Helping expectant mothers understand inadequate ultrasound images

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Abstract

Background: Obstetric ultrasound scans may fail to provide all the information that is needed because of poor visualisation. Two main causes of poor visualisation are addressed. These are poor foetal position and poor quality imaging due to beam distortion by overlying fatty tissue.

Method: To improve communication with patients attending obstetric scans, a poster and leaflet were designed to explain these causes of inadequate scans. A questionnaire was used to assess the value of the poster.

Results: 57/66 (86%) questionnaires were completed. 52 (91%) found the information on the poster was helpful and well explained. For 8 (14%) the information changed their thoughts about the scan.

Conclusion: Clear communication aids the expectant mothers understanding of why scans may be suboptimal. The way this is recorded in the scan results is discussed.

Keywords

Pregnancy, ultrasound, poor visualisation, obstetrics, obesity

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Introduction

There are two main reasons why ultrasound obstetric scans may fail to get the information required: poor foetal position and poor ultrasonic visualisation. Looking at non-obese women, Padula et al.¹ found that poor foetal position requires a second scan in about 4% of cases. In these scans, the foetus lies in such a position that organs are obscured by shadowing from overlying bones and structures. More commonly, poor visualisation is caused by the effect of overlying maternal tissues through which the ultrasound has to pass to reach the foetus. The problem of achieving a high-quality obstetric scan in women with a high BMI has always been an issue that is not getting any easier with the increasing rise in obesity within this population.^{2–4} Uhden et al.⁵ found that the rate of obtaining inadequate images for assessing foetal heart defects, in patients where the foetus did have a defect, increased from 6.4% for a normal weight population to 17.4% in the obese population (BMI ≥ 30), and that these obese patients were significantly more likely to have a foetus with a heart

defect (relative risk 2.04). Following the introduction of the NICE Guidelines in 2010,² our own department has introduced a midwife-led BMI clinic (BMI 30–34.9) and a consultant-led clinic (BMI >35). These clinics are full and overflowing, anecdotally consistent with the rise in maternal obesity.

Apart from the question of obtaining the clinical information the scan is intended to provide, there is a high expectation amongst those being scanned that the scan will produce excellent images of their ‘baby’ and all will be well. When the scan is suboptimal, with poor quality images, the reaction of the patient is often to blame the sonographer or the equipment.³ This

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reaction may be compounded when the patient receives a copy of the scan report that indicates that the scan was suboptimal because of the patient body habitus or high BMI. There are well-understood reasons why some types of subcutaneous fat will distort an ultrasound beam, thereby degrading the image quality.^{6,7} The layer of subcutaneous fat and its interface with the underlying muscles will distort the ultrasound beam and cause phase aberration through refraction and scattering. A fat type that consists of a matrix of dense and less dense fat has the same effect on an ultrasound beam that uneven glass has on a beam of light. What should be a well-defined thin beam of sound becomes a more widely spreading beam that insonates a larger volume of tissue than the intended target. This produces a degraded image with lots of extraneous echoes superimposed on the intended target.

Phatak and Ramsay⁸ assessed the impact of obesity on the mid-trimester scan. They suggested that there was a need for women attending scans to be informed of the reduced sensitivity of foetal anomaly scans in obese patients. In order to aid communication with expectant women coming for a scan, we carried out a project to develop a poster and a leaflet that could be used within the obstetric scanning department that would explain the main causes of suboptimal scans.

The population served by the Newcastle Obstetric Department is typical of a city hospital that also serves as a tertiary referral centre. There are 7500 births per year with 49% coming from Newcastle and 51% coming from outside. Expectant mother age range is from teens to 45 years.

Method

The project was to produce a poster and a leaflet that explained, in the clearest way possible, the two main reasons for failed obstetric scans. These were the position of the foetus obscuring the features that need to be examined and measured, and a failure due to poor image quality arising from distortion of the ultrasound beam by overlying fatty tissue. This would be achieved by explaining the causes accurately but using simple language and images to illustrate the explanation. The poster developed is shown in Figure 1 (a pdf copy is available with the online version of this article at <http://ult.sagepub.com>).

The poster was then displayed in the common obstetric scanning waiting room. In order to gauge the value of the poster, a questionnaire survey was taken of those attending for a scan. There are five scanning rooms. Sixty-six questionnaires were given to consecutive patients as they finished their scan. There were five specific questions, shown in Figure 2, and one free field open question asking 'How did the poster change your thoughts about the scan?'. Two of the questions

were 'yes/no' answers and the other three used a scale of 1–5 for agree/disagree. Audit department approval was not required for this study.

Results

Of the 66 questionnaires given out, 57(86%) completed questionnaires were returned. The results are shown in Figure 2. Ten patients (18%) had not seen the poster before going in for their scan. In response to the question: 'Was the answer well explained?', 52 (91%) agreed or strongly agreed and 52 (91%) agreed or strongly agreed that the information was helpful; 43 (75%) thought it would be useful to include the information in their patient notes pack. For 8 (14%), the information in the poster had changed their thoughts about the scan. There was also a free field for open comments to the question 'How did the poster change your thoughts about the scan?'. There were 16 responses and these are summarised in Table 1. These responses also included comments arising from the other questions.

Discussion

Those attending for obstetric scans have a very high expectation of a successful outcome both in terms of confirmation of a normally progressing pregnancy and in being able to 'see their baby'. In a significant number of cases, their expectation cannot be met because the imaging obtainable is suboptimal with poor visualisation of the foetus. This may be due to the position of the foetus within the uterus or because of poor penetration of the ultrasound beam, with beam distortion due to the physical effects of overlying fatty tissue. In the case of a poorly positioned foetus, this can usually be resolved by waiting for the foetus to move or requesting a further scan at a later date. Where it is a case of poor image quality due to the distorting effects of overlying tissue, it is less likely that a repeat transabdominal examination will improve the situation and a TV scan may be requested. Fuchs et al.³ suggested that moving the position of the foetus and using a more experienced sonographer may sometimes improve the result. However, if approaching the imaging from another plane or compressing the skin with the ultrasound transducer has no effect, then a repeat TA scan is not really indicated.

It is important to understand that it is not obesity per se that is the cause. It is the type of fatty tissue that is the problem, namely non-uniform fatty tissue that has a matrix of both dense and less dense fat within it.⁶ Poor image quality may be seen in someone with a low BMI and a thin layer of such tissue, or perfectly clear images may be seen in someone with a higher BMI. Some people have this tissue type, some people

WHY YOUR ULTRASOUND SCAN MAY NOT SHOW EVERYTHING WE WOULD LIKE TO SEE

ULTRASOUND IS NOT PERFECT

The ultrasound image may not show everything we need to see. There are two main reasons for this.

THE BABY'S POSITION CAN CAUSE PROBLEMS

Then we cannot get the measurements needed. A repeat scan may be booked.

Baby lying face down, shadow from the spine obscures heart

IMAGE QUALITY MAY BE POOR

A beam of ultrasound passes through the layers of fat and muscle under the skin to reach the baby. Echoes bounce back off the baby and are picked up to produce the image we see on the screen.

Some types of fat distort the beam like "wobbly" bathroom glass. Detail is lost and measurements are less accurate.

It does not depend on size or body weight. It just depends on whether you have the type of fat layer that spreads the sound beam. However, a thicker layer of fat is more likely to do this than a thin layer.

Unfortunately there is little we can do to improve the quality of images in this situation. The scan report may then say something like, "Poor visualisation due to poor echo quality".

skin
fat
muscle

fatty tissue distorts the sound beam

Good visualisation

Poor visualisation

Figure 1. The Poster.

do not. This is a source of misunderstanding amongst those being scanned as is evidenced by discussion boards on the internet.^{9,10} Having said that, it is the case that poorer image quality will, generally, be seen in someone with a high BMI.⁵

Many patients attending for antenatal scans do not have a clear idea of how an ultrasound scanner works and why the images may be suboptimal. They may then blame the sonographer for not being up to the task and producing a poor scan or the equipment or the

department.^{4,9,10} They may then take further exception to the sonographer report, which suggests that it was a patient-related factor that caused the scan to fail. They may take it personally and take offence at the sonographer for suggesting such a cause. It was hoped that the display of a poster explaining how a scan works and the physical reasons why it may fail would help patients attending scans understand some of the reasons why they may be asked back for a repeat scan and why the report says what it says.

Figure 2. Questionnaire results (1 = agree, 5 = disagree). (a) Did you see the poster before your scan? (b) Was the answer clearly explained? (c) Was the information helpful? (d) Would you like a copy in the information pack? (e) Did it change your thoughts about the scan?

Table 1. Summary of patient comments

'Helpful and very visual – clear concise and attractive to read'
'Explained how the scan works'
'I didn't think the sound waves could change the picture'
'Helped put my mind at ease'
'Made me realise I might have to return for another scan'

Although it was a small study, the questionnaire results show that the poster was found to be helpful. It appears to have achieved the aim of clear communication. The leaflet mirrored the information on the poster with a little more written detail and would be something that could be included in the patient information pack to be looked at by the patient later. Ten people noted that they had not seen the poster before going into the scan room for their scan. The position of such a poster needs to be carefully considered to be of maximum benefit.

With reference to the information given on the poster, consideration may be given by the reporting sonographers as to how they describe and qualify the examination result when visualisation was poor. This is also a point raised by the feature in *Synergy News*.⁴ High BMI may be a material fact and may be the cause of poor visualisation. However, it may be better to phrase the report in terms of poor visualisation due to 'poor echo quality' or 'poor echogenicity' rather than refer to 'obesity', 'body habitus' or 'high BMI'. This records the problem in the scan report for future reference but does not make reference to what may cause offence to the patient. It also covers the case where poor visualisation is observed in a non-obese patient. Their BMI will be routinely recorded in their notes and in the case of a missed diagnosis all the relevant information is noted.

Until now, the information about the ultrasound scans given to expectant mothers in our own department has been limited, briefly detailing when scans are likely to be performed. Nothing was said about how ultrasound works or what technical problems might arise with the scan. Following this study, our plan is to put up a second poster so that everyone in the waiting area can see it and to include a copy in the patient information booklet when it is next revised.

We conclude that the patient experience and understanding was improved by clearly explaining these two causes of a failed examination through a poster and a leaflet.

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Ethical Approval

Not applicable.

Guarantor

CPO.

Contributorship

CPO conceived the project and designed the study and poster. PT displayed the poster and undertook the questionnaire. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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