Dating Ultrasounds are Fundamental to Modern Obstetric Care

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Abstract

Aims
Dating ultrasounds for all women remains a goal of the National Maternity Strategy. We sought to examine the utility of guideline based first trimester scanning when performed in a tertiary maternity unit.

Methods
A retrospective review of all public dating ultrasound scans was preformed over a one year period.

Results
6,077 scans were reviewed. Viability was confirmed in 97.9% (n=5953), 1.5% (n=94) were deemed non-viable, and 0.48% (n=29) required follow up for uncertain viability. There were 97.9% (n=5,951) singleton pregnancies, 1.8% (n=112) multiple pregnancies, and 0.2% (n=14) with an absent fetal pole. Of those attending for a first dating ultrasound, 81.7% (n=4,966) were between 10 and 13+6 weeks. 16% (n=977) of women relied on dating scans rather than last menstrual period (LMP) to estimate gestational age. Overall, the mean difference between ultrasound scan and recalled menstrual dates was 3.9 gestational days. Other findings of significance included 0.4% (n=25) pregnancies with fetal anomalies diagnosed and 1.2% (n=78) of women were reported as having uterine anomalies.

Conclusion
Dating ultrasound confirms viability, pregnancy number and due date. These factors are the basis of antenatal care. This study reinforces the need for routine scanning of all pregnancies in the first trimester.

Introduction

Obstetric ultrasound is a core part of modern antenatal care[1] . At the basic level it can be used to confirm the presence and viability of a pregnancy. In specialist hands it now has wide ranging uses including to assist decision making in the birth centre[2], to diagnose fetal structural anomalies as early as the first trimester[3] and to predict women at risk of preeclampsia[4]

Recommendations regarding ultrasound scans vary by jurisdiction and resource availability[1,5-7]. Dating scans are recommended by the UK NICE Guidelines[6]. These scans should ideally be performed after 10 and before 14 weeks gestation[5]. The importance of dating scans includes the confirmation of viability, the accurate determination of gestational age, the identification of multiple pregnancy and fetal/maternal structural anomalies[1]. These factors are fundamental to determining a woman's pathway of care and stratifying her risk category, a key component of the Irish National Maternity Strategy 2016[8].

There are many other benefits of first trimester scans. Accurate determination of gestational age may reduce the incidence of unnecessary induction of labour for suspected prolonged pregnancy and is crucial in the extremes of viability where discrepancy of a few days can significantly affect decision making[5,9]. In multiple pregnancy, first trimester ultrasound is critical in accurately determining chorionicity and amnionicity, so as to plan appropriate antenatal management[5]. It is also possible to detect major fetal anomalies in the first trimester. If detected early, this can facilitate parental choice with respect to continuing with or terminating the pregnancy[10].

There is wide variation in the provision of obstetric ultrasound in Ireland[11]. Contributing factors may include the absence of national ultrasound guidelines, the lack of hospital policies around ultrasound, and the suboptimal number of trained sonographers in many units[12]. A 2017 study found that only 47% of women were offered a first trimester ultrasound scan performed by a suitably qualified sonographer nationally[11]. This highlights the current failure to meet the recommendations of the Maternity Strategy which states that women should have "equal access to standardised ultrasound service to accurately date the pregnancy (and) to assess the fetus for ultrasound diagnosable anomalies as part of a planned Prenatal Fetal Diagnostic Service"[13].

We aimed to illustrate the benefits of a structured dating ultrasound programme in a tertiary setting following international guidelines[5].

Methods

A retrospective review of dating scans preformed in a tertiary referral maternity hospital was performed. All public patients undergoing scans over a one year period (January- December 2017) were included. All scans were undertaken by qualified sonographers working in a single dedicated ultrasound department, who maintained their professional competence.

Dating ultrasound scan images and reports were reviewed with respect to gestational age calculated from last menstrual period (LMP), gestational age estimated by scan, assigned gestational age, single or multiple fetuses detected on scan, viability, liquor, adnexal findings, recommendation for further imaging and the final pregnancy diagnosis.

The Institute of Obstetricians and Gynaecologists guidelines were adhered to in relation to early pregnancy diagnosis[14]. Viability was assigned by detection of fetal cardiac activity. Missed miscarriage was diagnosed if the fetal crown rump length (CRL) was greater than 7 mm with transvaginal scan (TVS) or 8 mm with transabdominal scan (TAS) with no visible cardiac activity confirmed by M-mode on ultrasound[14]. Early pregnancy with uncertain viability was diagnosed if no fetal cardiac activity was seen and the fetal CRL was ≤7mm (TVS) or ≤8 mm (TAS).

Multiple pregnancy was recorded when more than one fetal pole was identified on dating scan. Relevant data on uterine anomalies, liquor, molar pregnancy, sub-chorionic haematoma, and fetal anomalies were also recorded. The records were reviewed using the Picture Archiving and Communication System (PACS), which is routinely available to all clinicians working in CUMH and Cork University Hospital (CUH). Microsoft Excel and IBM SPSS 26.0 were used for descriptive data analysis. Ethical approval was granted for this study from the Clinical Research Ethics Committee of the Cork Teaching Hospitals.

Results

A total of 6077 dating ultrasound scans were reviewed.

Dating

Of those attending for a first dating ultrasound, 81.7% (n=4,966) pregnancies were measured between 10 to 13+6 weeks. A further 13.1% (n=798) measured ≥ 14 weeks, and 5.1% (n=313) measured ≤10 weeks, requiring repeat scans. With regards to LMP, 11.1% (n=677) women were unable to recall their LMP, 3.2% (n=199) reported irregular cycles, 0.7% (n=47) reported short cycles and 0.8% (n=54) reported long cycles. Consequently, 16% (n=977) women relied on dating ultrasound scans as the primary source for estimation of gestational age and estimated due date (EDD).

Where LMP was recorded 88.8% (n=5,400), ultrasound dating estimates were compared. The mean difference between gestational age from dating ultrasound and LMP was found to be 3.9 days. In 77.5% (n=4,189) of all dating ultrasound scans, the difference in gestational age was 5 days or less. There were 82.9% (n=4,477) women with ultrasound estimated gestational ages of 10 to 13+6 weeks who had LMPs recorded.

The difference between the gestational age estimated from dating ultrasound scan and recalled LMP for dating ultrasound scans performed between 10-13 weeks was reduced to 3.2 days, while the percentage of ultrasound scans with difference in gestational age of 5 days or less increased to 82.7% (n=3702).

Figure 1 summarises the calculated difference in gestational age by days and the number of ultrasound scans associated with each age difference. Spearman's rho statistical test showed a moderate correlation with a correlation coefficient equal to 0.758.
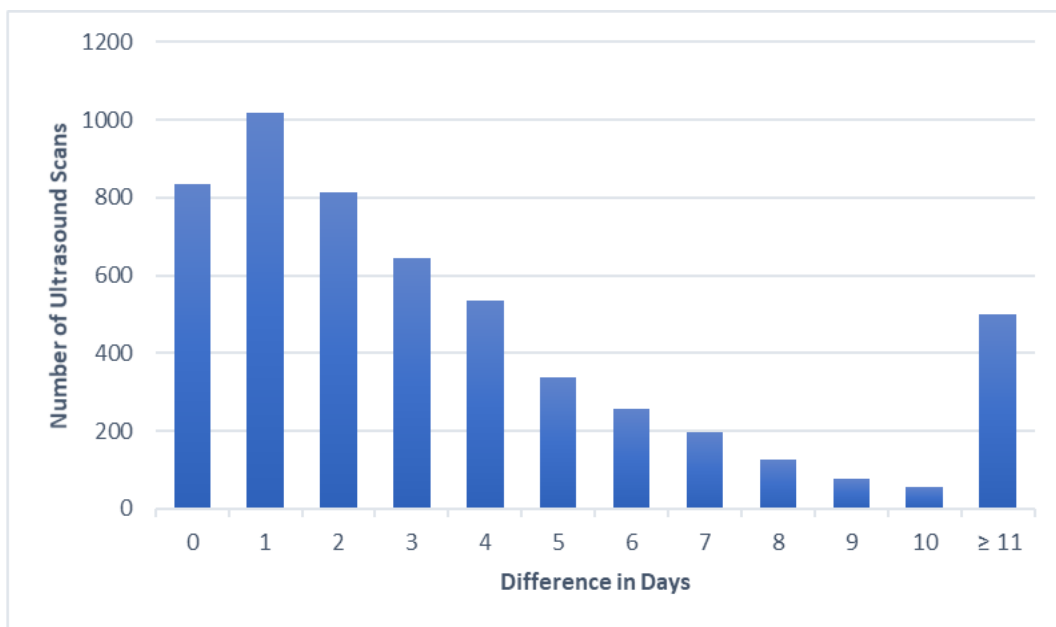

Figure 1: *Gestational age difference between dating ultrasound scan and LMP.*

Viability

There were 97.9% (n=5,950) viable pregnancies, 1.5% (n=94) non-viable pregnancies (early pregnancy loss or missed miscarriage) and 0.4% (n=29) pregnancies with non-confirmed viability (see Table 1). In total there were 94 missed miscarriages. There was no cardiac activity in 80 scans (1.3%) and no fetal pole in 14 scans (0.2%). There were three scans of twin pregnancies with a single fetal death. Intrauterine early pregnancy of uncertain viability was seen in 29 scans (0.5%).

Pregnancy number

There were 97.9% (n=5951) singleton pregnancies. Multiple pregnancy was diagnosed in 1.8% (n=112) of scans, with chorionicity correctly assigned in all cases on postnatal review. There were 89 DCDA twins, 20 MCDA twins, 1 MCMA twin pregnancy, 1 TCTA triplet pregnancy and 1 DCTA triplet pregnancy with a monochorionic pair.

For the remaining 14 scans, there was no fetal pole identified and a diagnosis of early pregnancy with non-confirmed viability was made, followed by further scans to reach a final diagnosis.

Anomalies

Fetal anomalies were detected in 0.4% (n=25) of scans, with increased nuchal translucency (NT) being the main anomaly detected 68% (n=17). Other anomalies included cystic hygroma, anterior abdominal wall defect, fetal acrania, anencephaly and megacystis. There was one partial molar pregnancy diagnosed.

Maternal anatomy

Uterine anomalies were diagnosed in 1.2% (n=78) of dating ultrasound scans, with uterine fibroids being the most frequent anomaly seen (n=69; 88%). Ovarian cysts were diagnosed in 57.6% (n=45) of these scans.

Table 1: *Findings at dating ultrasound scan.*

Diagnosis	Number of scans (n=6077)
Viable pregnancies	5950 (97.9%)
Non-viable pregnancies	94 (1.5%)
Single fetus	5951 (97.9%)
Multiple fetuses	112 (1.8%)
Fetal anomalies	25 (0.4%)
Uterine anomalies	78 (1.2%)
Adnexal cysts	45 (0.7%)
Recommended further scans	529 (8.7%)

Discussion

This study reviewed 6,077 dating ultrasound scans over the course of one year at a tertiary maternity hospital. It showed that 82% of women had their first dating ultrasound scan during the appropriate gestational age window[5]. The remaining 18% of women had dating ultrasound scans outside this window; due to LMP uncertainty, late booking into antenatal care, or transferring antenatal care between maternity. Importantly, 16% of women relied entirely on dating ultrasound scans to estimate gestational age and estimated due date (EDD). This highlights that if dating ultrasound scans are not routinely performed more than one in seven women will start their antenatal care journey without accurate information. A 2015 Cochrane systemic review confirmed that early routine ultrasound compared to selective use improves gestational dating[15].

In this study, the mean difference in gestational age estimated from dating ultrasound scan and by recalled LMP was 3.9 days, and in the majority of scans (78%), the difference in gestational age was 5 days or less. This is important as accurate determination of gestational age by ultrasound is essential in preventing incorrect diagnosis of fetal growth restriction or increasing obstetric interventions such as induction of labour for post term pregnancy[9]. This is particularly important as studies have shown that slow growth in the first trimester (in the absence of chromosomal abnormality or miscarriage) is associated with adverse late pregnancy outcome[16]. Increased risk of fetal growth restriction has also been shown in women with a discrepancy from LMP at early dating ultrasound scan of at least seven days[17]. Thus, adverse outcomes in late pregnancy may be predicted by early pregnancy growth[16,17]. These findings are similar to other studies which showed that ultrasound was more accurate than LMP in dating, whereby LMP was shown to misclassify more pregnancies as being postdates: 10% by LMP dating vs 3% by ultrasound dating[18].

Fetal anomalies were detected in 0.4% of dating ultrasound scans. This is less than other reports where 1% of first trimester scans detected anomalies[19], and a systematic review which found that the mean number of anomalies per 100 fetuses was 1.01[3]. This report concluded that first trimester ultrasound can identify about half of all major fetal anomalies diagnosed antenatally[3]. Early diagnosis of fetal anomaly is important so as to inform and counsel parents, especially since their decision about termination may be time limited. *In Ireland, the focus of the first trimester scan has been around dating, rather than a detailed approach to fetal anatomy; this is likely to change given international guidance, training, and standardised guidance for first trimester anatomy ultrasound[20].*

Uterine anomalies were reported in 1% of dating ultrasound scans. Early detection of uterine anomalies is important as diagnosis in later pregnancy may become technically more challenging. An important minority of uterine anomalies place women at higher risk of complications including premature delivery and fetal malposition[21]. Fibroids were the most commonly identified uterine anomaly in this study and although often asymptomatic, may predispose women to complications including post-partum haemorrhage, increased risk of prematurity, and can sometimes impact the mode of delivery[22]

Diagnosis of miscarriage is important and has potential maternal physical, emotional, and psychological sequelae[23]. In our study, viable pregnancies were confirmed in 98% of ultrasound scans. All women diagnosed with missed miscarriage were reviewed by medical personnel and received counselling around further management options at the dating scan.

Diagnosis of multiple pregnancies and determining both chorionicity and amnionicity is an essential part of antenatal care[24]. Multiple pregnancies have an increased risk of pregnancy complications including preterm birth, hypertensive disorders of pregnancy, and fetal growth restriction and therefore require additional monitoring during pregnancy. A key factor in the management of multiple pregnancy is the identification of chorionicity, which is most accurately assigned before 14 weeks.

Fetuses sharing a single placenta are at risk of unique pathologies including twin to twin transfusion syndrome (TTS) and twin anaemia polycythaemia sequence (TAPS). Correct identification of multiple pregnancy and assigning chorionicity allows appropriate decision making regarding frequency of scans, place and mode of delivery and need for onward referral to specialised clinics or centres.

In 2017 in Ireland, only 47% of women were offered a first trimester ultrasound scan performed by a suitably qualified sonographer nationally[11], which does not meet the fundamental aims of the 2016 National Maternity Strategy[13]. Further, 18% of women did not have their first trimester ultrasound scan performed within the gestational age recommended by ISUOG guidelines. Additionally, other studies have highlighted the lack of a national guideline for obstetric ultrasound and the variation in providing the service between the maternity units in Ireland[11,12,25]. This shows that there is a lot more to do to improve and standardise antenatal care for women nationally.

A strength of this study is that a large number of dating ultrasound scans were examined over a full calendar year in a tertiary-referral maternity unit. All scans were undertaken by qualified sonographers working in a single dedicated ultrasound department, who maintained their professional competence. Some limitations of this study include that data were analysed retrospectively. However the PACs system allowed our team access to high quality documentation which we believe mitigated this limitation. A second limitation of this study was that it only included public patients. The decision to exclude the 18% of patients attending private consultants was to ensure full patient records were available to reviewers (not all private documentation is easily accessible) and to avoid heterogenicity in off-site ultrasound practices among our sample population.

In conclusion we have illustrated the many benefits of the first trimester dating scan including optimisation of dating, management of non-viable pregnancy and the identification of multiple pregnancy/fetal anomalies/maternal pathologies. Research and policy indicate that it is fundamental part of antenatal care and should be made available to women attending all maternity units nationally.

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