Could an online ultrasound training programme improve the accuracy and timeliness of diagnosis of placenta accreta spectrum disorder?

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1. BACKGROUND

Placenta Accreta Spectrum (PAS) is a complex obstetric complication whereby the placenta abnormally adheres to the uterine wall. It occurs in 0.1-1% of pregnancies[4]. There are three subtypes (Fig.1.). The current hypothesis is that iatrogenic uterine scarring at the endometrial-myometrial interface, most often secondary to a caesarean surgery (CS), results in an area of defective decidua. If the placenta cannot then routinely anchor itself to the decidualized endometrium, normal regulation is disrupted, and the chorionic placental villi and trophoblasts can infiltrate deep into the myometrium (Fig.2.). Rates of PAS are increasing in concordance with increasing CS rates, the single biggest risk factor for PAS[3,5]. Ultrasound (US) is the primary diagnostic tool used (Fig. 3&4.).

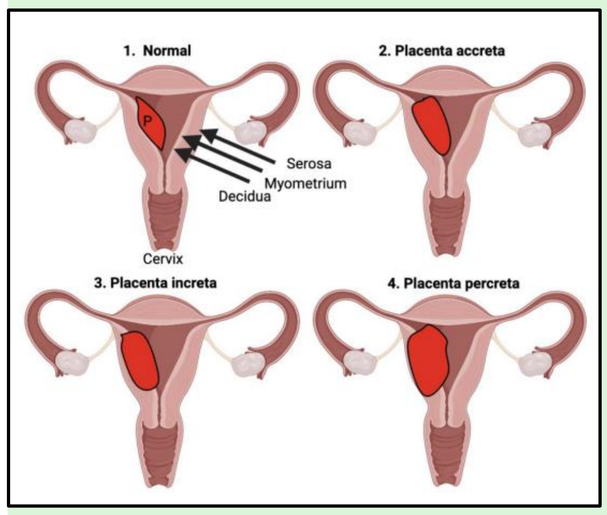

Fig.1:The subtypes of placenta accreta spectrum (PAS) disorder. *This figure shows the subtypes of PAS in order of their increasing chorionic invasiveness into the myometrium;* ***accreta*** *(superficial adherence of chorionic villi to myometrium),* ***increta*** *(invasion into myometrium without affecting serosa) and* ***percreta*** *(breaches myometrium, potentially the serosa too).*

Source: *Diagram by Isabelle Dowle using BioRender.com[1].*

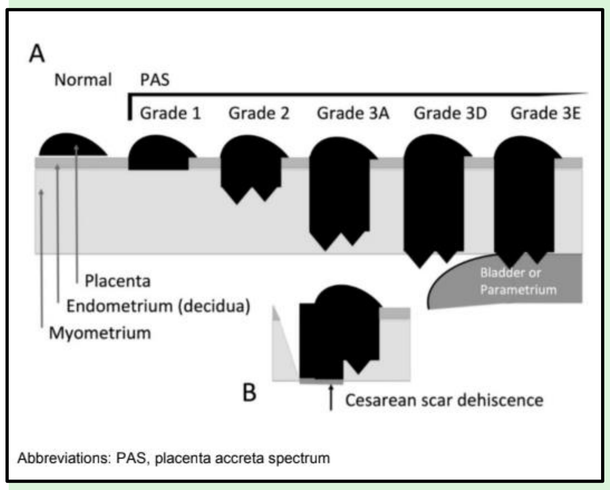

Fig 2: A summary of the International Federation of Gynaecology and Obstetrics placenta accreta spectrum grading system. *The defining feature of all grades is the absence of decidualized endometrium between the placenta and myometrium. The grades are based on how invasive the placental villi are into the uterine wall.*

Source: *Information and figure taken from (Hecht et al., 2020).*

THE ISSUES

- Up to two-thirds of cases are thought to be undiagnosed prior to delivery[7].
- Many sonographers lack sufficient exposure to abnormal placental implantation to confidently identify the signs & there is no standardised training or screening protocol in place for PAS.
- Currently, for women with risk factors, diagnosis of PAS in the UK occurs at around 28 weeks' gestation. Accurate, early antenatal diagnosis of PAS is crucial to optimize management which requires multiple skilled personnel.

2. AIMS

This research aimed to look at whether providing a combined ultrasound-based training and self-assessment programme can improve sonographers' confidence and accuracy in detecting PAS, and whether identification before 28 weeks of gestation is feasible.

3. METHODOLOGY

For this study, the performance of participants before and after an educational intervention was assessed, based on the first two levels of the Kirkpatrick model of training evaluation[6]. An online training tool was devised comprising three sections; pre-training assessment (part 1), a training resource (part 2), and a post-training assessment (part 3), all compiled onto *Collective Minds Radiology,* using both normal and pathological ultrasound images.

1. US scans were retrospectively obtained from PAS patients (n=38). Five patient cases were chosen based on image quality, including 1 set of normal placental images. The signs present were identified and cross referenced with 2 experts.

2. The images were collated, grouping the US images at around 12, 20 and 28 weeks of gestation.

3. Expert and non-expert sonographers were recruited. Participants had to:
a) Answer if the placenta was normal or abnormal. If answering abnormal, they ticked which signs they thought were present and indicated their confidence in their answer via a five-point Likert scale.
b) These same questions were answered both before (part 1) and after (part 3) accessing an interventional educational resource (part 2) created specifically for this project.

Signs chosen: Loss of hypoechoic 'clear zone', lacunae, colour Doppler flow, and bladder wall abnormalities.

4. RESULTS

- A mix of expert and non-expert clinicians in PAS imaging took part, including 3 obstetric sonographers. Nine completed pre-training and seven completed post-training.
- The Wilcoxon signed rank test showed a statistically significant increase in test scores ($P<0.05$) and in the correct identification of lacunae and colour Doppler flow (Fig.5).
- Over 50% of participants were able to identify normal/abnormal before and after training. This was across all categories including early gestation. This was decided as a benchmark to indicate a tentative possibility of earlier detection (Table 1).
- The confidence levels did not show a statistically significant change between pre- and post-training. 'Not at all confident' remained the mode confidence level for 10-16 weeks gestation in pre-and post- training.

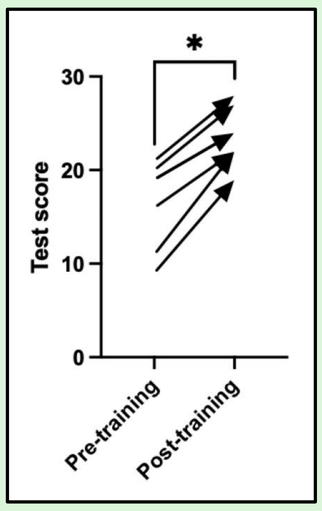

Fig. 5: The change in test scores before and after training *(n=7)*. *The values are the test scores, with the arrow beginning at pre-training and ending at post-training for each participant. The overall test score was out of 29. *P<0.05.*

Gestation	Pre-training (n=9)	Post-training (n=7)
10-16 weeks	66%	74%
18-22 weeks	73%	77%
28-36 weeks	71%	94%

Table 1. The average proportion of participants who correctly identified normal/ abnormal before and after training.

5. DISCUSSION

This study showed some signs of success, but importantly has provided a plethora of feedback to further improve upon. This project was not carried out on a sufficiently large scale. More participants and grouping individuals on their level of expertise and/or clinical role are needed to interpret the results in a wider context.

- Unsurprisingly, there was low confidence answering questions around earlier gestations. Greater exposure to images at 12 weeks and use of live ultrasound clips could help this.
- Add re-testing to the programme to understand participants' areas of weakness. This may also benefit confidence levels because of reinforced knowledge via clinical experience.

6. CONCLUSION

Providing a training programme on identifying specific ultrasound signs in PAS could provide more accurate identification of PAS with potential to enable detection at an earlier gestation.

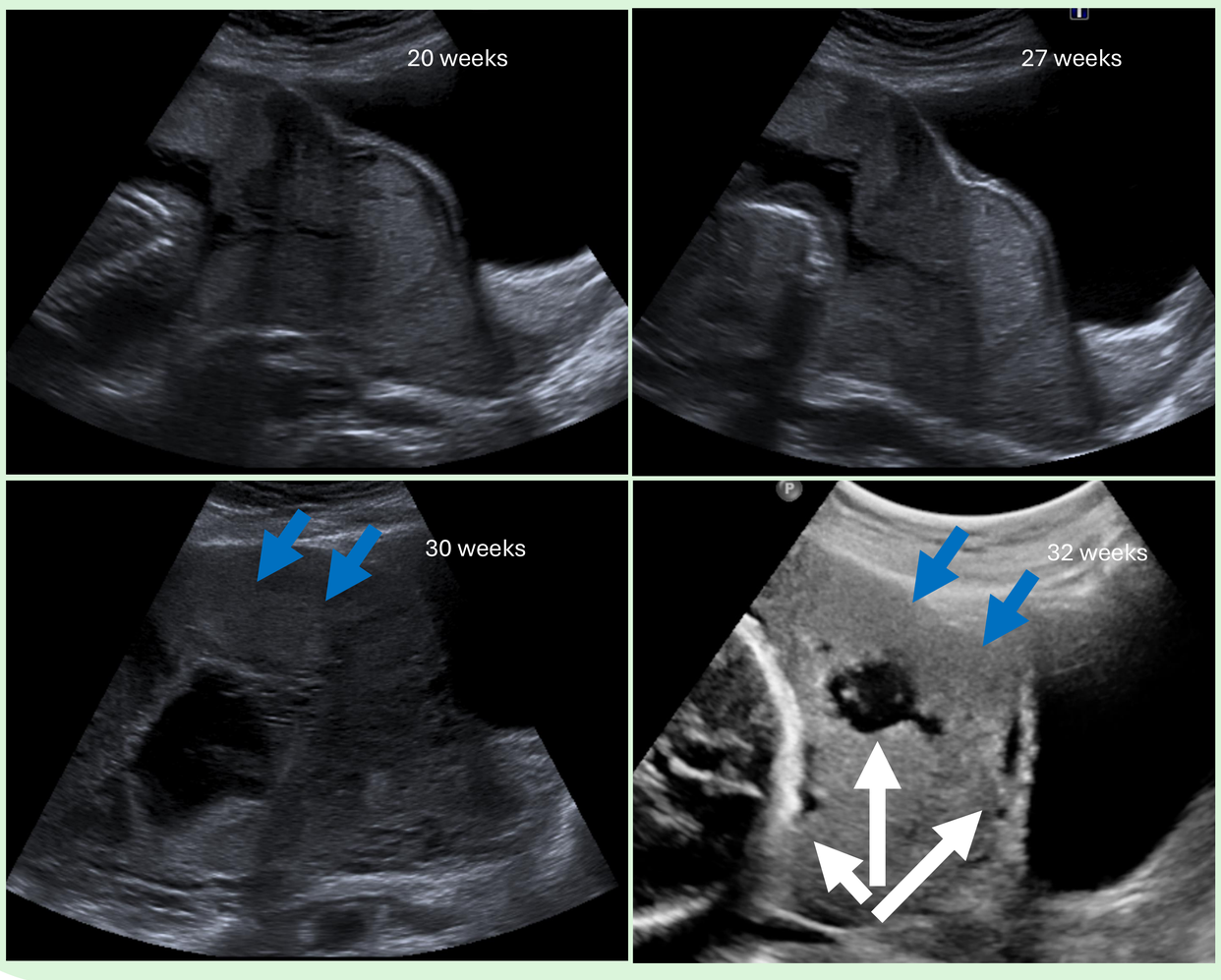

Fig.3: Greyscale ultrasound images showing a placenta increta at 20, 27, 30 and 32-weeks' gestation. *Multiple lacunae are present at 32 weeks as indicated by white arrows, and an absence of a retroplacental clear zone at 30 and 32 weeks, shown with blue arrows.*

Source: *Images used with permission from Dr Elspeth Whitby.*

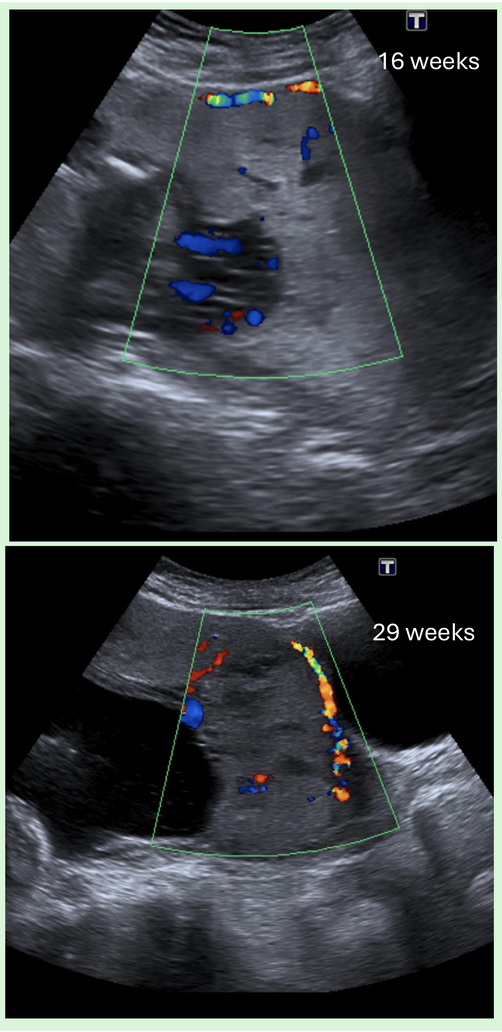

Fig.4: Colour Doppler images of a placenta percreta at 16 and 29 weeks. *At 16 weeks, normal vessels within the placental bed can be seen. There are a few lacunae within the placenta, but it is not abnormal. At 29 weeks, there is abnormal vasculature within the placenta. This figure raises the possibility that unfortunately we cannot detect some cases earlier.*

Source: *Images used with permission from Dr Elspeth Whitby.*

1. Biorender (2023). Created from https://www.biorender.com/
2. Hecht, J.L. *et al.* (2020) 'Classification and reporting guidelines for the pathology diagnosis of placenta accreta spectrum (PAS) disorders: recommendations from an expert panel', *Modern pathology: an official journal of the United States and Canadian Academy of Pathology, Inc*, 33(12), pp. 2382–2396. Available at: https://doi.org/10.1038/s41379-020-0569-1.
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