Guidelines for the performance of the first trimester ultrasound

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Abstract

The purpose of this document is to guide ultrasound practitioners in providing accurate information on the assessment of gestational age, viability and fetal development in the first trimester. In the presence of twins and higher order multiple pregnancies, it is also intended to assess chorionicity and amnionicity which have implications for risk assessment and continuing antenatal care. This guideline has been adopted by the ASUM Council and is applicable to all ultrasound practitioners.

Keywords: ultrasound, standards, first trimester, safety, guidelines.

1. Introduction

The Australasian Society for Ultrasound in Medicine (ASUM) is a multidisciplinary society whose mission is to advance the clinical practice of diagnostic medical ultrasound for the highest standards of patient care. These guidelines were established to help guide standards of care for the performance of the ultrasound procedure offered during the first trimester of pregnancy and have been endorsed by the ASUM Council. The purpose of a first trimester ultrasound is to confirm viability, establish the number of viable fetuses and accurate gestational age, plus if requested, and to evaluate fetal gross anatomy and the risk of aneuploidy.

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2. Pre-performance of ultrasound

2.1 Requirement

Studies should be performed using an abdominal and/or vaginal approach.

A vaginal transducer should always be available. A transvaginal scan should be offered to the patient when it is anticipated that this would result in a more diagnostic study. The patient may choose to accept or refuse this offer.

Reference should be made to either or both ASUM Statement on Abdominal Scanning and ASUM Statement on the Performance of a Gynaecological Scan regarding the facilities and preparation for such an examination.

2.2 Patient history

Estimate gestation based on last menstrual period or time of conception. Document symptoms and, if possible, the result and date of any pregnancy test – human chorionic gonadotrophin (hCG). In women undergoing assisted reproduction, the date of oocyte retrieval, age of the blastocyst and whether the conception is the result of a fresh or frozen cycle will influence the estimation of gestational age.

2.3 Patient consent

If performing transvaginal scan, local recommendations/policy on the consent process of the transvaginal scan should be adhered to.

Note (for Australian practitioners):

In WA, transvaginal scan is an invasive imaging procedure which requires written consent.

For Australian practitioners who have to comply with DIAS, please note DIAS Standard 2.2, *Consumer Consent and Information Standard* (Table 1).

3. Equipment

3.1 Requirement

A high-frequency transducer should be used. The equipment should be operated with the lowest ultrasonic exposure settings capable of providing the necessary diagnostic information.

All ultrasound transducers should be disinfected as per the Guidelines for Reprocessing Ultrasound Transducers.[1]

Table 1: Abbreviations and Definitions

Term	Definition
BPD	Biparietal diameter
CRL	Crown rump length
DIAS	Diagnostic Imaging Accreditation Scheme
EDC	Estimated date of confinement
EDD	Estimated date of delivery
GA	Gestational age
hCG	Human chorionic gonadotrophin
IVF	*In-vitro* fertilisation
LMP	Last menstrual period
MSD	Mean sac diameter
PUL	Pregnancy of unknown location
First trimester	A stage of pregnancy starting from the time at which viability can be confirmed with presence of a gestational sac in the uterine cavity with an embryo demonstrating cardiac activity, up to 13 + 6 weeks of gestation[2]

4. The examination

4.1 Gestational sac

The gestational sac should usually be visible from four (4) weeks and three (3) days after the last menstrual period (assuming the dates are correct, and the woman has a regular menstrual cycle and normal body mass index), using high-frequency transvaginal ultrasound (TVS). In women who have undergone assisted reproductive techniques, a gestational age should be calculated based on the ovulation, oocyte retrieval dates or embryo transfer dates.

One should make a clear distinction between a true gestational sac and intra-cavity fluid. A true gestational sac is eccentrically placed within the endometrial cavity and surrounded by an 'echogenic ring' on TVS. Intra-cavitary fluid, previously called a 'pseudo-gestational sac', is in the midline of the endometrial cavity, displacing the anterior and posterior surfaces of the endometrial cavity.

If a gestational sac is not visible in the uterus of a woman believed to be pregnant, the adnexal regions should be carefully examined looking for evidence suggesting the presence of an ectopic pregnancy. Most ectopic pregnancies can be visualised with high-frequency TVS assuming the practitioner is experienced.

The clinical scenario in which there is a positive pregnant test and in which there are no signs of intra- or extra-uterine pregnancy and where there are no obvious retained products of conception on TVS, is defined as a pregnancy of unknown location (PUL). Under these circumstances, there are three possibilities:

1 intra-uterine pregnancy;
2 ectopic pregnancy or
3 failed PUL.

When interpreting the scan result of a woman with a PUL, there is no evidence to suggest that a single level of quantitative serum human chorionic gonadotrophin (hCG) is helpful. Rather it is the change in hCG over time which is of value. Therefore, serial estimations are recommended.

Atypical location of the gestational sac within the endometrial cavity should be noted and reported. This is particularly important for low positioned gestational sac, adjacent to or bulging into a Caesarean section scar.

4.2 Fetal number

The diagnosis of a multiple pregnancy requires the visualisation of multiple sacs prior to six (6) weeks and subsequent visualisation of multiple embryos.

The first trimester is the optimum time to determine chorionicity of the fetuses. The chorionicity of the fetuses should be stated in the report. The presence of separate sacs and the thickness of the intervening membrane and the shape of its junction with the placenta should be assessed. Be aware that early in the first trimester an intervening amnion may not be visible in monochorionic diamniotic twins. A transvaginal ultrasound scan should be offered to help determine amnionicity when monoamnionicity is suspected on a trans-abdominal scan. Later, in the first trimester, the number of placentas can be evaluated.

4.3 Fetal heart movements

With a high-resolution vaginal transducer, fetal heart movements are often visible from five to six (5–6) weeks (i.e. crown-rump length (CRL) = 2 mm), but may not be seen until CRL = 6–7 mm (refer to 4.5 Pregnancy failure).

4.4 Gestational age

This is most accurately assessed by measurement of the CRL in the first trimester.

Before an embryo is visible, the mean sac diameter (MSD) can support gestational age by LMP but it should not be used as the sole determinant of due date.

Once an embryo is visible, the CRL can be used to calculate the due date and the MSD should not be included in this calculation. After eleven (11) weeks, multiparametric assessment can be used with biparietal diameter (BPD) being the most often used second measurement.

The EDD by LMP (adjusted for cycle length) should be used unless:

1 The LMP is unknown;
2 The GA by CRL is <10 weeks and differs from GA by LMP by more than five (5) days or
3 The GA by CRL (± BPD) is ten to fourteen (10–14) weeks and differs from GA by LMP by more than seven (7) days.

EDD by assisted reproduction dates (e.g. IVF) should only be adjusted with extreme caution.

In the presence of twins, the CRL for the larger twin is used in assessing the EDC.

For measurement criteria for a CRL, see RANZCOG-FMF Protocols.[2]

4.5 Pregnancy failure

At initial or follow-up scan, an experienced practitioner using high-quality transvaginal equipment may diagnose pregnancy failure under either of the following circumstances:

1 when the MSD is ≥25 mm with no visible fetal pole; or
2 when there is a visible fetal pole with CRL ≥7 mm but no fetal heart movements can be demonstrated. The area of the fetal heart should be observed for a prolonged period of at least thirty (30) seconds to ensure that there is no cardiac activity.

If no live embryo is demonstrated but the above criteria are not met, then the following criteria can be used to diagnose pregnancy failure by follow-up imaging:

1 if the initial scan showed a fetal pole <7 mm with no fetal heart beat and a repeat scan in seven (7) or more days also shows no cardiac activity;
2 if the initial scan showed a MSD ≥12 mm with no embryo and a repeat scan in seven (7) or more days does not show an embryo with cardiac activity or
3 if the initial scan showed a MSD <12 mm with no embryo and a repeat scan in fourteen (14) or more days shows no visible cardiac activity and the MSD has not doubled.

If there is any doubt as to the diagnosis of a miscarriage, a further scan should be offered.[3]

In situations where pregnancy failure is suspected by a practitioner who either does not have extensive experience in making the diagnosis or does not have access to high-quality equipment or if there is any doubt about the viability of the fetus, a second opinion or a review scan in one (1) week should be recommended in the report.[4]

4.6 Fetal structure

The following list of gestational ages at which various fetal structures may be visualised is not intended to provide a complete list of what should be examined. However, using high-resolution equipment, the following structures can commonly be seen:

9 weeks	Head, trunk and limbs
10 weeks	Some ossification of long bones, jaw and skull
11 weeks	Stomach, spine, ossified cranium, four chamber heart, hands and feet
12 weeks	Kidneys, bladder
13 weeks	Mid-gut herniation resolution

4.7 Nuchal translucency

The nuchal translucency measurement is a test to assess the risk of chromosomal abnormality, in particular of trisomy 21. The measurement may also be abnormal in other fetal anomalies (e.g. some congenital heart disease). It has been estimated that first trimester screening by a combination of sonography and material serum testing of PAPP-A and free βhCG can potentially identify 94% of trisomy 21 fetuses with a false-positive rate of 5%.[5]

This study should be performed by adequately trained staff according to strict protocol. The outcomes of the test should be audited regularly. The recommendations of the Fetal Medicine Foundation/Royal Australian and New Zealand College of Obstetricians and Gynaecologists should be noted.[2]

The nuchal translucency should be measured in accordance with the Fetal Medicine Foundation guidelines.[2]

It may be performed between the gestational ages of eleven (11) weeks and thirteen (13) weeks plus six (6) days (CRL 45–84 mm). A nuchal translucency measurement of greater than 3–3.5 mm is usually considered to be abnormal but must be correlated with gestational age. Reference values have been provided by Fetal Medicine Foundation First Trimester Screening Group.[6]

The nuchal translucency measurement may be performed at the request of the referring health practitioner. Due consideration should be given as to how and who is going to counsel the patient prior to the performance of a nuchal translucency scan.

Each practice should develop a written protocol on the procedure to be followed when the measurement is abnormal. This protocol should include guidelines for the immediate care of the patient and how the referring health practitioner will be informed. Usually, the referring health practitioner should be notified so that appropriate counselling may be given. The patient can be referred to a specialised unit where formal risk assessment and counselling process can be undertaken.

4.8 Uterus, ovaries and adnexa

Each ovary should be examined. The corpus luteum can vary greatly in appearance during the first (and early second) trimesters of pregnancy. Sonographic appearances include a solid, rounded target-like lesion or a predominately cystic structure. Peripheral vascularity is usually detectable.

The size of a corpus luteum is also variable, commonly measuring up to 3 cm.

Larger or unusual masses should be assessed as in the non-pregnant woman.

The uterus should be examined for evidence of a fibroids or uterine developmental defects. The uterine position should also be noted (anteverted, axial, retroverted). The cervical length may be assessed in certain high-risk women although at this early gestation, it may not be predictive of outcome. In addition, the uterine landmarks are difficult to delineate at an early gestation which reduces the accuracy. It is recommended that the cervical length measurement is deferred until at least 14 weeks gestation where possible.

The adnexa should be examined for coexistent ectopic pregnancy and free fluid.

5. Reports

As a minimum, the following details should be included in the report:

1 The clinical gestational age based on LMP or IVF procedure.
2 Embryonic or fetal size and number with corresponding gestational age.
3 Presence of fetal heart motion.
4 In the presence of twins or higher order multiples, an assessment of chorionicity and amnionicity.

6. Conclusion

These guidelines set out procedures for ultrasound practitioners to conduct a first trimester ultrasound; from 5 to 14 weeks of a pregnancy. They should be followed in conjunction with the ASUM's Statement on Normal Ultrasonic Fetal Measurements, Guidelines for Abdominal Scanning, Statement on the Performance of a Gynaecological Scan, and Guidelines for Reprocessing Ultrasound Transducers.

Disclaimer

The ASUM Standards of Practice Board have made every effort to ensure that these guidelines are accurate and reflect best practice at the time at which they are issued. The information provided in this document is of a general nature only and is not intended as a substitute for medical or legal advice. The Society, employees and members do not accept any liability for the consequences of any inaccurate or misleading data/opinions or statements issued by ASUM.

Authorship declaration

We acknowledge that (i) the authorship conforms with the journal's authorship policy and (ii) all authors are in agreement with the content of the submitted manuscript.

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References

1 Basseal JM, Westerway SC, Juraja M, van de Mortel T, McAuley TE, Rippey J, et al. Guidelines for reprocessing ultrasound transducers. *Australas J Ultrasound Med* 2017; 20: 30–40.
2 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), the Fetal Medicine Foundation (FMF). *Protocols for Measuring the Nuchal Translucency*. Retrieved from https://www.nuchaltrans.edu.au/Documents/Protocols-for-measuring-the-NT
3 Priesler J, Kopeika J, Ismail L, Vathanan L, Farren J, Abdallah Y, *et al.* Defining safe criteria to diagnose miscarriage: prospective observational multicentre study. *BMJ* 2015; 351: h4579.
4 Hately W, Case J, Campbell S. Establishing the death of an embryo by ultrasound. *Ultrasound Obstet Gynecol* 1995; 5: 353–7.
5 Nicolaides KH. Nuchal translucency and other first-trimester sonographic markers of chromosomal abnormalities. *Am J Obstet Gynecol* 2004; 191: 45–67.
6 Snijders RJM, Noble P, Sebire N, Souka A, Nicolaides KH; for the Fetal Medicine Foundation First Trimester Screening Group. UK multicentre project on assessment of risk of trisomy 21 by maternal age and fetal nuchal-translucency thickness at 10–14 weeks of gestation. *Lancet* 1998; 352: 343–6.