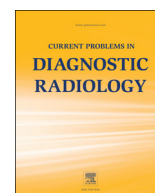




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Perioperative Internal Iliac Artery Balloon Occlusion, In the Setting of Placenta Accreta and Its Variants: The Role of the Interventional Radiologist

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Placenta accreta and its variants (increta and percreta) are conditions of abnormal placentation that are encountered with increasing frequency. The spectrum of placenta accreta (including placenta increta and percreta) involves an abnormal attachment of the placental chorionic villi to the uterine myometrium. This abnormal attachment leads to increased adherence of the placenta to the uterus and abnormal placental-uterine separation at the time of delivery. Placental invasion into, or through the myometrium is associated with increased postpartum morbidity and mortality as a result of uterine hemorrhage during and following cesarean section. A multidisciplinary clinical approach to the treatment of patients with placenta accreta is recommended by the American College of Obstetricians and Gynecologists. As potential members of an interdisciplinary team, interventional radiologists can perform prophylactic internal iliac arterial balloon occlusion as an adjunctive therapy for reducing potentially life-threatening postpartum hemorrhage. The procedure involves placement of a balloon catheter into the internal iliac or common iliac arteries bilaterally prior to cesarean section. Following delivery, and prior to placental separation, the catheter balloons are inflated with a pre-determined volume of saline leading to transient occlusion of the internal iliac arteries and reduced uterine blood flow.

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Introduction

Placenta accrete (PA) and its variants are disorders of abnormal placentation that lead to abnormal postpartum uterine-placental separation. Due to the highly vascular nature of the gravid uterus, the condition is associated with increased maternal morbidity and mortality as a result of postpartum uterine blood loss.

The antepartum diagnosis of PA and variants is based on sonographic or magnetic resonance imaging (MRI) findings that indicate abnormal uterine attachment of or invasion by placental villi. Clinical management of PA and variants typically involves cesarean section at 34 weeks gestation with recruitment of a skilled surgical and anesthesia team to minimize the risk of spontaneous labor.¹ An interdisciplinary approach to clinical management of PA, which can include the interventional radiologist, is recommended by the American College of Obstetricians.¹

The purpose of this article is to review normal and pathological placentation as it relates to PA and variants, provide an overview of diagnosis and clinical significance of PA and variants and to describe the role of prophylactic internal iliac balloon occlusion in achieving homeostasis following cesarean section in the setting of PA and its variants.

Normal Placentation

The development of the placental-uterine interface is a complex process in which placental chorionic villi become associated with the maternal endometrial layer. This process involves the interdigitation of chorionic villi with the endometrial decidua basalis layer for a proper placental association with the maternal circulation.² The indirect interaction between placental vessels and the maternal circulation occurs in the intervillous space, a component of the decidua basalis that contributes maternal uterine tissue for placental formation and serves as portion of the placental-uterine interface.²

In normal placentation, placental chorionic villi are separated from the uterine myometrium by the decidua basalis, as illustrated in [Figures 1 and 2](#). The decidua basalis consists of layers of large lipid and glycogen laden decidual cells. Shearing forces between the placenta and myometrium during uterine contractions allows for an orderly placental-uterine separation during childbirth.

Ultrasound Appearance of Normal Placentation

The appearance of the normal uterine-placental interface is somewhat variable, but typically the placenta is homogeneously hyperechoic (to the uterine myometrium) with a thin hypoechoic rim at the uterine-placental interface known as the retroplacental

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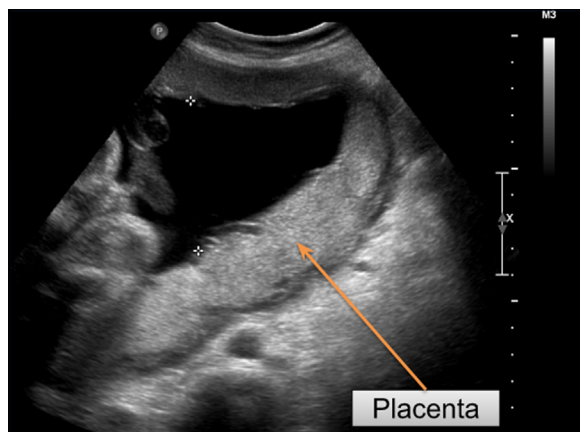


FIG. 1. Transabdominal ultrasound and graphic illustration in a 26-year-old woman demonstrating a normal placenta (arrows) with a preserved retroplacental clear space (arrowheads), which represents subplacental veins that drain placental cotyledons. (Color version of the figure available online.)

clear space, as illustrated in Figures 1 and 2.³ Obliteration of the retroplacental clear space can suggest the loss of an appropriate separation between chorionic villi and the underlying myometrium.

Placenta Accreta and Its Variants, Background

PA and its variants constitute a spectrum of placentation disorders with varying degrees of abnormal attachment of the chorionic villi to the uterine myometrium as illustrated in Figure 3. Placenta accreta is a condition in which chorionic villi are in direct contact with the myometrium without myometrial invasion. Placenta increta involves invasion of the myometrium by chorionic villi, without extension through the uterine serosa. The most severe degree of myometrial invasion occurs with placenta percreta, in which chorionic villi invade through the uterine serosa

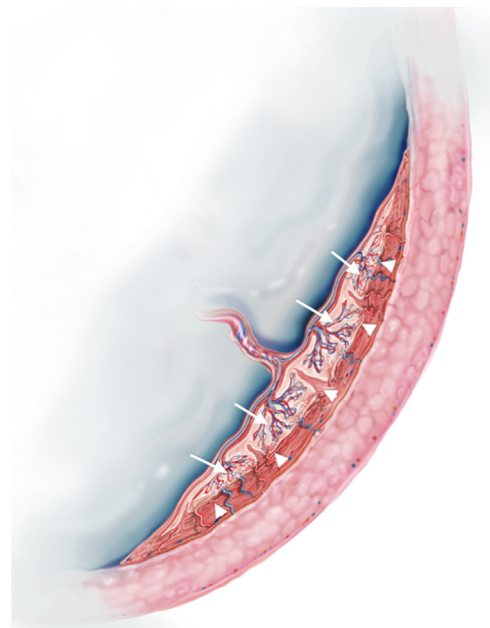


FIG. 2. Transabdominal ultrasound and graphic illustration in a 26-year-old woman demonstrating a normal placenta (arrows) with a preserved retroplacental clear space (arrowheads), which represents subplacental veins that drain placental cotyledons. (Color version of the figure available online.)

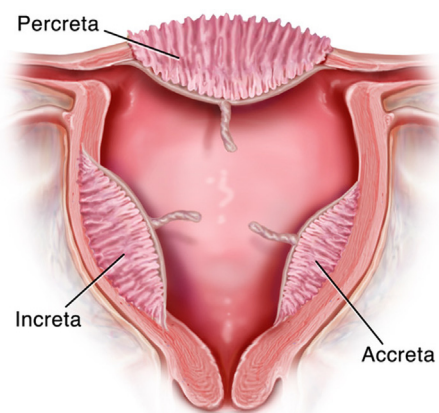


FIG. 3. Graphic illustration of the spectrum of placental abnormalities associated with placenta accreta and its variants. Placenta accreta involves attachment of the placental chorionic villi to the myometrium. Placenta increta results in chorionic villi invading into the myometrium. Placenta percreta involves invasion of chorionic villi through the myometrium with or without invasion of adjacent structures, such as the urinary bladder or colon. (Color version of the figure available online.)

with or without invasion of adjacent organs (most commonly the urinary bladder or colon).

The abnormal attachment of placental villi can lead to abnormal placental-uterine separation following delivery. The zone of separation between the placental chorionic villi and the myometrium is formed by the decidua basalis and, under normal placentation, this separation allows for appropriate postpartum placental detachment from the uterus. PA and its variants cause varying degrees of obliteration of the decidua basalis, leading to increased adherence of the entire placenta or portions of the placenta to the uterine wall.³ The incomplete placental separation can lead to potentially life-threatening maternal hemorrhage requiring hysterectomy. For example, average blood loss at delivery in women with placenta percreta was between 3 and 5 l in one 2014 study from *Clinical Radiology*.⁴ The same study showed that as many as 90% of patients with placenta accreta required blood transfusions and 40% of those patients required more than 10 units of packed red blood cells. A study performed by O'Brien et al⁵ reported mortality rates as high as 7% in patients with placenta percreta.

In addition to life-threatening hemorrhage, postpartum complications of placenta accreta and its variants include disseminated intravascular coagulopathy resulting from hemorrhage, hysterectomy (with its associated complications), adult respiratory distress syndrome, acute transfusion reaction, and renal failure.⁶ In patients requiring hysterectomy to control postpartum hemorrhage, complications include cystotomy (15.4% of cases), pulmonary embolus (2.1%), and ureteral injury (2.1%) with 21% of patients undergoing hysterectomy being admitted to the intensive care unit.⁶

In a 2013 study performed by Fitzpatrick et al⁷ patients with an antenatal diagnosis of placenta increta and percreta had median estimated peripartum blood loss of 2750 ml versus 6100 ml in patients without an antenatal diagnosis. Reduced peripartum hemorrhage reached statistical significance and underscores the importance of antenatal diagnosis by ultrasound or MRI.

Prevalence and Risk Factors

The estimated prevalence of placenta accreta, including increta and percreta, is estimated to be between one in 2500 and one in 500 deliveries according to several studies.^{5,6} The incidence of placenta accreta and its variants has significantly increased from

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