CME Article

Ultrasonographical features of morbidly-adherent placentas

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ABSTRACT

Morbidly-adherent placentas manifest as placenta accreta, increta or percreta, depending on the depth of placental invasion. These conditions present high risks of severe obstetrical haemorrhage at delivery. The underlying pathology is due to defects in the decidua basalis caused by a variety of insults, such as previous surgery, excessive curettage or infection. The incidence of morbidly-adherent placentas is rising as the frequency of caesarean sections increase. Imaging plays an important role in the antenatal detection of this condition. Based on the case series seen at our local institution, we describe the imaging characteristics of this condition as seen on grayscale ultrasonography, colour/power Doppler ultrasonography, three-dimensional ultrasonography and magnetic resonance imaging.

Keywords: adherent placenta, Doppler ultrasonography, placenta accreta, placenta increta, placenta percreta, ultrasonography

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INTRODUCTION

The incidence of the morbidly-adherent placenta, previously thought to be very uncommon, is rising in contemporary obstetrical practice and obstetricians must be cognizant of this. Massive obstetric haemorrhage, particularly at delivery, is the principal clinical problem; and the condition is associated with a risk of maternal and perinatal mortality of up to 10% of patients.[1] Previously thought to be very rare, the incidence of placenta accreta has increased ten-fold in the past 50 years and now occurs with a frequency of one per 2,500 deliveries.[2] More worrying is the rising incidence of more severe manifestations of placenta percreta, in which the trophoblast has invaded beyond the confines of the entire myometrium to breach the uterine serosa and penetrate the surrounding organs, most usually the bladder. This trend is attributed to rising caesarean section rates, although the condition is also seen in the context of previous myomectomies, and previous uterine curettage for pregnancy terminations or evacuations associated with trauma or infection. Successful management of this potentially catastrophic condition requires early antenatal diagnosis, and referral to a tertiary institution where multidisciplinary expertise in perinatology, anaesthesia, diagnostic radiology, haematology and blood transfusion services are available. There is therefore a need for reliable antenatal diagnoses, since such a condition, when encountered unexpectedly at delivery, will invariably lead to massive blood loss, multiple complications such as adult respiratory distress syndrome, Sheehan's syndrome, renal failure and death.

AETIOLOGY AND RISK FACTORS

The exact aetiology is unknown, but it has been postulated to be related to damage of the decidua basalis, which allows for placental invasion into the myometrium. The barrier function of the decidua is absent in this scenario, and the invasive trophoblasts may invade the myometrium to varying depths, from the most superficial (placenta accreta) to deeper myometrial invasion (placenta increta), with breaching of the uterine serosa and possibly invasion into adjacent organs. There are several risk factors and they include placenta previa with or without previous uterine surgery, prior myomectomy, prior caesarean section, Asherman's syndrome, submucous fibroids and maternal age older than 35 years.[2] In women with placenta previa, the risk of placenta accreta varies from 2% in women younger than 35 years old with no previous caesarean section to 39% in women at or over 35 years of age with two or more caesarean sections.[3] In women with placenta previa, previous caesarean section and advanced maternal age are independent risk factors.[3] In the presence of these risk factors, the obstetrician must have a high index of suspicion for placenta accreta and take appropriate precautions. In particular, this condition must be included in the differential diagnosis in women with previous caesarean sections and anterior low-lying placentas.

ULTRASONOGRAPHICAL FEATURES

The diagnosis of placenta accreta can be difficult but is possible using grayscale ultrasonography (US) and colour Doppler US. US is a very useful tool in screening for placenta previa accreta. It was reported that grayscale

ultrasound had a sensitivity of 93% and a specificity of 79% in the diagnosis of placenta accreta.[4] Two-dimensional (2D) colour Doppler US has a sensitivity of between 82.4% and 100%, and a specificity of between 92% and 96.8%.[5] Diagnostic criteria that suggested placenta accreta, increta, or percreta included ≥ 1 of the following situations:

(a) placental lacunae

(b) obliteration of clear space

(c) interruption of bladder border

(d) myometrium of less than 1 mm.

Placental lacunae

The visualisation of placenta lacunae, defined as multiple linear, irregular vascular spaces within the placenta has been found to be predictive of placenta accreta. It has been shown to have the highest sensitivity to detect placenta accreta among the other diagnostic features. It has a sensitivity of 79% when the ultrasonography is done in the 15–20 week gestation period and a sensitivity of 93% in the 15–40 week gestation period.[6] These placental lakes need not necessarily be in the area of invasion,[3,6] and the likelihood of placenta accreta increases with the number of lacunae.[3] They give the placenta a "moth-eaten" appearance and usually have turbulent flows within them. They also appear irregular and more linear rather than rounded and smooth bordered. They do not have the highly echogenic borders that standard venous sinuses have (Fig. 1).

Obliteration of clear space

Obliteration of clear space is defined as the obliteration of any part of the echolucent area located between the uterus and the placenta. This area is usually seen from week 12 and is thought to correspond to the dilated vessels of the decidua basalis. Since the decidua basalis is absent in the placenta accreta, it has been suggested that the absence of this line predicts placenta accreta. This feature was quoted to have a poor sensitivity of only 7% as an isolated finding.[3,6] However, if used in conjunction with other ultrasonographical features, its sensitivity improved to 57% (between 15–20 weeks gestation) to 80% (between 15–40 weeks gestation).[6] Callen and Filly reported that out of 27 patients with a retroplacental clear space, none had placenta percreta,[7] again emphasising its poor sensitivity (Fig. 2).

Interruption of the bladder border

When interruption of the posterior bladder wall-uterine interface occurs, the usually continuous echolucent line appears instead, as a series of dashes. This can give an appearance of intermittent interruptions of the bladder wall-uterine interface or an impression that the bladder wall is bulging into the uterine wall. This feature is a specific sign

Fig. 1 US images (a,b) show a "moth-eaten" placenta, with lacunae within the placenta.

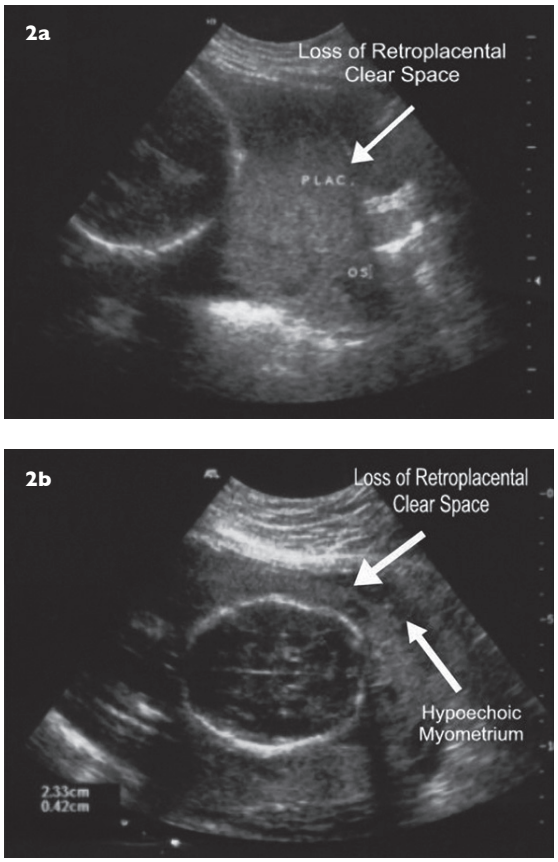


Fig. 2 US images (a, b) show obliteration of the clear space.

for placenta accreta but with poor sensitivity.[3,6] However, bulging is not specific for placenta percreta involving the bladder. Thus, it appears that bulging of the bladder wall may indicate accreta but does not diagnose percreta (Fig. 3).

Thin myometrium

In patients who had a previous caesarean delivery and a low-lying anterior placenta, the lower uterine segment has been measured, and it was found that all patients with placenta accreta had a myometrium of less than 1 mm.[8] This was shown to be as predictive for morbidly-adherent placenta as placental lacunae[3] (Figs. 4 & 5).

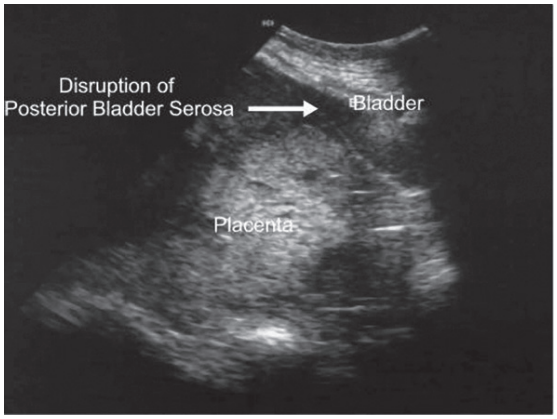


Fig. 3 US image shows disruption of the posterior bladder wall-uterine interface.

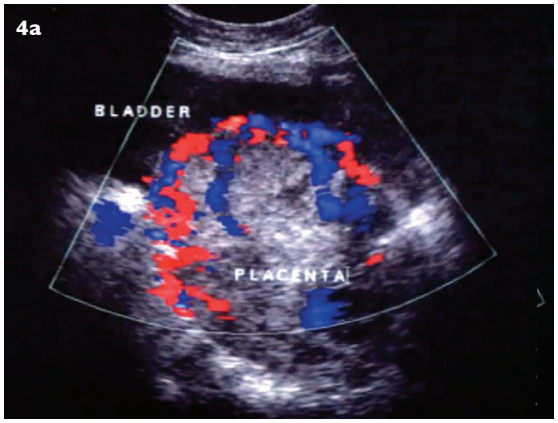
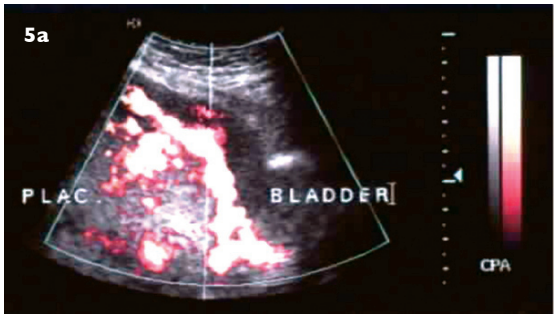


Fig. 4 Colour Doppler US images (a,b) show large vessels at the bladder base, which cross the placenta.

COLOUR/POWER DOPPLER ULTRASONOGRAPHY

The reported sensitivity of 2D colour Doppler ultrasonography in diagnosing placenta previa accreta has ranged between 82% and 100%, and the specificity between 92% and 97%.[5] It was found that turbulent blood flow extending from the placenta into the surrounding tissues was very sensitive. Colour Doppler ultrasonography appears to be more informative than power Doppler ultrasonography, as it is able to display the velocity and nature of the flow. High velocity and turbulent flow are always associated with placenta accreta. The placental vessels are usually large and this can only be picked up by using colour Doppler rather than power Doppler ultrasonography. Levine et al also found that power Doppler ultrasonography did not improve the diagnosis of placenta accreta.[9] Although the use of colour enhances the appearance of these vascular spaces, it has been shown that grayscale images appear to be as effective. It has been found that colour Doppler ultrasonography does not add any additional information that could already be obtained from grayscale ultrasonography.[9]



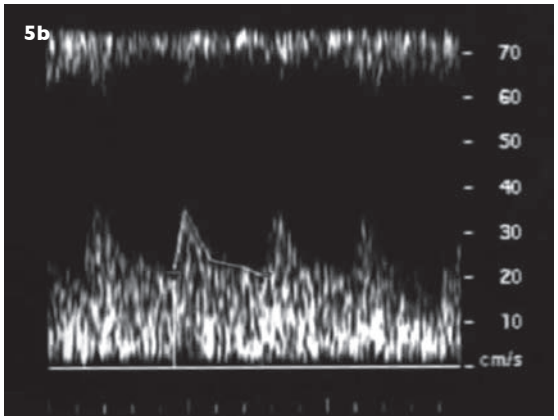


Fig. 5 (a) Spectral and (b) power Doppler US images of a vessel exhibiting high velocity and low impedance flow.

3D COLOUR POWER DOPPLER ULTRASONOGRAPHY

Colour power Doppler ultrasonography has been described to assess the uteroplacental neovascularisation as well as to depict the abnormal angioarchitecture in placenta previa percreta.[5,10] The multiplanar image display permitted by this modality allows the demonstration of aberrant vessels protruding into the bladder and is believed to be indicative of placental invasion of the bladder.[11] It helps to characterise the exact site, extent of involvement and depth of invasion by aberrant vessels over the uterine serosa-bladder junctional region.[5,10] Hence, 3D imaging provides an adjunct to existing grayscale technology, while 2D colour Doppler ultrasonography provides additional information regarding the pathology.

OTHER IMAGING MODALITIES

Ultrasonography may be limited in detecting the more severe implantation anomalies, specifically in its ability to evaluate the degree of extrauterine involvement in placenta percreta. The degree of invasiveness will alter the treatment plan; and magnetic resonance (MR) imaging, due to its better inherent contrast, is better able to exhibit this feature.[12] However, there are no studies to compare ultrasonography with MR imaging. A point to note is the most common site for placenta accreta is anterior at the lower uterine segment. This allows a high frequency ultrasound transducer to evaluate this area with optimal resolution, due to its superficial location. When the abnormality is located further away, as in posterior or fundal accreta, or when patient is obese, the resolution will be poor. MR imaging, will be a better modality for antenatal diagnosis.[12]

CONCLUSION

There is no one imaging modality that provides the gold standard for diagnosing placental invasion. A high index of clinical suspicion is required for its detection in high risk patients. In contemporary obstetrical practice, this applies to patients with previous caesarean sections, and especially if there is a coexisting anterior low-lying placenta. A probable case of morbidly-adherent placenta will benefit from preoperative multidisciplinary input and perioperative measures in preparation for an elective planned delivery. Similar to so many other obstetrical emergencies, to be forewarned is to be forearmed.

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200709A)

	True	False
Question 1. Morbidly-adherent placenta:		
(a) Is rising in incidence in current obstetrical practice.	☐	☐
(b) Is associated with significant risk of maternal and perinatal mortality.	☐	☐
(c) Is always seen in the context of a previous caesarean section.	☐	☐
(d) Is often associated with placenta previa.	☐	☐
Question 2. The following are diagnostic criteria for morbidly-adherent placenta:		
(a) Placenta previa.	☐	☐
(b) Placental lacunae.	☐	☐
(c) Myometrium less than 1 mm.	☐	☐
(d) Interruption of the bladder border.	☐	☐
Question 3. The diagnosis of morbidly-adherent placenta:		
(a) Requires a high index of clinical suspicion.	☐	☐
(b) 2D colour Doppler ultrasonography is of little use.	☐	☐
(c) There is good evidence that MR imaging is superior.	☐	☐
(d) Can be made as early as 15 weeks gestation.	☐	☐
Question 4. The aetiology of and risk factors for morbidly-adherent placenta:		
(a) Is related to the damage of the decidua basalis.	☐	☐
(b) Include previous terminations of pregnancy.	☐	☐
(c) Is related to trophoblastic invasion of uterine myometrium.	☐	☐
(d) Include submucous fibroids.	☐	☐
Question 5. Placenta lacunae seen on grayscale ultrasonography:		
(a) Is predictive of placenta accreta.	☐	☐
(b) Represent areas of trophoblastic invasion.	☐	☐
(c) The number seen on ultrasound increases the likelihood of placenta accreta.	☐	☐
(d) Have sluggish blood flow within them.	☐	☐

Doctor's particulars:

Name in full: _____

MCR number: _____ Specialty: _____

Email address: _____

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(1) Answers will be published in the SMJ November 2007 issue. (2) The MCR numbers of successful candidates will be posted online at **www.sma.org.sg/cme/smj** by 15 November 2007. (3) All online submissions will receive an automatic email acknowledgment. (4) Passing mark is 60%. No mark will be deducted for incorrect answers. (5) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.

Deadline for submission: (September 2007 SMJ 3B CME programme): 12 noon, 25 October 2007