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ORIGINAL ARTICLE

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Detection of vasa praevia in the mid-trimester ultrasound by Australian sonographers

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Abstract

Objective: To ascertain Australian obstetric sonographers knowledge and current practice when assessing for vasa praevia in the mid-trimester ultrasound with the view to improve prenatal diagnosis.

Methods: Between August and September 2018, a survey was emailed to 4868 Australian sonographers registered to participate in Australian Sonography Association Registry (ASAR) facilitated research projects. A total of 577 responses were received. The sonographers survey response was compared with published Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) recommendations.

Results: There appears to be an unfamiliarity with the RANZCOG recommendations, in particular that vasa praevia is defined as a fetal vessel lying within 20 mm of the cervical internal os (IOS). Transabdominally, if a vasa praevia risk factor is identified (including a fetal vessel observed in the lower uterine segment), less than 48% of surveyed sonographers proceed to a targeted transvaginal scan.

Conclusion: To enable effective diagnosis of vasa praevia, it is important to recognise associated risk factors that can raise suspicion for a potential vasa praevia; these are velamentous cord insertion, succenturiate lobe, and low-lying placenta. A lower threshold of performing a transvaginal ultrasound when risk factors are identified (including a fetal vessel is identified in the lower uterine segment) may significantly improve vasa praevia diagnosis in the mid-trimester ultrasound.

KEYWORDS

mid-trimester ultrasound, obstetrics, vasa praevia

1 | INTRODUCTION

In September 2017, Sullivan et al[1] published the AMOSS (Australasian Maternity Outcomes Surveillance Systems) study. They highlighted that between May 1, 2013 and April 30, 2014 there were 63 cases of confirmed vasa praevia in Australia with 51 (88%) of women diagnosed through ultrasound and five (8%) cases being missed on ultrasound and diagnosed only during labour.[1] In the beginning of 2018 two patients presented to our institution in their third trimester with antepartum haemorrhage. Both women were diagnosed with vasa praevia which had not been detected at their mid trimester ultrasound performed elsewhere. This experience of cases missed by ultrasound prompted us to perform a survey to try and identify factors which might explain why vasa praevia is sometimes not diagnosed in the mid trimester ultrasound.

Vasa praevia is a silent condition with potentially fatal consequences for the fetus. It is defined as fetal vessels (unsupported by either the Wharton's jelly in the umbilical cord or placental tissue) that run through

TABLE 1 RANZCOG recommendations relevant to vasa praevia detection in mid-trimester ultrasound[7]

Recommendation	Summary
1	Diagnosing vasa praevia prenatally is associated with significant reduction in perinatal mortality and morbidity.
2	Transvaginal ultrasound using colour and pulse-wave Doppler to evaluate the internal os and the lower uterine segment is the most accurate means to diagnose vasa praevia.
3	Vasa praevia should be diagnosed when there is a fetal vessel either covering or located within 2 cm from the internal OS.
4	Universal screening of singleton pregnancies with transvaginal ultrasound is not recommended.
5	Where possible, universal screening at the routine mid trimester scan to locate the placental cord insertion using transabdominal ultrasound and colour Doppler is recommended.
6	The presence of a velamentous cord insertion, succenturiate lobe or other risk factors associated with vasa praevia at the mid-trimester scan should prompt further evaluation by appropriate trained personnel that may include a transvaginal ultrasound.

Abbreviation: RANZCOG, Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

the amniotic membranes in close proximity to or overlying the cervix.[1–4] The estimated incidence of vasa praevia is 1:1250 – 1:4667 pregnancies.[1–3,5] Vasa praevia has a high perinatal mortality rate of up to 56% if not detected prenatally and appropriate care not instituted.[1,3,4] This is due to the risk of unprotected fetal vessels shearing at the time of membrane rupture causing rapid fetal exsanguination.[1,7]

Vasa praevia is characterised into two types based on its pathological appearance: Type I is a single-lobed placenta with a velamentous cord insertion that runs over or near the cervical IOS. Type II is a placenta with a succenturiate lobe and the intramembranous vessels connecting the two placental components cross over or near the cervical IOS.[4,5] In 2012 (reviewed 2016) RANZCOG published the vasa praevia statement.[7] This statement made 10 recommendations on vasa praevia based on imaging findings, clinical diagnosis and patient management. Recommendations 1 to 6 are applicable to imaging in the mid trimester ultrasound (Table 1).

2 | METHODS

The authors conducted an e-mail–based survey of Australian sonographers using the Survey Monkey® between August and September 2018. The survey was developed by two sonographers and reviewed within the authors institution by a consultant sonologist and a consultant radiologist. The survey comprised of seven questions that covered four areas of ultrasound practice relevant to vasa praevia diagnosis in the mid-trimester ultrasound. The survey was approved on the 18th June 2018 by the Mercy Health Human Research Ethics Committee (Ref 2018-031) and distributed through the Australian Sonography Association Registry (ASAR) to sonographers registered to participate in their facilitated research projects. The survey accompanied an e-mail outlining the study aims, ensuring anonymity, and consent was achieved through participation.

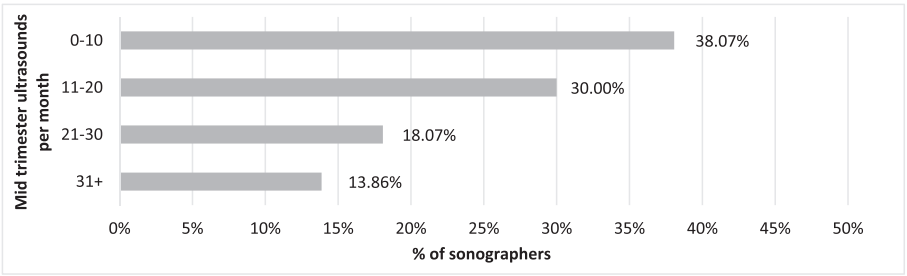

FIGURE 1 Number of mid-trimester ultrasounds performed per month by surveyed participants

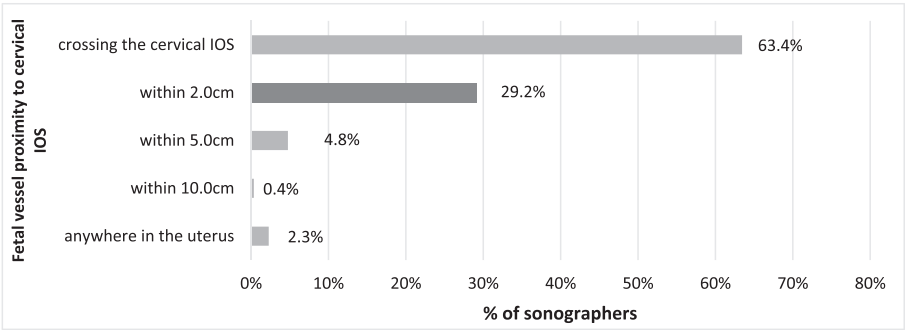

FIGURE 2 Surveyed participants definition of vasa praevia

The survey was e-mailed to 4868 sonographers; of this, 3522 were qualified to perform obstetric ultrasounds. The authors received 577 responses within 4 weeks, a response rate of 16%. This appears low, but only sonographers with regular obstetric practice were requested to complete the survey. The participating sonographers had a varied range of mid trimester experience per month as shown in Figure 1.

3 | RESULTS

To establish sonographers definition of vasa praevia participants were asked if a fetal vessel was observed in the lower uterine segment, at what distance from the cervical IOS does it need to be to diagnose vasa praevia. Participants were asked to choose one of five options that they thought was correct (Figure 2).

To ascertain when do sonographers assess the lower uterine segment transabdominally with colour Doppler in the mid trimester scan, participants selected a response applicable to their practice (Figure 3).

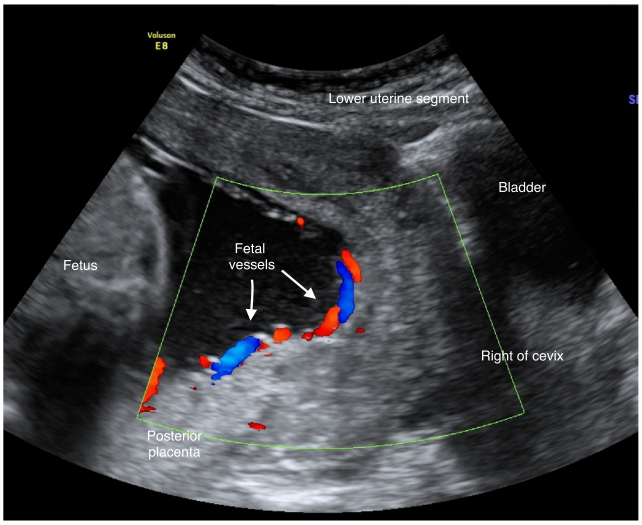

FIGURE 6 Sagittal transabdominal colour Doppler image in the lower uterine segment at the mid trimester scan showing fetal vessels located to right of the cervix (arrows)

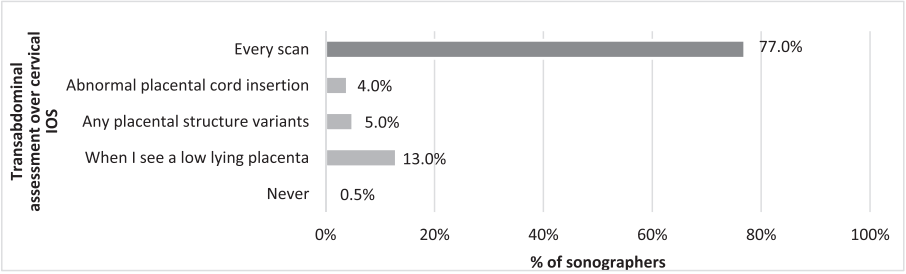

FIGURE 3 Transabdominal assessment of the lower uterine segment with colour Doppler

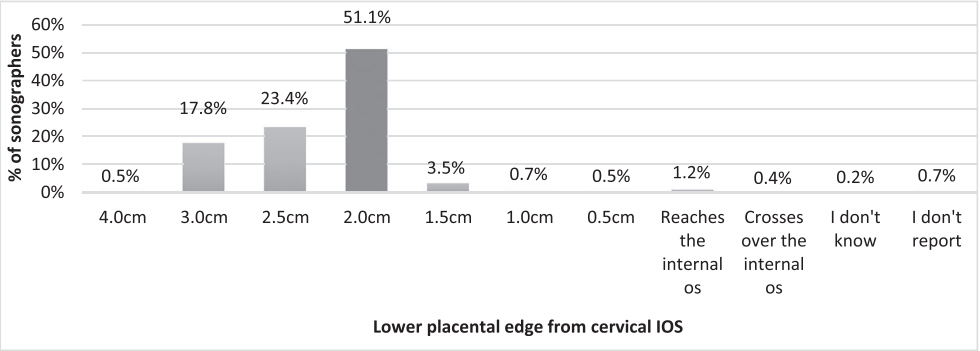

FIGURE 4 Numerical value sonographers use to define low-lying placenta

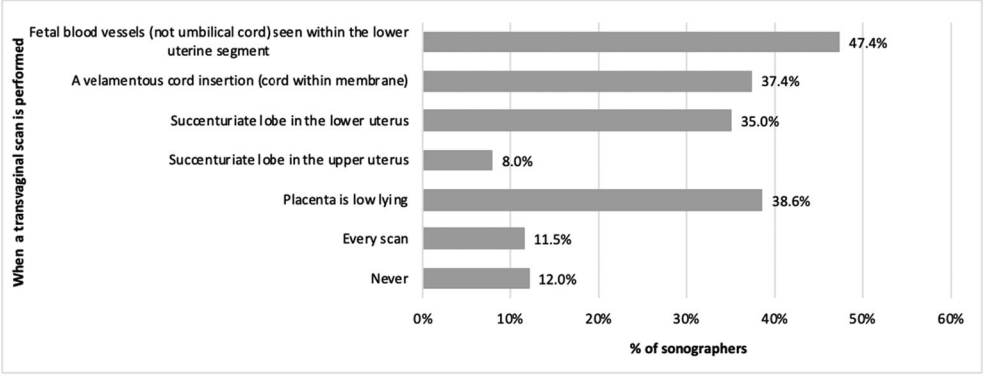

FIGURE 5 Vasa praevia risk factors in the mid trimester scan that prompt participant to proceed to a transvaginal scan

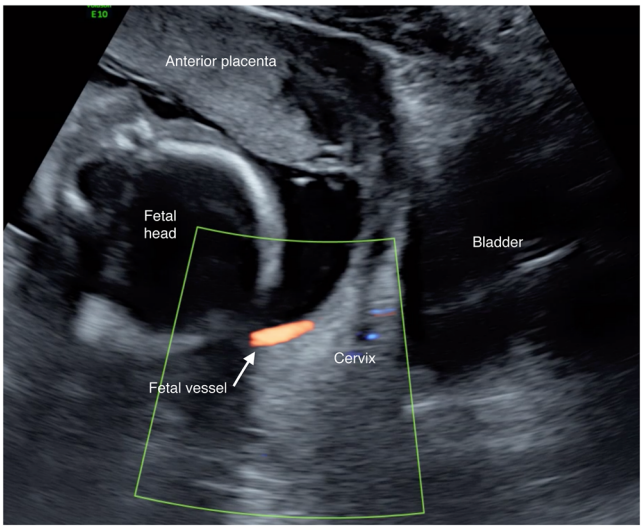

FIGURE 7 Sagittal transabdominal colour Doppler image in the lower uterine segment at the mid trimester scan showing a fetal vessel lying over the cervical internal os

Participants were asked about other structures aside from the fetus they examined in the mid-trimester ultrasound. 87% of sonographers identify the placental cord insertion; 97% identify placental structural variants, and 99% measure the distance of the lower placental edge to the cervical IOS. Participants were asked what numerical measurement they use to define a low-lying placenta (Figure 4).

Sonographers were asked to specify what associated vasa praevia risk factors seen transabdominally would prompt them to proceed to a transvaginal scan. The question listed risk factors and sonographers selected a response applicable to their practise (Figure 5).

4 | DISCUSSION

RANZCOG recommendation three defines vasa praevia as fetal vessels that run through bare membranes that lie on or are within 20 mm of the cervical IOS[4,7,8] (Table 1). In the survey, only 29% of sonographers used this definition (Figure 2) indicating an unfamiliarity of the threshold measurement recommended in the literature to quantify a vasa praevia.

The systematic review by Ruiter et al[9] demonstrated 83% of vasa praevia cases had one or more clinical risk factors, highlighting that occasionally, a vasa praevia case will have no detectable risk factors. Screening every woman in the mid-trimester ultrasound transabdominally over the lower uterine segment with colour Doppler should improve the detection in these cases (Figures 6 and 7).[2,10]

The prevalence of velamentous cord insertion is the most common cause of vasa praevia and occurs in 1:100 singleton pregnancies.[7,11–13] The number of women with a velamentous cord insertion that will have a vasa praevia has been reported high as 1 in every 13.[9] RANZCOG recommendation five advises identifying the placental cord insertion transabdominally with colour Doppler in every mid-trimester ultrasound (Table 1).[7] In the survey, 13% of participants do not follow the recommendation, potentially missing a velamentous cord insertion. If a velamentous cord insertion is identified in the mid-trimester ultrasound, the sonographer should proceed to a transvaginal scan regardless of its location in the uterus. This is due to the vascular architecture between the umbilical cord and placenta insertion having multiple communicating vessels that can potentially take a long and circuitous route (Figure 8).

Another risk factor for vasa praevia is a succenturiate lobe placenta, this is due to the unsupported communicating vessels between

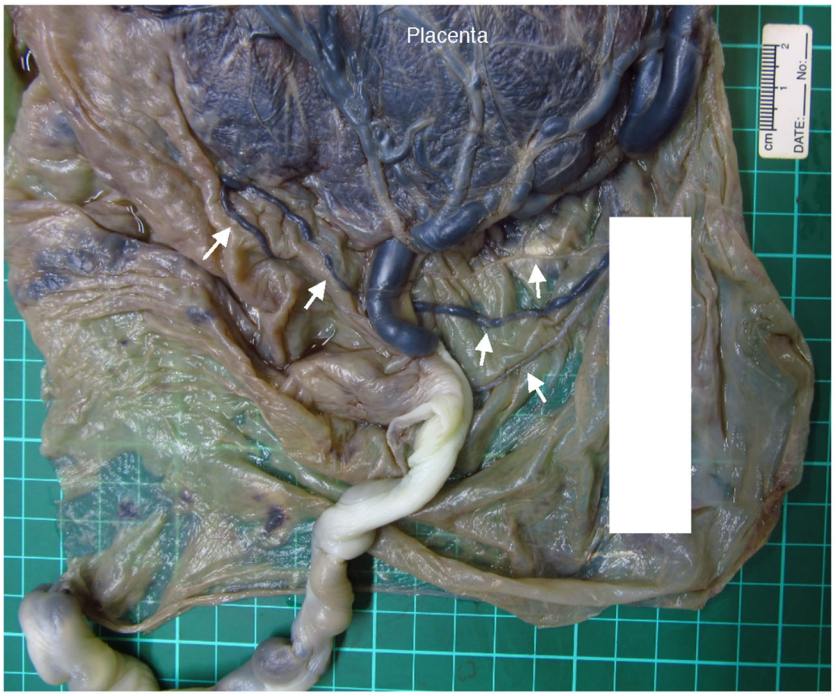

FIGURE 8 Macroscopic pathology specimen of a velamentous cord insertion with multiple small unsupported vessels connecting the umbilical cord to the placenta cord insertion (arrows)

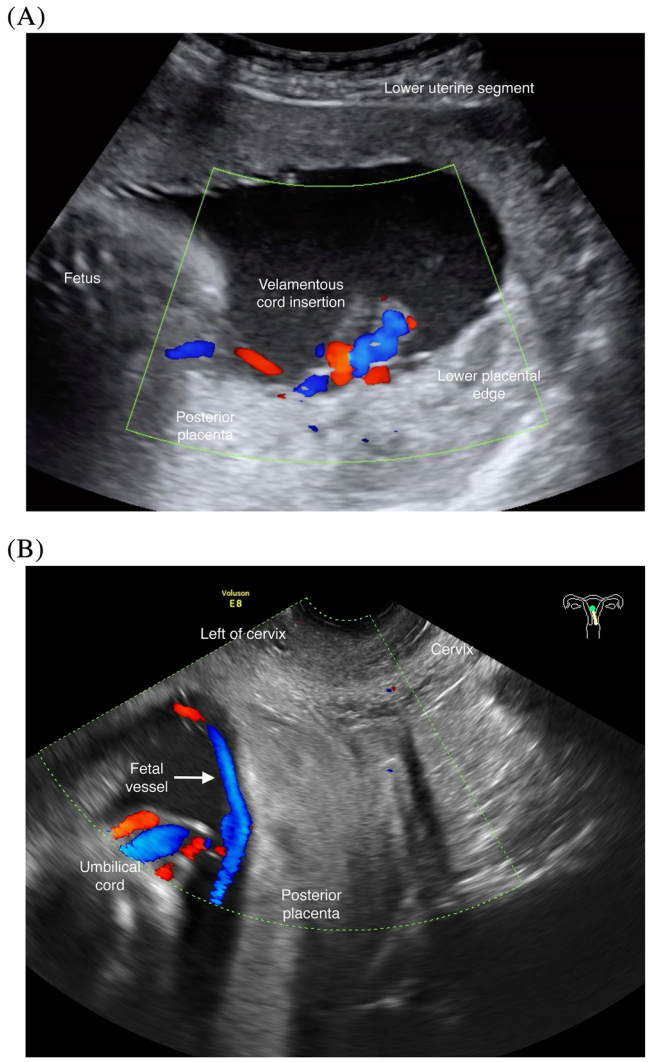

FIGURE 9 Posterior placenta with a velamentous cord insertion in the lower uterine segment at the mid trimester ultrasound. Images (A) demonstrates the velamentous cord insertion transabdominally. Image (B) is a sagittal transvaginal image showing an unsupported fetal vessel in close proximity to the cervical IOS (arrow)

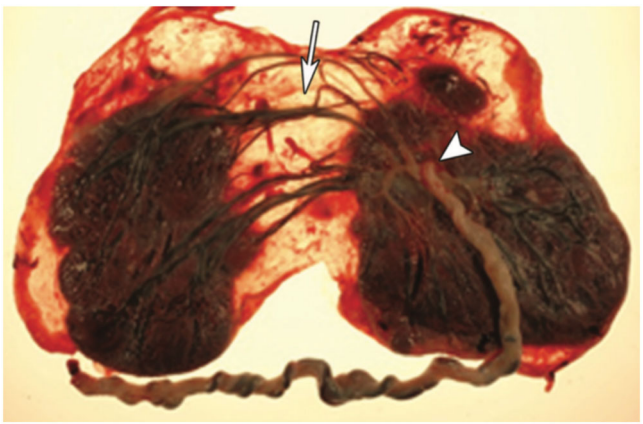

FIGURE 10 Macroscopic placenta specimen of a succenturiate lobe placenta with multiple unsupported vessels connecting the two lobes[13]

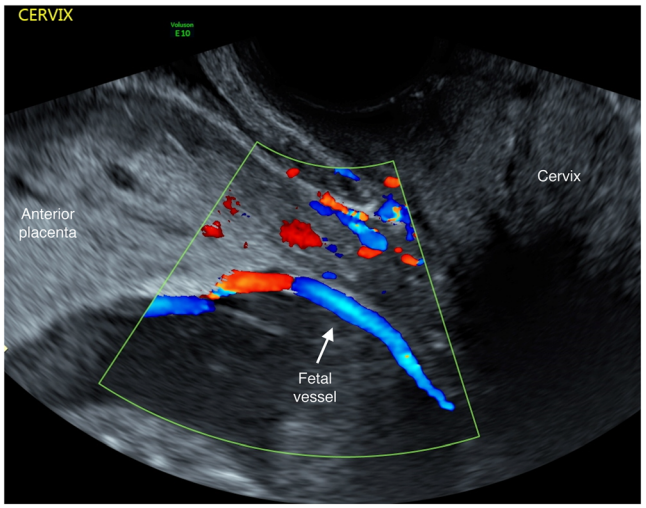

FIGURE 11 Sagittal transvaginal image in the mid trimester ultrasound demonstrating an anterior placenta with a posterior succenturiate lobe (not in image) and the unsupported connecting vessels crossing over the cervical IOS (arrow)

the two placental components to course over the cervical IOS.[2,4,7] It has been reported that if a woman has a succenturiate lobe placenta, the risk of vasa praevia is as high as 1 in every 37 cases.[6] A transvaginal scan should be performed regardless of the succenturiate lobe location within the uterus, as it cannot be assumed that there is a single communicating vessel that will take the shortest route to connect the two lobes (Figure 10).

The third risk factor for vasa praevia is a low-lying placenta because of the potential for placental vessels to remain in the lower uterine segment after placental migration and trophotropism in the third trimester (Figure 12 and 13).[2,11] A low-lying placenta in the mid-trimester ultrasound is defined as the lower placental edge being 20 mm or less from the cervical IOS.[2,8,13,15] From the survey, 99% of participants do this measurement; however, there was a disparity in the range of measurements used by sonographers, and only 51% of participants used the commonly accepted measurement (Figure 4). When a low-lying placenta is identified transabdominally, sonographers should proceed to a transvaginal scan to improve diagnostic accuracy of their measurement.[14] A transvaginal scan improves specificity (more selective patient recall in the third trimester) and has a higher negative predictive value (providing better reassurance that the pregnancy will not be complicated by placenta praevia).[14] A followed-up transvaginal ultrasound is recommended between 32–36 weeks to exclude placenta praevia and vasa praevia. [2,4,14]

RANZCOG recommendation six reported that if associated vasa praevia risk factors were present in the mid-trimester ultrasound this should prompt further evaluation that may include a transvaginal ultrasound (Table 1).[7] A transvaginal ultrasound is already a well-established standard of care to assess the cervical length[15,16] and assessing for vasa praevia transvaginally has identical patient preparation and imaging technique. The only difference is the colour box is placed over the lower uterine segment and the transducer is

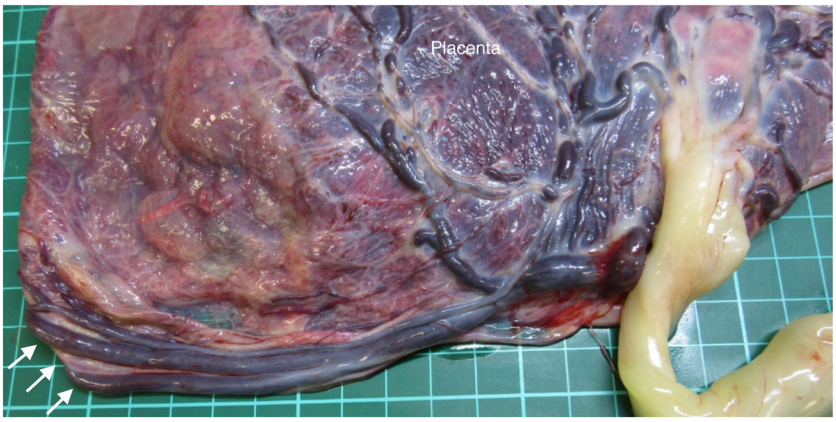

FIGURE 12 Macroscopic placenta specimen with confirmed low lying placenta (minor placenta praevia) at birth. The cervix was confirmed by pathologist to be located at arrows

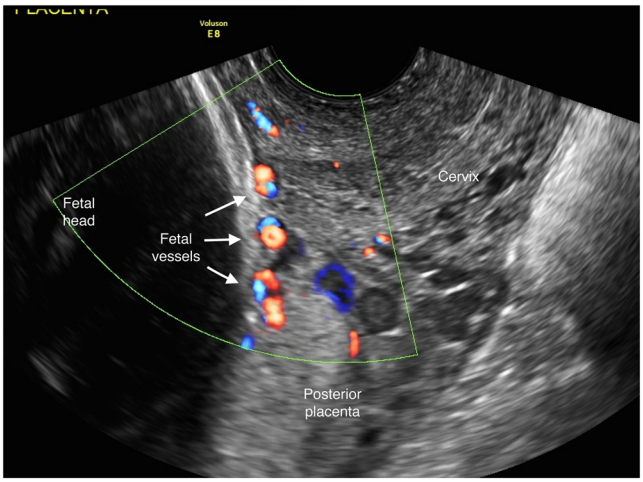

FIGURE 13 Transvaginal scan in the third trimester with low-lying placenta (minor placenta praevia) and vasa praevia (arrows). The placenta reached the cervical internal os in the mid-trimester ultrasound

swept longitudinally and transversely identifying fetal vessels within 20 mm of the cervical IOS[2,17] (Figures 9, 11, 12, and 13). RANZCOG recommendation 2 identifies colour and pulse wave Doppler are the most accurate means to diagnose vasa praevia.[7] Pulse Doppler arterial flow can confirm a vessel is fetal when the Doppler rate approximates the fetal heart rate (Figure 14). If the venous vessel is fetal, there is no phasic change with maternal valsalva or breath hold (Figure 15).

A transvaginal scan is a safe yet invasive investigation and need not be performed at every mid-trimester ultrasound but should be offered to a targeted at-risk group of women (RANZCOG recommendation four).[7,11] The findings of our study demonstrate when a vessel is identified in the lower uterine segment, less than 48% of sonographers proceed to a transvaginal scan, and less than 40% of sonographers do so when vasa praevia risk factors were identified. A lower threshold for performing transvaginal ultrasounds in the mid-trimester ultrasound will improve vasa praevia diagnosis.

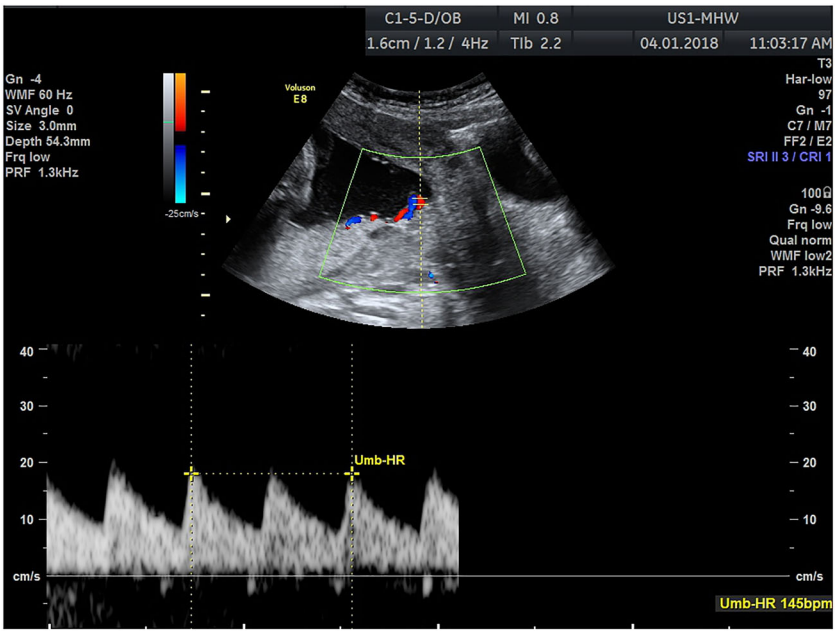

FIGURE 14 Pulse wave Doppler of a vessel in the lower uterine segment confirming fetal origin

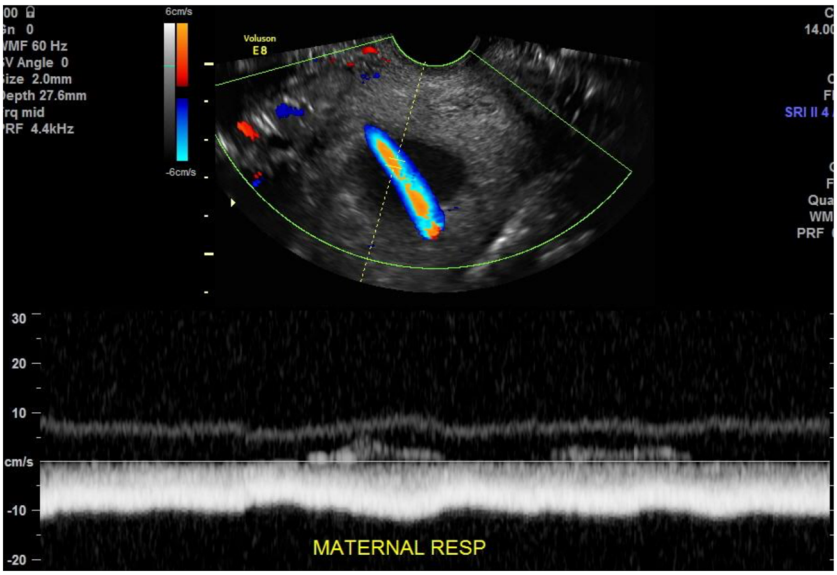

FIGURE 15 Transverse pulse wave Doppler at the cervical internal os of a venous vessel confirming fetal origin because of no phasic change with maternal respiration

5 | CONCLUSION

Improved vasa praevia detection in the mid-trimester ultrasound can be achieved with (a) better knowledge of the definition and (b) familiarity with risk factors (velamentous cord insertion, succenturiate lobe, and low-lying placenta) which can direct sonographers to further investigate with transvaginal colour Doppler ultrasound. Screening all women transabdominally in the lower uterine segment with colour Doppler will help diagnose vasa praevia, particularly in women with no detectable risk factors. RANZCOG recommendation 1 identifies that prenatal diagnosis together with appropriate obstetric care can make a significant difference to perinatal morbidity and mortality outcomes.[7]

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