
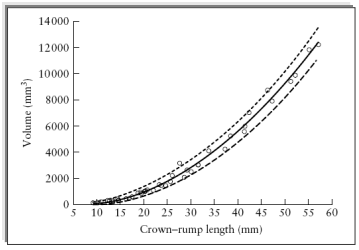
Total embryo-fetal body volume estimation






Riproducibility:

% Error - 0.12 (-8.9 - 17.1)

I trimester

VOLUMETRY

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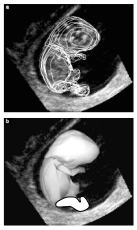
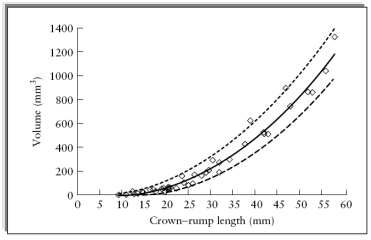
Inferior limbs volumetry






I trimester

VOLUMETRY

Correlation between total embryo-fetal body volume tra volume corporeo totale and CRL

ELSEVIER
Early Human Development
Early Human Development 80 (2004) 1–5
www.elsevier.com/locate/earlhumdev

Three-dimensional first trimester fetal volumetry: comparison with crown rump length

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[b]Department of Obstetrics and Gynecology, Sapir Medical Center, Kfar Saba 44281, Israel
[c]Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

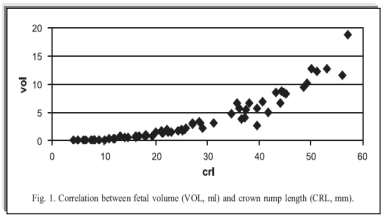


Fig. 1. Correlation between fetal volume (VOL, ml) and crown rump length (CRL, mm).

Ultrasound Obstet Gynecol 2005; 26: 517–520
Published online 5 September 2005 in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/uog.1990

Fetal trunk and head volume in chromosomally abnormal fetuses at 11 + 0 to 13 + 6 weeks of gestation

O. FALCON, C. F. A. PERALTA, P. CAVORETTO, M. AUER and K. H. NICOLAIDES
*Harris Birthright Research Centre for Fetal Medicine, King's College Hospital Medical School, London, UK*

- Trisomy 21 e Monosomy X
  → CRL ≈ normal
  → head and trunk volume <10-15% (p<0.004)
- Trisomy 18, Trisomy 13 e Triploidies
  → CRL <15% (p<0.001)
  → head and trunk volume <45% (p<0.001)

"In the quantification of the degree of early growth impairment in chromosomally abnormal fetuses, measurement of the fetal trunk and head volume using 3D ultrasound may be better than measurement of CRL."

## Embryo-fetal volume acquisition:

-To store volumes to be re-evaluated either for biometric and anatomic study

-To measure traditional biometry off-line

-To improve accuracy and reproducibility of traditional biometric measurements, either by using anatomical multiplanar reference points and using axial rotation in the presence of sub-optimal fetal position