The Egyptian Journal of Radiology and Nuclear Medicine (2016) 47, 1111–1115

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

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www.sciencedirect.com

ORIGINAL ARTICLE

Gray scale and Doppler ultrasound in placenta accreta: Optimization of ultrasound signs

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Received 13 January 2016; accepted 5 April 2016
Available online 25 April 2016

KEYWORDS

US;
Doppler;
Placenta accreta;
Placental lacunae

Abstract *Aim of work:* To optimize ultrasound and Doppler signs in placenta accreta, and to clarify sensitivity and specificity.
Patients & methods: This study included 50 pregnant women. The examinations were done in private center from January 2013 to November 2013. Patients have anterior low lying placenta or anterior placenta previa with history of previous CS. US was done using curvilinear or endovaginal transducer at frequency 3–5 MHz and 3–9 MHz.
Results: This study included 50 pregnants with mean age of 29.92 y. Placental lacunae, loss of retroplacental space, retroplacental myometrial thickness, echogenic bladder wall (hyperechoic uterine serosato–bladder interface) and Doppler criteria were evaluated. Of 18 cases having placenta accreta, 16 (88.9%) had placental lacunae with Doppler abnormality. *P* values for the above mentioned US signs were <0.001(HS), 0.006(S), <0.001(HS), 0.019(HS). Placental lacunae were found in 16 of 18 women with placenta accreta with sensitivity of 89%, specificity of 81%, 73% positive predictive value and 93% negative predictive value. Placental lacunae were found in 6 women (18.8%) with no placenta accreta.
Conclusion: Ultrasound and Doppler examinations of placenta have signs highly suggestive of placenta accreta due to high sensitivity and specificity with placental lacunae of turbulent flow and retro-placental myometrial thickness $\leqslant 1$ mm are of the highest specificity.

1. Introduction

The placenta is often overlooked in the routine evaluation of a normal gestation, receiving attention only when an abnormality is detected. Although uncommon, abnormalities of the placenta are important to recognize owing to the potential for maternal and fetal morbidity and mortality (1).

Placenta accreta occurs when the chorionic villi invade the myometrium abnormally. It is divided into three grades based on histopathology: placenta accreta where the chorionic villi are in contact with the myometrium, placenta increta where the chorionic villi invade the myometrium, and

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Peer review under responsibility of The Egyptian Society of Radiology and Nuclear Medicine.

http://dx.doi.org/10.1016/j.ejrnm.2016.04.010

placenta percreta where the chorionic villi penetrate the uterine serosa (2).

Risk factors for placental attachment disorders (PAD) have been clearly documented—placenta previa, previous Cesarean section and age are the most common. More infrequent risk factors are Asherman syndrome and endometrial ablation. An increase has also been seen in in vitro fertilization pregnancies (3). The risk of placenta accreta is 24% in women with placenta previa and one prior Cesarean delivery and 67% in women with placenta previa and three or more prior Cesarean deliveries (4).

The exact pathogenesis of placenta accreta is unknown. A proposed hypothesis includes a maldevelopment of decidua, excessive trophoblastic invasion, or a combination of both. Defective decidualization, abnormal maternal vascular remodeling, excessive trophoblastic invasion, or combinations are considered to be the consequences of previous instrumentation (5).

Clinically, hypertrophied disorganized uteroplacental vascularity in patients with placenta accreta creates a risk of massive intrapartum hemorrhage. Other maternal complications of placenta accreta include disseminated intravascular coagulation, damage to the ureters or bladder, sepsis, and deep venous thrombosis. Patients with placenta accreta usually deliver by Cesarean section at 34–35 weeks after fetal lung maturity has been documented. Cesarean delivery is carefully planned with arrangements for possible multiple intraoperative transfusions and multispecialty consultations including interventional radiologists and experienced surgeons (6).

Second and third trimester gray-scale sonographic characteristics include loss of continuity of the uterine wall, multiple vascular lacunae (irregular vascular spaces) within placenta, giving "Swiss cheese" appearance adjacent to the placental implantation site, lack of a hypoechoic border (myometrial zone) between the placenta and the myometrium, bulging of the placental/myometrial site into the bladder, and increased vasculature evident on color Doppler sonography (7).

2. Patients and methods

2.1. Patients

This study included 50 pregnant women. The examination was done in private center from January 2013 to November 2013. The range of age was from 20 to 37 year (with mean age = 29.92 SD ± 3.99). All patients have anterior low lying placenta or anterior placenta previa with history of previous Cesarean section.

2.2. Methods

Ultrasound was done by ultrasound machines using the curvilinear transducer (at frequency 3–5 MHz) or endovaginal transducer (at frequency 3–9 MHz). The lower uterine segment is evaluated using the highest-frequency transducer that can produce an adequate image, which is often a 5-MHz transducer. Transabdominal imaging is performed with the patient's bladder full. Transvaginal US is always performed when the placenta is low lying or placenta previa is present. The placenta was assessed for the following:

1. Placental lacunae: The lacunae are assessed for the number, the site whether near or away from the myometrium, the shape (irregular, linear or round), the borders (echogenic or non-echogenic i.e. distinct or indistinct) and Doppler study (turbulent or non-turbulent flow).
2. Retroplacental space, whether present or absent.
3. Retroplacental myometrial thickness: is measured in millimeter.
4. The bladder wall (hyperechoic uterine serosa-to-bladder interface): is assessed for smooth echogenic appearance or interrupted and focal bulge anteriorly.
5. Color Doppler study of the placenta:

– The placental lacunae (turbulent, tornado sign or non-turbulent).
– Increased peri-uterine vascularity between uterus and urinary bladder.

2.3. Statistical analysis

Results were collected, tabulated, and statistically analyzed by IBM personal computer and statistical package SPSS version 20. Two types of statistics were done:

1. Descriptive: e.g. percentage (%), mean.
2. Analytical:-

(A) Sensitivity or true positive rate (TPR) = True +ve/(True +ve + False −ve).
(B) Specificity (SPC) or True Negative Rate = True −ve/(True −ve + False +ve) = 1 − False +ve rate.
(C) Positive predictive value (PPV): True +ve/(True +ve + False +ve).
(D) Negative predictive value (NPV): True −ve/(True −ve + False −ve).
(E) *P* value.

- Significant difference if $P < 0.05$.
- Non-significant difference if $P > 0.05$.
- Highly significant difference if $P < 0.001$.

3. Results

This study included 50 pregnant women with a mean age of 29.92 year and age range of 20–37 year. In 18 of the enrolled 50 pregnant woman, placenta accreta was diagnosed by surgical criteria on doing Cesarean section (one case was placenta percreta on laparotomy).

The ultrasound signs namely placental lacunae, loss of retroplacental space, retroplacental myometrial thickness, the echogenic bladder wall (hyperechoic uterine serosa-to-bladder interface) and Doppler criteria were evaluated. Of the 18 cases having placenta accreta, 16 (88.9%) had placental lacunae, 16 (88.9%) had absent retroplacental space, 6 (33.3%) had lost the hyperechoic uterine serosa-to-bladder interface (Fig. 4), and 12 (66.7%) had myometrial thickness less than 1 mm with Doppler abnormality (Figs. 5 and 6). *P* value for the above mentioned US signs was <0.001(HS), 0.006(S), <0.001(HS), and 0.019(HS).