Suzanne K. W. Mankowitz
Editor

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ISBN 978-3-319-59679-2 ISBN 978-3-319-59680-8 (eBook)
https://doi.org/10.1007/978-3-319-59680-8

Library of Congress Control Number: 2018951064

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

This book is dedicated in memory of my parents: to my father who taught me the importance of careful analysis, perseverance, and scientific discovery and to my mother whose curiosity and love of ideas live on in me.

With special gratitude to my wonderful children, Benjamin, Zachary, Tamar, and Yaakov, whose support and understanding have made this project possible.

Preface

The goal of this book is to share information on the management of high-risk parturients. This endeavor was inspired by my colleagues at other institutions who informed me that no antepartum consultation service had been established at their hospitals. I recognized an unmet need and felt uniquely qualified to fill it.

I have had the wonderful opportunity to meet many high-risk parturients in our antenatal anesthesiology consultation clinic. Our clinic has proven an essential part in our high-risk parturient care program, and it is the hope of this book that sharing our experience will help other programs.

Some topics are meant to guide management for patients whom we treat daily such as those with obesity. Other topics relate to patients with more obscure diseases that may complicate pregnancy. A few sections address acute diseases that may occur unexpectedly on the labor and delivery floor.

While much of this information can now be readily accessed online, there is a need to consolidate valid, detailed information on these topics in a format easily accessible to practitioners.

For ease of use, these topics have been arranged alphabetically. My hope is that this project will allow residents, fellows, attending anesthesiologists and obstetricians to obtain enough information to develop the best anesthetic plans for our patients, to facilitate informed consent interviews, and to do so quickly and efficiently.

I would like to give special thanks to my section authors for their hard work and dedication to this project and am grateful to my residents and fellows who inspire me every day. I would also like to thank Mr. Kumar Athiappan, my Project Coordinator at Springer, for his patience and guidance on this journey. Most importantly, I would like to thank my children for relinquishing time with me so that I could devote myself to others. Finally, we are deeply saddened by the sudden and untimely loss of Dr. Jerry Green, whose contributions were very much appreciated.

New York, NY, USA — Suzanne K. W. Mankowitz

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Abnormal Placentation

1

Joshua D. Younger and Laurence E. Ring

Background and Epidemiology

Definition

Placenta accreta has been used broadly to describe abnormal placentation with placental invasion into or beyond the myometrium of the uterus. When the placenta implants into the myometrium alone, it is termed *placenta increta*, and when it invades beyond the myometrium into the uterine serosa or even into the adjacent abdominal organs, it is termed *placenta percreta* [1].

Incidence

The incidence of placenta accreta was recorded as 1/4000 in the 1970s and as high as 1/500 in the early 2000s [2]. This steady and steep increase has mirrored the rising cesarean delivery (CD) rate, which has risen from 5% in the 1970s to 30% in the modern day [3].

Risk Factors

1. CD has the greatest association with the risk of accreta; however, others include myomectomies, dilation and curettages, and ablation procedures. Prior uterine surgery or any pathology that has disrupted the uterus's normal architecture also increases risk [1].
2. Placenta previa, an independent risk factor for placenta accreta, is a placenta that occludes the internal cervical os. The risk of accreta is anywhere between 1 and 5% in this population. Patients with a history of prior uterine surgery with a placenta previa are at increased risk of accreta. One study concluded that placenta previa increases the risk of an accreta, correlating with the number of prior CDs. This ranged from 3%, for the first repeat CD, to 67% in a patient undergoing her fifth CD [4] (see Table 1.1).
3. A history of four or fewer CDs, in the absence of previa, imbues a <1% risk of accreta. However, five or more previous CDs increase the risk of accreta to 4.7%. As independent variables, repeat CDs and the presence of placenta previa only marginally increase the risk of an accreta, but when combined, the risk is profoundly increased [5].
4. Maternal age, multiparity, hypertension in pregnancy, and smoking have also been identified as risk factors for accreta. However, their contribution is much less well understood [6–8].

Pathophysiology

1. The pathogenesis of placenta accreta is unknown.
2. It has been suggested that an accreta is a function of maldeveloped decidua, excessive trophoblastic invasion, or both [9].
3. Some have suggested that it is the cytotrophoblast that secretes factors that promote invasion and the decidua plays no role. This theory has been countered by studies showing that the immunophenotype in extravillous trophoblastic placenta accreta and normal placenta is identical, suggesting that overactive trophoblastic tissue is not the reason behind the accreta's formation [10].

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S. K. W. Mankowitz (ed.), *Consults in Obstetric Anesthesiology*, https://doi.org/10.1007/978-3-319-59680-8_1

Table 1.1 Risk of developing placenta accreta in patients is closely related to the presence of placenta previa and the number of previous cesarean deliveries

Number of previous C-sections	Incidence of placenta accreta, placenta previa not present (%)	Incidence of placenta accreta, placenta previa present (%)
0	0.03	3.3
1	0.20	11
2	0.10	40
3	0.80	61
4	0.80	67
5	4.70	67

Adapted from [5]

Diagnosis

1. Definitive diagnosis will only be revealed intraoperatively and with a confirmed pathologic specimen.
2. When high clinical suspicion exists, ultrasound and magnetic resonance imaging (MRI) may be used to assist with the predelivery assessment.
   (a) Ultrasound
   - As the ultrasound has long been in use to assess fetal well-being, it has a proven safety record and is considered the primary modality for investigating an accreta [11].
   - The ultrasound has proven to be 77–87% sensitive and 96–98% specific and is overall considered sufficient to diagnose an accreta [12].
   - When a patient has a known placenta previa, and is therefore at higher risk for an accreta, one may be reluctant to use the transvaginal ultrasound approach. However, this concern is unfounded and safe use has been reported. The transvaginal approach is one of the best ways to view the uterus's lower uterine segment, which is often the area of prior scarring from prior CDs [11].
   - Classically, a hypoechoic boundary is visualized between the placenta and the bladder. However, irregularly shaped lacunae, thinning of the myometrium, or irregular vascularity at the junction of the uterine serosa and bladder can all be signs of an accreta [13].

   (b) MRI
   - MRI is considered equally accurate when compared to the ultrasound and adds very little to ultrasound's diagnostic accuracy.
   - When the ultrasound is inconclusive, MRI is often used to further characterize the placenta.
   - In the situation of a questionable posterior placenta accreta, MRI may be better suited to evaluate the placenta.
   - Though MRI is a much newer technology than ultrasound, it has gained some favor in the pregnant population. This is due to its avoidance of ionizing radiation. MRI has no known negative effects on the maturing fetus [11].
   - The American College of Obstetricians and Gynecologists ACOG) permits and encourages MRI's use when the benefits seriously outweigh the potential dangers [14].

Preoperative Concerns

Preoperative Consultation

1. As there is a significant increase in morbidity and mortality with an accreta, an anesthesia and surgical consultation is imperative.
2. With an accreta, unlike in a standard CD, clean separation of the placenta from the uterus will not be possible. Remnants of the placenta within the myometrium (and surrounding structures in the event of a percreta) can lead to massive hemorrhage requiring extreme surgical undertakings.
3. Depending on the involvement and depth of invasion, the patient needs to be counseled regarding possible hysterectomy, modes of anesthesia, blood transfusion, and possible postoperative ICU care.
   (a) Surgical Approach
   - While intraoperative findings may alter the surgical plan, it behooves the anesthesiologist to be well informed of the surgical plan at the time of consultation.
   - Depending on the severity of the accreta and local practices, the obstetrician may plan for a uterine-sparing approach, hysterectomy, or an approach which leaves both the uterus and placenta *in situ* with subsequent ablation of the blood supply of the placenta.
   - For any of these approaches, the surgeon may consult with other specialties to facilitate the surgery and reduce overall morbidity and mortality from the procedure.
     – A gynecologic oncologist brings certain surgical expertise that may be required to manage these pregnant patients intraoperatively.
     – Urology may be consulted to provide expertise in protection of the urinary system from inadvertent surgical injury. Due to the possibility of direct injury and anatomic abnormalities in the pelvis, the urology team may choose to place ureteral catheters prior to the CD.
     – Vascular surgery or interventional radiology may be consulted to place uterine artery catheters. In

the event of hemorrhage, these catheters may be used to occlude blood flow to the uterus, or the catheters may be used to direct the embolization of the placenta after the delivery of the fetus.
  - Neonatology may be consulted to determine appropriate timing for delivery of the fetus.

(b) Anesthetic Concerns

- Massive hemorrhage is the major anesthetic concern with placenta accreta. There is a threefold increase in the average blood loss in this population over the blood loss expected in a standard CD [15]. Studies have reported that as many as 90% of accreta patients have received blood transfusion and 40% received over 10 units of blood [16]. Acknowledgment and plans to address this chance of hemorrhage should heavily inform the consultation.
- Anesthetic Type
  - The anesthesiologist, in conjunction with the patient, may elect either the combined spinal-epidural technique or general anesthesia as the anesthetic approach. Both are safe and effective, each conferring unique sets of pros and cons.
  - As these surgeries may be long, and the patient may be subject to multiple procedures on the day of surgery (vascular access and urological intervention as noted above), patient comfort should be a major consideration if selecting neuraxial anesthesia.
  - Neonatal well-being should be a consideration. If the patient is to undergo general anesthesia, time from induction to delivery should be minimized as much as possible.
  - A combined approach of both neuraxial and general anesthesia may be discussed. Neuraxial anesthesia may be employed during all parts of procedures up until the point of delivery, after which the patient may be given general anesthesia for the duration of the surgery. Due to hemodynamic instability that would likely be encountered during massive hemorrhage, this technique is especially valid in the case of hysterectomy [17, 18].
- Monitoring and Access
  - Due to the risk of massive hemorrhage and cardiovascular instability, the patient should be informed that the placement of an arterial line will be undertaken.
  - In addition, good intravenous access is a prerequisite. Based on the extent of placental invasion, as well as local practices, the patient should be informed that one or more of the following techniques will be employed prior to the start of the surgery. All of these techniques may be used after the start of the case in the event of major hemorrhage:
    - Two (or more) large-bore (≥16G) peripheral intravenous lines.
    - One (or more) peripherally placed rapid infusion catheter (8Fr or larger).
    - A multichannel central venous line. Central venous line may placement may be a presurgical requirement if high-dose vasopressor use is expected [19].
- Blood Transfusion
  - As there is a high likelihood of blood transfusion, the anesthesiologist needs to address this possibility with the patient.
  - Given that the need for massive transfusion is a strong possibility, hospital protocols should be in place to ensure that blood products can be delivered efficiently in a swift and sufficient fashion to the operating room. In some centers, this may include autologously donated blood or recipient directed blood donation.
- Postsurgical Care
  - During the consultation, the patient must be prepared for what may be a difficult postoperative course
  - Depending on the operative course, this may include prolonged intubation and recovery in the intensive care unit.
  - Postoperative pain management should be discussed and may encompass a multimodal approach including patient-controlled analgesia (either intravenous or epidural) as well as NSAIDs and field blocks.

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