Gestational age and fetal growth assessment amongst general practitioners

Avaliação da idade gestacional e crescimento fetal por médicos de família

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Abstract

Background: In Portugal, low risk pregnant women are usually attended in primary care facilities until term. These clinicians interpret fetal ultrasound (routinely, three during this period).
Objectives: To characterize ultrasound report interpretation, in the context of gestational age (GA) and fetal growth assessment, by General practitioners (GP), and identify related concepts which may warrant further clarification.
Methods: Observational, cross-sectional study. We consecutively recruited a sample of GPs and residents (with at least one year of experience) in the Oporto Metropolitan region, who answered an anonymous questionnaire.
Results: We collected 56 valid questionnaires, including 34 GPs and 22 residents. Fifty-two percent of respondents claimed not to know the error associated with ultrasound weight estimation, with 11% correctly pointing out it is ± 15% of the estimate. Fifteen percent of respondents considered the 2nd trimester ultrasound to be more accurate for determining GA than the first trimester evaluation. This number was significantly higher among doctors with more experience (>15 years). Most doctors (72%) correctly interpreted the GA output from ultrasound machines (based on biometric parameters), which is often conveyed in the ultrasound report.
Conclusion: There are some problems in the interpretation of ultrasound reports by primary care physicians. In this context, changes in the way reports are presented may be important, but improvement and update of the analyzed concepts are needed.

Keywords: Birthweight; Fetal growth; Prenatal ultrasound; Pregnancy dating

INTRODUCTION

In Portugal, primary care physicians – General practitioners (GPs) or Family doctors- usually survey low risk pregnancies. They often analyze and stratify the obstetric risk, referring high-risk pregnancies to obstetricians, in state owned hospitals. This usually occurs according to predefined guidelines, agreed with each hospital. Depending on the region and referral hospital, GPs attend low risk pregnant women throughout most of the pregnancy.

According to the guidelines issued by the Serviço Nacional de Saúde (SNS – the Portuguese National Health Service) [1] three ultrasounds are routinely prescribed during standard prenatal care. The first trimester ultrasound is usually performed in a specialized prenatal ultrasound

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ABBREVIATIONS
CRL: Crown-rump length
EDD: Estimated due date
EFW: Estimated fetal weight
GP: General practitioner (Family doctor)
LMP: Last menstrual period
GA: Gestational age
SD: Standard Deviation
SNS: Serviço Nacional de Saúde (Portuguese National Health Service)
US: Ultrasound

department, in a state owned hospital. It integrates the first trimester combined screening for aneuploidies and it is performed between the 11th and 13th weeks. In some regions, SNS hospitals also perform the second trimester (morphology, between the 20th and 22nd weeks) and even fewer perform the third trimester (growth, between the 30th and 32nd weeks). In most regions, however, private clinics with financial agreements with the SNS perform second and third trimester ultrasounds.

Although there is a standard report and a minimum set of information specified for each ultrasound [1,2], there are widely different reports for each trimester, depending on the practice where it is performed, the medical doctor that performs the scan or even the specialty of the doctor (radiologist or obstetrician). Given this fact and the limitations that are inherent to the technique used to evaluate fetal growth with ultrasound, a sound and cautious interpretation of reports is very important to maximize the financial investment in these exams and to improve outcomes.

We aim to characterize ultrasound interpretation and prescription routine, in the context of gestational age and fetal growth assessment, by primary care physicians, and identify problems with the interpretation of related concepts.

METHODS

Study Design

Observational, descriptive, cross-sectional study, aimed at GPs and residents (the latter with at least one year of experience).

Selection of Study subjects

We recruited a consecutive sample of GPs from cities of the Oporto Metropolitan Area. We sampled primary care facilities (all state owned), followed by consecutive recruitment of all medical doctors working in each unit. The units were contacted and visited by appointment (to maximize the number of doctors present). After a brief introduction, the questionnaire was applied to all doctors. When a doctor of the intended sample was not present, we signaled a non-answer. We aimed to collect 50 completed questionnaires, and stopped recruitment when we exceed this number.

Data Collection

We developed a questionnaire for this purpose, and subsequently piloted it with five GPs. We then excluded these GPs and their workplaces from recruitment. Subjects perceived the questionnaire as clear and concise and we made only minor revisions, according to the gathered suggestions. The mean completion time for of the pilot questionnaire was five minutes. The questionnaire comprised 10 questions: six multiple choice; one multiple response; one yes-no; and two open-ended. The number of pregnant women per year, pregnancy dating and embryo/fetal growth evaluation variables were analyzed in these questions. Age, years of experience and resident/GP status were also recorded at the end of the questionnaire. We explicitly preserved anonymity, regarding both the respondent and workplace, to alleviate any fear of unintended performance comparison.

Statistical analysis

We analyzed data in IBM SPSS Statistics (Version 21.0; Armonk, NY: IBM Corp.) and Excel 2013 (2013; Redmond, Washington: Microsoft Corp). Fisher's exact was used to compare groups. When we found statistical significance (a p-value less than or equal to 0.05) we compared pairs with z-tests.

RESULTS

We collected 56 questionnaires from all 71 doctors who met the inclusion criteria (intended sample – doctors working in the visited facilities - 79% response rate), including 34 residents and 22 GPs.

The median number of ultrasounds regularly prescribed for each uncomplicated pregnancy was three, with a minimum of two (one answer) and a maximum of four (two answers).

Most respondents estimated that in a typical year they attended 5-9 (33 answers) and 10-20 (14 answers)

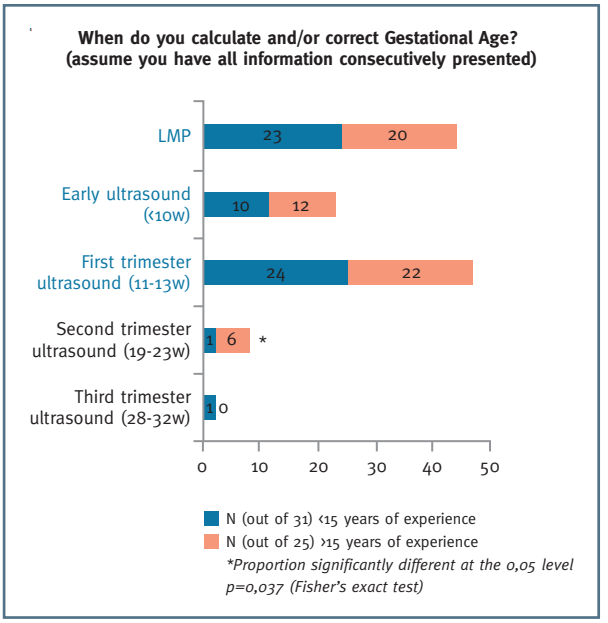

FIGURE 1. Multiple answer (more than one option possible) question regarding estimated due date/gestational age correction based on consecutive information (LMP - Last Menstrual Period). Appropriate/acceptable answers are in light blue

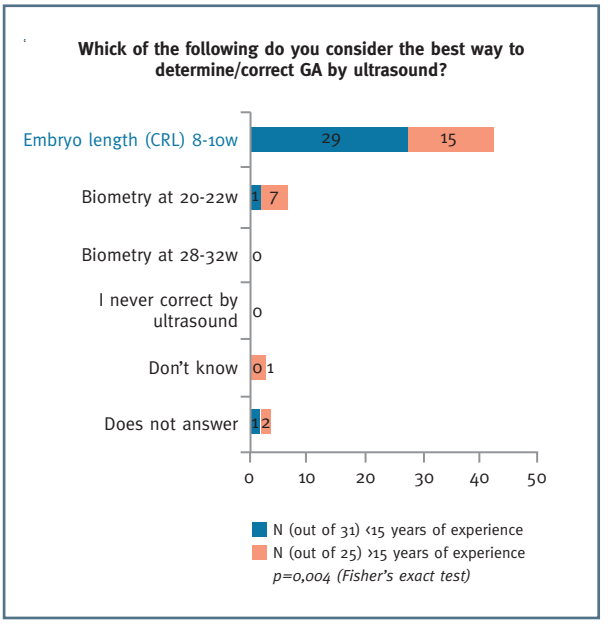

FIGURE 2. Question regarding the best ultrasound method for correction of gestational age (GA). The right answer is in light blue

pregnant women throughout the pregnancy.

Figure 1 shows the results of the multiple answer question regarding the estimated due date (EDD)/gestational age (GA) calculation and/or correction. We divided the respondents by years of experience. Older (more than 15 years' experience) doctors selected more often (p=0.037) correction at the second trimester ultrasound (with previous ultrasounds available). In the question regarding the best ultrasound method for calculating or correcting GA (Figure 2), the results were also significantly different (p=0,004), according to the number of years of experience: older doctors selected more often biometry at the second trimester as more reliable than early first trimester embryonic length. In Figure 3, regarding correction of EDD, answers also differed between older and younger doctors (p=0,035), as the latter selected more often the correction only if significantly different from first trimester US. This "significant" difference was also investigated and Figure 4 depicts the answers regarding the correction of GA/EDD at 12 weeks, in which there were no differences among years of experience, and 13 doctors select answers unsupported by the literature[3,4]. Figure 5 describes the answers regarding Estimated Fetal Weight (EFW) error. According to the literature[5,6], six (11%) of answers were right.

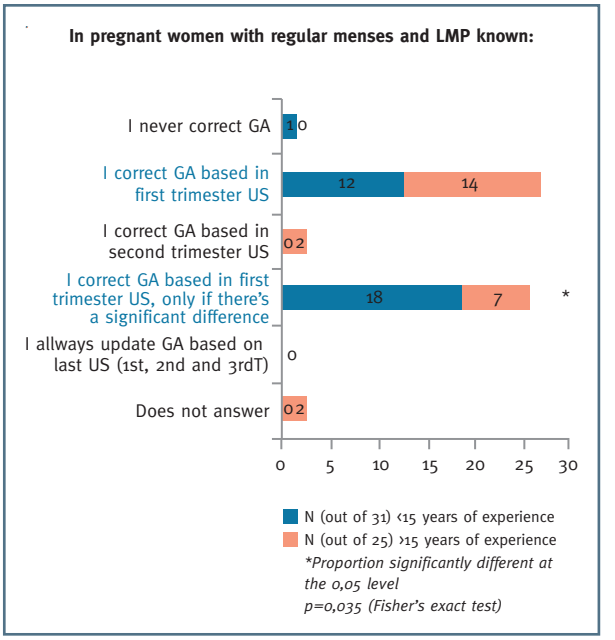

FIGURE 3. Correction of gestational age (GA) with ultrasound. Appropriate/acceptable answers are in in light blue
(LMP- Last Menstrual Period)

Most respondents (49 out of 54 valid answers - 90%) did not use a reference table or chart to compare the EFW in ultrasound reports.

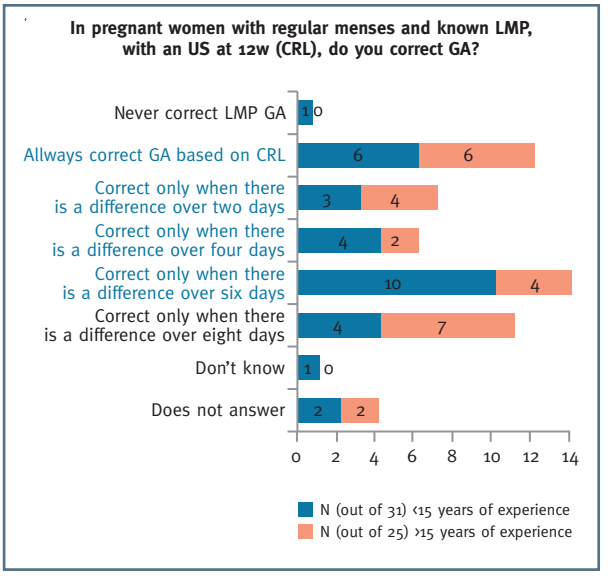

FIGURE 4. Correction of GA based on the difference given by CRL vs LMP. Only one option was accepted, of which possible appropriate/acceptable options are in in light blue

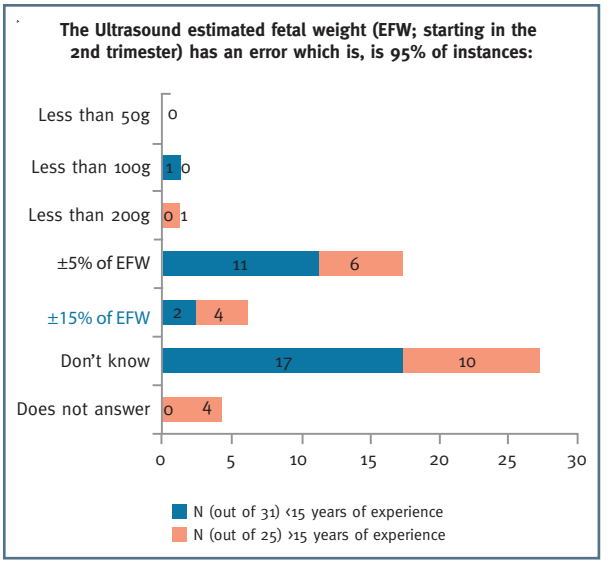

FIGURE 5. Answers regarding Estimated Fetal Weight (EFW) error, by ultrasound. The correct answer is in light blue

We checked for a possible confounding variable in all statistical tests, namely GP/resident status, but this comparison did not yield statistically significant differences.

The output of biometric GA, often conveyed in ultrasound reports (as opposed to the statement of gestational age and growth centile), was also assessed. 39 (72%) correctly interpreted it as "*The parameters measured in that fetus correspond to the mean found in fetuses with the reported GA*", but 13 chose the answer "*The number of weeks of the observed fetus (or that Estimated Due Date)*".

DISCUSSION

Fetal growth is difficult to evaluate, given the wide range of normal fetal development and the difficulties found with its estimation, namely by ultrasound. Still, this may have a role in the assessment of growth in low risk pregnancies: to confirm or correct GA in the first trimester, as most would agree; and, less consensually, to evaluate the centiles for growth, especially in the third trimester, selecting a group of fetuses that may benefit from closer surveillance, or, eventually, other obstetric interventions. It is worth noting that ultrasound in the third trimester has been shown to diagnose important placental anomalies (placenta accreta, placenta praevia), as well as fetal malpresentation, disorders of amniotic fluid volume (oligohydramnios, polyhydramnios), and impaired/excessive fetal growth, although it is not clear if this improved detection rate is associated with better outcomes. A systematic review by the Cochrane Collaboration found no evidence of improved maternal or fetal outcomes, from screening low risk or unselected populations for these conditions, as opposed to use ultrasound when high risk factors or clinical findings are present, and it may encompass a small increase in caesarean section rates[7]. This is a controversial issue, and in Portugal low risk obstetric populations are screened by ultrasound in all three trimesters.

The error associated with US assessment of fetal GA is roughly 8% (two standard deviations – SD) throughout the pregnancy, to include 95% of measured embryos/fetuses. This is true for embryo length/CRL in the first trimester[3,4] and for biometry in the second and third trimester with combined BPD, AC, HC and FL (the four parameter equations achieve the smallest errors in these trimesters)[8,9]. As the fetus grows, the absolute error (in days or weeks) associated with these measurements also rises. This is why it is inappropriate to correct the GA in the second or third trimesters (Figure 1), when we have more reliable first trimester data. The first trimester ultrasound measures an embryo/fetus which growth is not yet significantly altered

by the environment or genetics, and its measurements relate closely to the actual GA[4]. Because of this, the earliest the ultrasound with an appropriate CRL measurement, the more accurate the GA determination, and, especially true for CRL, the limited embryo movement allows for even lower intra and inter-observer variability[10]. The fact that the earlier ultrasound is slightly better for pregnancy dating does not, in any circumstance, warrant that this ultrasound should be done in the absence of an obstetrical reason or concern. However, when it is done for other reasons, it should be, at least, considered when dating a pregnancy.

Most GPs would not correct the GA with an early (8-10w) ultrasound, but would do it in the late first trimester (11-13w). The early CRL (or embryo length), especially when the embryo is clearly seen, is more accurate for pregnancy dating than the 11 weeks scan[3,4], but in this case we may have a bias, because, in this region, the 11-13w ultrasound is performed in specialized departments of SNS hospitals and thus may be perceived as technically more reliable.

This notion of accuracy of early ultrasound is noticeable in Figure 2, but nine doctors (16%) either do not know or perceive the second trimester scan as better for GA correction. We deliberately omitted the 11--13+6 weeks scan to eliminate the aforementioned bias (first trimester US in Fetal maternal centers perceived as more reliable) assessing embryo/fetal growth. The significantly higher proportion of older doctors (p=0,004) who chose the second trimester scan as more reliable than early US may point to the experience each respondent had with ultrasound and how recent this contact was. Younger GPs and residents are more likely to have had significant contact with ultrasound, because its utilization in everyday obstetrics practice has grown immensely in the last 20 years and it is now ubiquitous in most obstetrics settings, not just specialized centers and professionals.

Correction of GA in the first trimester in women with regular menses and known LMP divides GPs but also obstetricians: some will always correct it and others will do it only if the difference is significant. The significance of the difference is another issue entirely. We have already discussed the error of CRL formulas as ± 8% for 2 SD, which stands roughly for: ±4 days at 7 weeks; ±5 days at 9 weeks; ±6,7 days at 12 weeks; ±7,8 days at 14 weeks [3]. However, first trimester US for pregnancy dating has consistently shown to be more reliable predicting the delivery date and seems to reduce errors caused by wrong LMP recollection and delayed ovulation[11,12]. To further complicate matters, a study yielded marginally better delivery date prediction than US alone, with a combination algorithm (correction when difference ≥ 7days) [13]. Therefore, in a woman with regular menses and known LMP, it may be reasonable to correct the GA only if the difference from CRL dating is more than 6 days at 12 weeks. Most GPs would correct the GA based on a first trimester ultrasound (Figure 3 and Figure 4), the difference that would trigger this change would vary between 1 and 8 days. The "eight days or more" option would be inappropriate, for the reasons discussed. Seventeen doctors (30%) either did not answer, did not know, or chose a wrong option in this question.

Ultrasound EFW, in most reporting software, is derived from 2 to 4 biometric variables. Some of the best known formulas are from Hadlock and collaborators, and one of the most accurate of these is a regression equation, based on HC, FL, AC and BPD[8,14]. However, after nearly three decades since this update, despite multiple attempts to improve fetal weight estimation, with better image quality and the introduction of new technology, such as three-dimensional (3D) ultrasound[15,16], most formulas perform similarly to each other[5,6]. Specifically, 3D is technologically limited to imaging of limbs (as opposed to the whole fetus) and formulas developed this way have only marginally improved the typical SD of 2D formulas[6], besides the fact it is more expensive and time consuming. The estimates for EFW have a 95% confidence interval that exceeds ±14% (two SD) of birth weight in all studies in a systematic review[6], which means that a fetus with 3000g would yield, with 95% confidence, an estimate between 2580g and 3420g, regardless of the formula used. This fact is highly relevant when one uses EFW to diagnose and intervene in intrauterine growth restriction, or to schedule an elective caesarean section for a macrosomic fetus. In the case of GPs, it would determine the referral to a hospital whenever this value would suggest pathologic growth. Most doctors in this study stated that they did not know this number and most of those who pointed a value answered ±5% (Figure 5). Only six doctors (11%) answered the correct "±15% of the estimate". There seems to be over reliance on the results of ultrasound EFW.

The result to the question regarding the biometric GA, presented in many reports, in which 13 doctors chose that it related to the actual GA of the fetus, is clinically significant. When interpreted this way, it may lead to correction of GA with each ultrasound, which

in turn may obscure an underlying pathological growth pattern. It may also be very confusing to parents, especially when the same or different doctors use different EDD in the same pregnancy.

Very few of the enquired doctors use a reference to analyze or compare the growth of the fetus. This may be outside the required set of skills for GPs, but may prove useful, especially when presented with poorly elaborated US reports. The reports should present growth centiles, but some do not, and instead will provide a biometric GA. Added to the possible misinterpretation of biometric GA, it would be harder, e.g. to correctly identify a fetus at risk of Intrauterine Growth Restriction.

This study has some weaknesses, namely a relatively small sample, without a probabilistic approach. Furthermore, the median number of pregnant women per clinician/year is not high, although this is a feature of SNS, as each GP will only see pregnant women from his/her list of patients (mean 1800). Considering the 2012 Portuguese Synthetic Fecundity Index (1.28) [17], it may be expected roughly six pregnant women per year/GP. To our knowledge, this is the first paper that assesses the interpretation of fetal growth ultrasound data by GPs. The response rate in the visited units was high and these are, in our assessment, representative of the highest quality primary care in Portugal, as they are teaching facilities (almost all have specialty trainees and most have both medical students and trainees) situated in the second most populated urban area of the country.

CONCLUSION

As the Portuguese SNS encourages three ultrasounds in low risk pregnancies and one of the key aspects of the third trimester exam is evaluation of fetal growth, it is important for those who care for these women to understand both the usefulness and limitations of ultrasound. We find the limitations less understood, as it is important to critically appraise the ultrasound report, especially when there is often little control on where and by whom the ultrasound is performed, which may lead to different approaches in the way the information is presented. GPs, especially younger ones, seem to be generally aware of some, but not all of these issues, and thus there may be room for further improvement, in the form of local Medical Education programs, in Portugal's already excellent results in fetal maternal healthcare.

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