



## Complete Summary

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### GUIDELINE TITLE

Ultrasound scanning during pregnancy.

### BIBLIOGRAPHIC SOURCE(S)

Finnish Medical Society Duodecim. Ultrasound scanning during pregnancy. In: EBM Guidelines. Evidence-Based Medicine [Internet]. Helsinki, Finland: Wiley Interscience. John Wiley & Sons; 2008 Feb 15 [Various]. [17 references]

### GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Yla-Outinen A. Ultrasound scanning during pregnancy. In: EBM Guidelines. Evidence-Based Medicine [CD-ROM]. Helsinki, Finland: Duodecim Medical Publications Ltd.; 2004 Apr 19 [various]. [27 references]

## COMPLETE SUMMARY CONTENT

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## SCOPE

### DISEASE/CONDITION(S)

- Pregnancy
- Post-term pregnancy
- High-risk pregnancy, including multifetal pregnancy
- Fetal abnormalities

### GUIDELINE CATEGORY

Diagnosis  
Evaluation

Prevention  
Screening

### **CLINICAL SPECIALTY**

Family Practice  
Internal Medicine  
Obstetrics and Gynecology

### **INTENDED USERS**

Health Care Providers  
Physicians

### **GUIDELINE OBJECTIVE(S)**

Evidence-Based Medicine Guidelines collects, summarizes, and updates the core clinical knowledge essential in general practice. The guidelines also describe the scientific evidence underlying the given recommendations.

### **TARGET POPULATION**

Pregnant women

### **INTERVENTIONS AND PRACTICES CONSIDERED**

Ultrasound during routine and high-risk pregnancies

### **MAJOR OUTCOMES CONSIDERED**

- Number of perinatal deaths
- Admissions to hospital
- Incidence of post-term pregnancy
- Need for induction of labor

## **METHODOLOGY**

### **METHODS USED TO COLLECT/SELECT EVIDENCE**

Hand-searches of Published Literature (Primary Sources)  
Hand-searches of Published Literature (Secondary Sources)  
Searches of Electronic Databases

### **DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE**

The evidence reviewed was collected from the Cochrane database of systematic reviews and the Database of Abstracts of Reviews of Effectiveness (DARE). In addition, the Cochrane Library and medical journals were searched specifically for original publications.

## NUMBER OF SOURCE DOCUMENTS

Not stated

## METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

## RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

### Classification of the Quality of Evidence

Code	Quality of Evidence	Definition
<b>A</b>	<b>High</b>	Further research is very unlikely to change our confidence in the estimate of effect. <ul style="list-style-type: none"><li>• Several high-quality studies with consistent results</li><li>• In special cases: one large, high-quality multi-centre trial</li></ul>
<b>B</b>	<b>Moderate</b>	Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate. <ul style="list-style-type: none"><li>• One high-quality study</li><li>• Several studies with some limitations</li></ul>
<b>C</b>	<b>Low</b>	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate. <ul style="list-style-type: none"><li>• One or more studies with severe limitations</li></ul>
<b>D</b>	<b>Very Low</b>	Any estimate of effect is very uncertain. <ul style="list-style-type: none"><li>• Expert opinion</li><li>• No direct research evidence</li><li>• One or more studies with very severe limitations</li></ul>

GRADE (Grading of Recommendations Assessment, Development and Evaluation) Working Group 2007 (modified by the EBM Guidelines Editorial Team).

## METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review

## **DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE**

Not stated

## **METHODS USED TO FORMULATE THE RECOMMENDATIONS**

Not stated

## **RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS**

Not applicable

## **COST ANALYSIS**

A formal cost analysis was not performed and published cost analyses were not reviewed.

## **METHOD OF GUIDELINE VALIDATION**

Peer Review

## **DESCRIPTION OF METHOD OF GUIDELINE VALIDATION**

Not stated

# **RECOMMENDATIONS**

## **MAJOR RECOMMENDATIONS**

The levels of evidence [A-D] supporting the recommendations are defined at the end of the "Major Recommendations" field.

### **Basic Rules**

- Training under a specialist is essential (exceptions: foetal pulse on weeks 7 to 9 of pregnancy and presentation in late pregnancy).
- Do not hesitate to consult a specialist.

### **Aims**

- Expected date of confinement (EDC) (the most important and easiest to carry out)
- Number of foetuses
- Position of the placenta
- Foetal structures, morphology
- Presentation, when needed (easy to carry out)
- Growth if deviation is suspected
- The time of the first routine scan is agreed upon locally and depends on the mode of trisomy screening.

- The current national recommendation in Finland is that all pregnant women are offered an ultrasound scan in the early pregnancy (week 11 or 12) to establish the duration of pregnancy and the number of foetuses and to reveal major foetal abnormalities. If the mother so wishes, also measurement of nuchal translucency and determination of blood human chorionic gonadotropin (hCG) and pregnancy-associated plasma protein-A (PAPP-A) concentrations are included to assess the risk of trisomy. In addition, a mid-pregnancy ultrasound scan is offered for systematic investigation of foetal morphology around the 20th week of pregnancy.

## **Recognizing Pregnancy**

### **Amniotic Sac**

- An intrauterine amniotic sac can be identified on the 5th week of pregnancy (WOP) with a transvaginal scan (TVS). The sac is visualized as a round clear area in the uterine cavity.
- With a transabdominal scan (TAS) the amniotic sac usually becomes discernible between the 7th and 9th WOP, depending on the thickness of mother's abdominal wall and the position of the uterus.
- In practice, visualization of an intrauterine amniotic sac rules out the possibility of an extrauterine pregnancy.

### **The Embryo**

- First seen as a small dense echo within the amniotic sac.
- The foetal heart beat can be detected as a barely visible flutter already when the foetus is only a few millimeters long.
- The yolk sac is seen as a separate ring-like structure in the amniotic sac.

### **Multifoetal Pregnancies**

- A twin pregnancy can be determined in early pregnancy. One embryo can, however, be aborted, which manifests as bleeding in early pregnancy.
- The twins are usually dizygotic if the placental tissue penetrates between the layers of the placental insertion of the separating membrane ("twin peak" or lambda sign). If the thickness of the separating membrane is less than 2 mm, the twins are likely to be monozygotic. It may sometimes be possible to count the number of layers of the separating membrane (two in monozygotic and four in dizygotic twins).

### **Corpus Luteum Cyst**

On WOP 7 to 11, a separate unilocular clear, thin, walled cyst measuring 2 to 4 cm is often seen beside the uterus. This vanishes later on and needs no intervention.

### **Estimation of the Expected Date of Confinement**

- Ultrasound scan before 20 WOP is the most reliable method for determining EDC.
- Accuracy is best on 10 to 12 WOP  $\pm 3$  to 4 days, at other times  $\pm 7$  days. If the time determined by ultrasound differs from that determined from menstruation by more than one week, EDC should be corrected.
- The crown-rump-length (CRL) is used to estimate gestational age before 13 WOP (Daya, 1993).
- After 11 WOP biparietal diameter (BPD) or the length of the diaphysis of the femur (femur length) or both are used.
- The gestational age corresponding to the obtained measures is given in tables that are programmed into many ultrasound devices. Such devices give both the gestational age and EDC automatically.

### **Foetal Structures (Morphology)**

- The structures are systematically examined on the mid-pregnancy ultrasound scan.

#### **1. The Head and Spinal Canal**

- In the transverse plane the foetal skull is seen as an ellipsoid structure with a symmetric mid-echo. BPD is measured in this plane. If a good BPD cannot be achieved, anencephaly should be suspected.
- Normally, symmetrical dense echoes, choroid plexuses, are seen on both sides of the mid-echo. In some cases, a choroid plexus cyst may be identified: these are virtually harmless. If the echoes are asymmetrical or nonhomogeneous and the duration of gestation counted from menstruation and femur length differs clearly from that estimated from BPD, further investigations are warranted.
- In the area of the posterior cranial fossa, the peanut-shaped cerebellum is visualized. The transverse diameter of the cerebellum in millimetres usually corresponds to the duration of the pregnancy in weeks. The hypoechoic area between the cerebellum and the occipital bone, the cisterna magna, is visualized as well. A neural tube defect is strongly suggested if the cerebellum is visualized as banana-shaped ("banana-sign"), often accompanied by the flattening of the frontal bones towards the midline of the skull ("lemon-sign").
- In the sagittal plane, a possible encephalocele can be visualized. The sagittal profile of the foetal face is also observed: a flat profile may suggest trisomy.
- The coronal view of the foetal face should normally be symmetrical. The nasal region and the upper lip are examined to exclude cleft lip.
- The spinal canal forms a zip-like structure. A clear defect in it suggests spina bifida or meningocele or both.
- The neck region is examined for possible cysts and nuchal translucency (NT). Every fourth foetus with abnormal nuchal translucency seen (on weeks 11 to 13) in subcutaneous tissue has a chromosomal deviation (most commonly trisomy, with 21 trisomy causing Down's syndrome being the most frequent finding) (Taipale et al., 1997). Nuchal translucency screening allows detection in up to 60 to 80% of foetuses with Down's syndrome (see the Finnish Medical Society Duodecim guideline "Down's Syndrome"). When the measurement of nuchal translucency is combined with hCG and PAPP-

A assays of maternal serum, the assessment of the trisomy risk is considerably more sensitive and specific.

### *Nuchal Translucency (NT)*

- The scan is most reliable when the foetal CRL is between 45 and 85 mm (gestational age 11 to 13 weeks). The upper limit for nuchal translucency still considered normal is 2 mm for the CRL of 45 mm and 3 mm for the CRL of 85 mm. However, the average cut-off point of 2.5 mm is widely used. The higher the NT, the greater is the risk for an abnormal karyotype.
- NT is always measured from the inner edge of the skin to the outer edge of the underlying tissue (i.e., the shortest possible distance. The best possible side profile and image magnification should be used).
- Strongly deflected foetal head can give a false positive finding. A loose amniotic membrane at the dorsal side of the fetus can also be a source for misinterpretation.
- Foetal nasal bone may also be visualized during the same scan. If this can be seen, the risk for a trisomy 21 is very low.

### **2. The Outline of the Foetal Body**

- Any abnormality on the dorsal side is usually seen upon inspection of the spinal canal.
- In the ventral outline, attention should be paid to the insertion of the umbilical cord for possible omphalocele or gastroschisis in the abdominal wall.
- A greater magnification is used to look for sacral teratoma.
- Foetal body movement should be noted.

### **3. The Thorax and Heart**

- In the transverse plane of the thorax the normal heart gives a four chambered view. The synchronized function of the atria, ventricles and valves should be noted. The heart is located near the midline, one third on the right side and two thirds on the left side of the vertebro-sternal axis. It takes up about one third of the cross-sectional area of the thoracic cavity.
- The ventricles and the atriae are of equal size on both sides. The interventricular septum is visualized intact and its line (the axis of the heart) is at an angle of about 45 degrees with the vertebro-sternal axis. There is a physiological defect, foramen ovale, in the interatrial septum with a membrane bulging slightly towards the left atrium.
- The origins and the normal crossing of the great vessels (i.e., aorta and pulmonary artery) are seen slightly cranially from the four-chamber view. A great deal of structural abnormalities of the heart may be excluded if the four-chamber view and the crossing of the vessels are normal.
- Small echo-dense spots (golf balls) in the area of the papillary muscles suggest a slightly increased risk of trisomy.
- The pulmonary tissue is homogenous in echodensity.
- The points of departure of the great vessels are difficult to distinguish before 20th WOP.

#### 4. The Abdominal Cavity

- The ventricle forms an echo-free, bean-shaped structure beneath the diaphragm, and this finding also indicates a patent oesophagus. An extra accumulation of fluid beside the ventricle ("double-bubble") suggests duodenal stenosis.
- Liver and kidneys are not easy to identify before 20 WOP. A fluid-filled bladder at the caudal end of the cavity indicates normal function of at least one kidney and ureter. If the bladder cannot be visualized but the amount of amniotic fluid is normal, control the finding. The foetus empties its bladder every 15 to 20 minutes.
- Fluid accumulation in the abdomen, other than the ventricle and bladder, indicate further investigation (e.g., if a fluid accumulation visualized beside the urinary bladder in a female foetus may be an ovarian cyst, which is usually harmless).
- Echo-dense intestines and/or mild pyelectasia suggest increased risk of trisomy.

#### 5. The Extremities

- In addition to biparietal length, the length of the femur is an important measure when determining gestational age on weeks 15 to 19 of pregnancy. A considerable discrepancy between these measures warrants further investigations.
- The outline of the limbs, hands and feet, and the position of the wrists and ankles should be noted.
- Foetal body movement should be noted.

#### 6. The Placenta, Umbilical Cord, and Amniotic Fluid

- A low-lying placenta is a common finding in early and mid-pregnancy. The position of the placenta needs to be determined on weeks 25 to 27. However, as the isthmic portion of the uterus usually grows more than the other parts, the placenta seems to "migrate" upwards.
- The identification of the lower end of the placenta is easier with full maternal bladder (Zelop et al., 1994).
- A back-wall placenta is seen better with transvaginal ultrasound.
- In early pregnancy the amniotic fluid is formed by the amniotic membranes, and the foetus can move freely in ample fluid.
- In mid- and late pregnancy the fluid results from foetal metabolism, predominantly urine. Severe oligohydramnios in mid-pregnancy, irrespective of the aetiology, is associated with poor prognosis due to the fact that a sufficient amount of amniotic fluid is essential for foetal pulmonary maturation.
- The amount of amniotic fluid is considered to be normal when the diameter of the deepest pocket measures 3 to 8 cm. Amniotic fluid index (AFI) is considered a more extensive measure of the amount of amniotic fluid. In this investigation, the amniotic cavity is divided into four equal-sized blocks, and the deepest pocket in each block is measured. AFI is the sum of these measures. On the second and third trimesters, AFI between 8 and 24 is regarded normal (Chamberlain et al., 1984).
- An abnormal amount of amniotic fluid is an indication for further investigations.

- In a cross-section of a normal umbilical cord, three vessels can be seen. A single umbilical artery can be associated with other vascular (or urinary) anomalies and warrants careful examination of foetal structures (Lilja, unpublished).

## 7. The Cervix

- In early and midpregnancy, the cervix is quite easy to see if the maternal bladder is full. If the length of the cervical canal is less than 30 mm or the proximal part is dilated, cervical incompetence should be suspected (Iams et al., 1996).

## 8. Gender

- There are very few clinical indications for identifying foetal sex.
- Labia suggest a female foetus and echo-dense testes that have descended to the scrotum and penis suggest a male. Umbilical cord between the legs easily causes false interpretations of gender.

## Ultrasound Markers for Trisomy in Mid-pregnancy

- As a single finding, the following markers (listed below) increase the risk for trisomy only slightly. However, if two or more markers are present in one foetus, foetal karyotyping should be considered (Snijders, Shawa, & Nicolaides, 1994).
  - Plexus choroideus cysts
  - Flat profile
  - Echodense dots in the papillary muscles of the foetal heart ("golf-balls")
  - Echodense intestine
  - Mild hydronephrosis
  - Growth retardation
  - Short femur
  - Umbilical cord cysts

## Foetal Growth

- On the latter half of pregnancy, the growth and development are followed up in addition to foetal structures.
- Routine ultrasound screening in late pregnancy is not necessary in low-risk pregnancies or without a clear target (Bricker & Neilson, 2007) [**B**].
- Rapidly growing BPD may suggest hydrocephalus and slowly growing microcephaly or some other central nervous system (CNS) disease.
- Retarded growth of the foetal abdominal circumference with normally growing BPD is often a sign of impaired function of the placenta. Excessive growth of the body may suggest foetal hydrops.
- Retarded growth of the limbs warrants further investigations.

## Estimation of Weight

- Measurement of abdominal circumference is the most important parameter for weight estimation. This should be measured as symmetrically as possible from the plane of the foetal liver, sinum umbilicalis, and ventricle. Several

measurements should be made, and the average should be used in the final estimation (Hadlock et al., 1984).

- Many programs give an estimate automatically on the basis of abdominal circumference and BPD.
- In the beginning of the third trimester, BPD correlates well with foetal weight; however, towards the end, and especially if foetal gigantism is suspected, femur length is a more accurate measure.
- In a large-sized foetus, small BPD and great abdominal circumference indicate an increased risk of getting stuck at the shoulders at birth.
- Before week 30, a weight estimate has little significance.

### **Presentation**

- After the 35th WOP anything other than a cephalic presentation is an indication for an obstetric consultation.

### **Post-term Pregnancy**

- Decreasing amniotic fluid volume is considered to correlate better with deteriorating placental function than structural changes (calcification and lobularity) in the placenta (Crowley, O'Herlihy, & Boylan, 1984).

### **Doppler Ultrasound of the Umbilical Artery**

There is some evidence that Doppler ultrasound of the umbilical artery may reduce perinatal deaths in risk pregnancies (Goffinet et al., 1997) [**A**].

### **Related Resources**

Refer to the original guideline document for related evidence, including Cochrane reviews and other evidence summaries.

### **Definitions:**

### **Classification of the Quality of Evidence**

<b>Code</b>	<b>Quality of Evidence</b>	<b>Definition</b>
<b>A</b>	<b>High</b>	<p>Further research is very unlikely to change our confidence in the estimate of effect.</p> <ul style="list-style-type: none"> <li>• Several high-quality studies with consistent results</li> <li>• In special cases: one large, high-quality multi-centre trial</li> </ul>
<b>B</b>	<b>Moderate</b>	<p>Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate.</p>

Code	Quality of Evidence	Definition
		<ul style="list-style-type: none"> <li>• One high-quality study</li> <li>• Several studies with some limitations</li> </ul>
<b>C</b>	<b>Low</b>	<p>Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.</p> <ul style="list-style-type: none"> <li>• One or more studies with severe limitations</li> </ul>
<b>D</b>	<b>Very Low</b>	<p>Any estimate of effect is very uncertain.</p> <ul style="list-style-type: none"> <li>• Expert opinion</li> <li>• No direct research evidence</li> <li>• One or more studies with very severe limitations</li> </ul>

GRADE (Grading of Recommendations Assessment, Development and Evaluation) Working Group 2007 (modified by the EBM Guidelines Editorial Team).

### CLINICAL ALGORITHM(S)

None provided

## EVIDENCE SUPPORTING THE RECOMMENDATIONS

### REFERENCES SUPPORTING THE RECOMMENDATIONS

[References open in a new window](#)

### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

Concise summaries of scientific evidence attached to the individual guidelines are the unique feature of the Evidence-Based Medicine Guidelines. The evidence summaries allow the clinician to judge how well-founded the treatment recommendations are. The type of supporting evidence is identified and graded for select recommendations (see the "Major Recommendations" field).

## BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

### POTENTIAL BENEFITS

- Appropriate use of Doppler ultrasound scanning during pregnancy to establish the duration of pregnancy, number of fetuses, and to reveal major fetal abnormalities.

- There is some evidence that Doppler ultrasound of the umbilical artery may reduce perinatal deaths in high-risk pregnancies.

#### **POTENTIAL HARMS**

Not stated

### **IMPLEMENTATION OF THE GUIDELINE**

#### **DESCRIPTION OF IMPLEMENTATION STRATEGY**

An implementation strategy was not provided.

### **INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES**

#### **IOM CARE NEED**

Staying Healthy

#### **IOM DOMAIN**

Effectiveness

### **IDENTIFYING INFORMATION AND AVAILABILITY**

#### **BIBLIOGRAPHIC SOURCE(S)**

Finnish Medical Society Duodecim. Ultrasound scanning during pregnancy. In: EBM Guidelines. Evidence-Based Medicine [Internet]. Helsinki, Finland: Wiley Interscience. John Wiley & Sons; 2008 Feb 15 [Various]. [17 references]

#### **ADAPTATION**

Not applicable: The guideline was not adapted from another source.

#### **DATE RELEASED**

2000 Apr 3 (revised 2008 Feb 15)

#### **GUIDELINE DEVELOPER(S)**

Finnish Medical Society Duodecim - Professional Association

#### **SOURCE(S) OF FUNDING**

Finnish Medical Society Duodecim

## **GUIDELINE COMMITTEE**

Editorial Team of EBM Guidelines

## **COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE**

*Primary Author:* Ari Ylä-Outinen

## **FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST**

Not stated

## **GUIDELINE STATUS**

This is the current release of the guideline.

This guideline updates a previous version: Ylä-Outinen A. Ultrasound scanning during pregnancy. In: EBM Guidelines. Evidence-Based Medicine [CD-ROM]. Helsinki, Finland: Duodecim Medical Publications Ltd.; 2004 Apr 19 [various]. [27 references]

## **GUIDELINE AVAILABILITY**

This guideline is included in a CD-ROM titled "EBM Guidelines. Evidence-Based Medicine" available from Duodecim Medical Publications, Ltd, PO Box 713, 00101 Helsinki, Finland; e-mail: [info@ebm-guidelines.com](mailto:info@ebm-guidelines.com); Web site: [www.ebm-guidelines.com](http://www.ebm-guidelines.com).

## **AVAILABILITY OF COMPANION DOCUMENTS**

None available

## **PATIENT RESOURCES**

None available

## **NGC STATUS**

This summary was completed by ECRI on August 28, 2001. The information was verified by the guideline developer as of October 26, 2001. This NGC summary was updated by ECRI Institute on December 29, 2003, October 5, 2004, and December 23, 2008.

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