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## The diagnosis and management of morbidly adherent placenta

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## ABSTRACT

The incidence of morbidly adherent placenta (MAP) has risen 13-fold since the early 1900s and is directly correlated with the rising rate of cesarean delivery. It is important for clinicians to screen all pregnancies for MAP at the time of routine second-trimester ultrasonography. In addition, patients with risk factors (e.g., multiple prior cesarean deliveries) should undergo targeted screening for MAP. Optimal maternal and fetal outcomes for these high-risk pregnancies result from accurate prenatal diagnosis and comprehensive multidisciplinary preparation and delivery between 34 and 36 weeks of gestation. There continue to be large knowledge gaps with respect to the optimal management of this condition especially around diagnosis, obstetric care, timing of delivery, and surgical management. Accordingly, most recommendations are based on expert opinion rather than on high-quality evidence. Prospective clinical trials are needed to address knowledge gaps and to continue to improve outcomes.

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### Background

Placenta accreta was first mentioned in the late 1500s by Plater, who tells of a noble lady in 88 AD who delivered, had a retained placenta, and died. On autopsy, the placenta was found to be firmly adhered around the internal os.<sup>1</sup> Morbidly adherent placenta (MAP) is defined as trophoblastic attachment to the myometrium without intervening decidua. It occurs as a consequence of partial or complete absence of the decidua basalis and defective formation of the Nitabuch (fibrinoid) layer. MAP is graded according to the depth of

villous invasion into the myometrium with placenta accreta or vera when the villi adhere to the myometrium without invasion beyond 50% of thickness of the myometrium, placenta increta when the villi invade the myometrium for more than 50% of its thickness, and placenta percreta when the villi penetrate through the uterine serosa.

Historically, the term placenta accreta has been used to refer to the entire spectrum of conditions including accreta, increta, and percreta as well as to cases of clinically apparent morbidly adherent placenta, however use of this term can obscure comparison in research. A review of the literature

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identified marked heterogeneity in the definitions used to identify adherent and invasive placenta. Particularly, the use of "placenta accreta" does not clearly define depth of invasion and may comprise subjects with accreta, increta, and percreta.<sup>2</sup> The authors of this review recommend that placenta accreta be divided into abnormally adherent placenta for the most superficial adherent attachment, such as accreta, and abnormally invasive placenta (AIP) to encompass placenta increta and percreta.

The incidence of MAP appears to be rising dramatically world-wide and is thought to be the result of a similar increase in the rate of cesarean delivery. Because of the relative rarity of MAP before the 1970s, the reported incidence varied, but Breen et al.<sup>3</sup> looked at the average of reports from 1871 to 1972 and found it to be 1 in 7000 deliveries. In the United States, the incidence increased from 1 in 30,000 pregnancies in the 1960s to approximately 1 in 2500 pregnancies in a cohort from 1985 to 1994.<sup>4</sup> This further increased to 1 in 533 pregnancies in a cohort from 1982 to 2002.<sup>5</sup> Other reports note a rate as high as 1 in 300 pregnancies.<sup>6,7</sup> It is important to note that these figures likely represent a high-risk cohort of women identified in tertiary centers, rather than a population that includes low-risk pregnancies. A population-based study in the United Kingdom and a review of a large, multicenter database that included deliveries from both tertiary referral hospitals and community hospitals in the United States independently reported a rate of MAP of 1 in 713 to 1.7 in 10,000 pregnancies.<sup>8,9</sup>

Prior cesarean delivery, especially multiple cesarean deliveries, and placenta previa are major risk factors for MAP.<sup>9-12</sup> Silver et al.<sup>11</sup> reported the risk for the first, second, third, fourth, and fifth or greater cesarean delivery, with previa, to be 3.3%, 11%, 40%, 61%, and 67%. Absent a placenta previa, the risk of MAP remains and rises with an increasing number of cesareans: 0.2% for the first, 2.1% with the fourth, and up to 6.7% with the sixth or greater.<sup>11</sup> It is possible that surgical technique plays a role in the pathophysiology of MAP, because rates vary throughout the world, and some but not all women with risk factors develop the condition. Likewise, placenta previa alone without previous uterine surgery is associated with a 1-4% risk of MAP.<sup>17</sup> Any surgery that damages the endometrium increases the rate of subsequent accreta. Such surgeries may include uterine curettage, myomectomy, pelvic radiation, and endometrial ablation.<sup>13-15</sup> Women with prior endometrial ablation are at particularly high risk for accreta.<sup>16</sup> For every year of age beyond 20, the risk for MAP rises, especially amongst women of advanced maternal age.<sup>17</sup> Other factors associated with MAP include smoking, multiparity, and a short interpregnancy interval following cesarean delivery.<sup>17,18</sup> Esh-Broder et al.<sup>19</sup> observed a 13-fold increased risk of placental invasion in women who underwent in vitro fertilization (IVF) (0.167%) compared with women who became pregnant spontaneously (0.012%). Kaser et al.<sup>20</sup> specifically identified that cryopreserved embryo transfer is a strong independent risk factor for placenta accreta among patients using IVF (adjusted OR = 3.20, 95% CI: 1.14-9.02). Proposed mechanisms include differences in the endometrial environment in women who are subfertile or infertile or changes in the endometrium that are a result of IVF treatment protocols.

## Clinical implications

Morbidly adherent placenta is associated with significant maternal and fetal morbidity and even mortality. Maternal complications are mainly the result of massive hemorrhage. Median estimated blood loss in the setting of MAP ranges from 1500 to 8000 cc. Many women require multiple units of blood and other blood products. The reported median number of units of blood required ranges between 5 and 6 units,<sup>21-25</sup> but cases requiring as many as 90 or more units have been reported. Complications from transfusion of large volumes of crystalloid, blood products, and other volume expanders may also occur. Such complications include dilutional coagulopathy, consumptive coagulopathy, immediate transfusion reactions, transfusion-related acute lung injury (TRALI), transfusion associated cardiopulmonary overload (TACO), acute respiratory distress syndrome, postoperative mechanical ventilation >4 hours, and electrolyte abnormalities.<sup>26</sup> In our series of 130 cases, 14% had transient disseminated intravascular coagulation.

Maternal morbidity is common and 25-50% of patients are admitted to an intensive care unit in the peripartum period.<sup>22,23</sup> Women with MAP have an increased risk of thromboembolism, pneumonia, acute respiratory distress syndrome, pyelonephritis and renal failure, in part due to the length and complexity of surgery, prolonged catheterization, and complications from hemorrhage.<sup>22,27</sup> Infection is also common and may occur in the wound, intraabdominal compartment, or vaginal cuff.<sup>22,28,29</sup> Vesicovaginal fistula is a rare but serious cause of morbidity.<sup>30</sup>

Surgical complications also are common, owing to the frequent need for hysterectomy, which can be technically difficult. The most frequently encountered problem is injury to the bladder. However, it is difficult to assess the true rate of incidental cystotomy, because cystotomy is often performed intentionally to facilitate the surgery and to avoid hemorrhage from invasive placental tissue. In our cohort, we performed intentional cystostomy in 35% of placenta percreta cases, and only 5% of patients had incidental cystostomy.<sup>22,28</sup> Ureteral injury has been reported in 10-15% of patients.<sup>25,26</sup> This risk may be dramatically reduced with the use of preoperative ureteral stent placement, to aid in identification of the ureters, especially if intraabdominal bleeding occurs that obscures visualization of the operative field. Other less common surgical complications include injury to the bowel, large vessels, and pelvic nerves. These are all more likely in cases of placenta percreta compared to cases where invasion does not extend beyond the confines of the uterus.

A subset of women need repeat surgery to control delayed intraabdominal hemorrhage, treat infection, or address an injury to a pelvic structure. Prompt surgical intervention may be necessary to avoid development of hemorrhagic shock and DIC, sepsis, or irreparable damage to injured organs/structures. Although the rate of maternal death has been reported in up to 7% of cases in a single-center study of cases of placenta percreta from 1996,<sup>27</sup> more recent data from large cohort studies suggest that this risk may be much lower.<sup>21-25</sup> This is a reflection of improved antenatal detection, prior

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