Cesarean hysterectomy in the parturient with abnormal placentation: evidence based strategy

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Summary

Peripartum hemorrhage still remains a cause of significant maternal morbidity and mortality worldwide. Abnormal placentation is one of the leading causes of peripatum hemorrhage. The incidence of this devastating problem is increasing secondary to the increased incidence of Cesarean section. This review summarizes the prevention, management and treatment of obstetric hemorrhages in parturient with abnormal placentation and highlights recent evidence based advances and developments. *Anestezjologia i Ratownictwo 2009; 3: 296-303.*

Keywords: pregnancy, complications, postpartum bleeding, abnormal placentation, placenta accreta, increta, percreta, previa, bleeding, cesarean section, hysterectomy, obstetric anesthesia, complications

Introduction

Peripartum hemorrhage remains a cause of significant maternal morbidity and mortality worldwide [1-32]. Abnormal placentation is one of the leading causes of peripatum hemorrhage [3-8, 14-32]. The main forms of abnormal placentation include placenta accreta, placenta previa and low-lying placenta. The incidence of abnormal placentation is increasing secondary to the increased incidence of Cesarean section [1-4]. The obstetrician and the obstetric anesthesiologist must know, on-the-spot, how to deal with abnormal placentation-related peripartum bleeding [13].

Incidence

Placenta accreta is an abnormal adherence of the placenta to the uterine wall owing to an absent or faulty decidua basalis. Separation of the placenta accreta from the uterine wall can result in fatal hemorrhage [5,8,10,12].

Association of placenta accreta with other forms of abnormal placentation such as low-lying placenta or placenta previa is common [3,21].

Clark et al. noted that women with placenta previa and an unscarred uterus had a 5% incidence of placenta accreta [3]. The diagnosis of placenta previa and history of four or more previous cesarean sections increased the incidence of placenta accreta to 67% [3,4].

Milosević et al. studied the incidence of abnormal placentation in parturients with history of previous cesarean section [14]. The incidence of placenta previa in the control group (parturient with no history of previous cesarean section) was 0.33%. The incidence of placenta previa was 1.86% after one previous cesarean section (p<0.001), 5.49% after two previous cesarean sections and 14.28% after three previous cesarean sections [14]. The authors concluded that previous cesarean section is an important risk factor for the development of placental complications [14].

Shellhaas et al. studied the frequency, indications, and complications of cesarean hysterectomy (prospective, 2-year observational study at 13 academic medical centers conducted between January 1, 1999,

and December 31, 2000) in all women who underwent a hysterectomy at the time of cesarean delivery [15]. A total of 186 cesarean hysterectomies (0.5%) were performed from a cohort of 39,244 women who underwent cesarean delivery. The leading indications for hysterectomy were placenta accreta (38%) and uterine atony (34%). Of the hysterectomy cases with a diagnosis recorded as accreta, 18% accompanied a primary cesarean delivery, and 82% had a prior procedure (P<.001). Major maternal complications of cesarean hysterectomy included transfusion of red blood cells (84%) and other blood products (34%), fever (11%), subsequent laparotomy (4%), ureteral injury (3%), and death (1.6%). Accreta hysterectomy cases were more likely than atony hysterectomy cases to require ureteral stents (14% compared with 3%, P=.03) and to instill sterile milk into the bladder (23% compared with 8%, P=.02). The authors concluded that despite the use of effective therapies and procedures to control hemorrhage at cesarean delivery, some women continue to require hysterectomy to control hemorrhage from both uterine atony and placenta accreta [15].

Pathophysiology

As one of the leading causes of peripartum hemorrhage placenta accrete involves the attachment of placental villi directly to the myometrium with potentially deeper invasion into the uterine wall or surrounding organs [3,13]. Placenta accreta is further subdivided into placenta accreta vera, placenta increta and placenta percreta, depending on the level of invasion of the uterine wall and surrounding structures [2,3] (Figure 1). Placenta accreta vera is defined as adherence to the surface of the myometrium without evidence of invasion into or through uterine muscle. Placenta increta refers to invasion into the myometrium, and placenta percreta represents invasion to the serosa or other pelvic structures [4-6].

Bahar et al. studied (a retrospective chart review study of 306 women presenting with placenta previa over a 10-year period from January 1996 to December 2005) the risk factors and pregnancy outcome in patients with different types of placenta previa [23]. The overall incidence of placenta previa was 0.73%. Major placenta previa (complete or partial) occurred in 173 women (56.5%) and minor placenta previa (marginal placenta previa or low-lying placenta) in 133 women (43.5%). There were no differences between women with major and minor placenta previa regarding age, parity, and previous miscarriages. Women with major placenta previa had a significantly higher incidence of antepartum hemorrhage (OR 3.18; 95% CI 1.58-6.4, P = 0.001), placenta accreta (OR 3.2; 95% CI 1.22-8.33, P = 0.017), and hysterectomy (OR 5.1; 95% CI 1.31-19.86, P = 0.019). Antepartum hemorrhage in women with placenta previa was associated with premature delivery (OR 14.9; 95% CI 4.9-45.1, P < 0.001). The authors concluded that complete or partial placenta previa is associated with higher morbidity than marginal placenta previa or low-lying placenta [23].
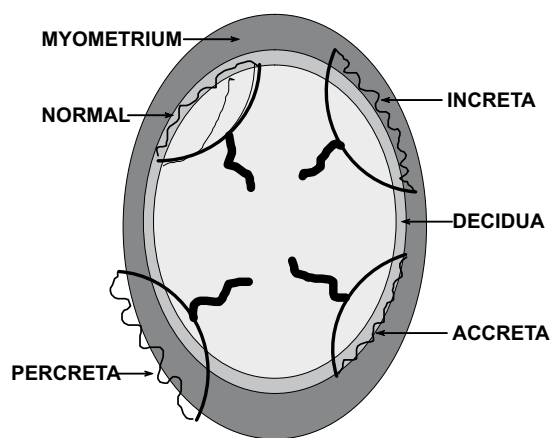

Figure 1.   Placenta accreta (classification)

Diagnosis

Historically placenta accreta was an incidental finding at the time of delivery and was associated with high maternal morbidity and mortality. Consequently, anesthetic management of these patients was usually limited to general anesthesia because of the emergent nature of the surgery, significant intraoperative blood loss, and coagulopathy.

The development of new imaging techniques such as magnetic resonance imaging (MRI) and transvaginal color Doppler sonography has allowed antenatal diagnosis of this condition and elective preoperative planning of the obstetric and anesthetic management of these patients [7,8].

The diagnosis of placenta accreta usually begins with clinical suspicion in patients at risk. Ultrasound and Doppler are first-choice diagnostic methods because of their accessibility and high sensitivity [22]. Placental MRI is an accurate method of topographic

stratification, which makes it possible to define anatomy, to plan the obstetric (surgical) approach and to consider other therapeutic options. When placenta accreta is diagnosed antepartum, specific preoperative preparations such as autologous blood donation, arterial and central line insertion or hypogastric artery balloon placement can be undertaken in preparation for surgery [7,9].

Teo et al. studied the use of MRI in evaluation of placental invasion [20]. A retrospective review was undertaken of the MRI images of seven consecutive patients with ultrasound findings suspicious for placental invasion. Two experienced MRI radiologists, blinded to the pathology and surgery findings, reviewed the MRI. The pathology or surgical findings were used as the reference standard to establish accuracy and concordance with the MRI findings. Three MRI features described in an earlier series were consistently present in the patients with placental invasion: lower uterine bulging, heterogeneous placenta, and dark intraplacental linear bands on T2-weighted images. The authors concluded that MRI features, which were described in patients with placental invasion in an earlier series, were useful in establishing the presence and depth of placental invasion [20].

Chou et al. studied the prenatal detection of bladder wall involvement in invasive placentation with sequential two-dimensional (2D) and adjunctive three-dimensional (3D) ultrasonography (US) [22]. Forty-five patients at risk of placenta previa were examined sequentially with 2D US and then with a targeted scan of the region of interest with adjunctive 3D US to determine whether those patients suspected of having advanced invasive placentation by conventional ultrasonographic evidence had placental invasion of the bladder. The images were coded as positive, negative or indeterminate (equivocal) for bladder invasion. Follow-up postoperative outcomes were obtained. Seven of the 45 patients exhibited characteristic ultrasonographic findings for placenta increta/percreta. Among these seven patients with advanced invasive placentation, a targeted scan with adjunctive 3D US correctly provided additional corroborative information to the 2D US indeterminate diagnosis in patients who were found with variable degrees of bladder wall involvement at surgery. The authors concluded that 3D US may be a useful adjunctive tool in refining 2D ultrasonographic techniques to identify the extent and degree of placental invasion of the bladder. The

advantages of 3D US are:
1. a multiplanar image display allows viewing of sections from sagittal, coronal and axial planes at the same time, thereby more accurately determining the location and extent of placental invasion;
2. the viewing planes of the spatial angioarchitecture network can be arbitrarily manipulated to better delineate the aberrant vessels protruding into the bladder;
3. 3D reconstruction images can be clearly displayed by live 3D in a rotation mode for a better illustrative effect [22].

Dwyer et al. compared the accuracy of transabdominal sonography and MRI for prenatal diagnosis of placenta accreta [32]. A historical cohort study was undertaken at 3 institutions identifying women at risk for placenta accreta who had undergone both sonography and MRI prenatally. Sonographic and MRI findings were compared with the final diagnosis as determined at delivery and by pathologic examination. Thirty-two patients who had both sonography and MRI prenatally to evaluate for placenta accreta were identified. Of these, 15 had confirmation of placenta accreta at delivery. Sonography correctly identified the presence of placenta accreta in 14 of 15 patients (93% sensitivity; 95% confidence interval [CI], 80%-100%) and the absence of placenta accreta in 12 of 17 patients (71% specificity; 95% CI, 49%-93%). Magnetic resonance imaging correctly identified the presence of placenta accreta in 12 of 15 patients (80% sensitivity; 95% CI, 60%-100%) and the absence of placenta accreta in 11 of 17 patients (65% specificity; 95% CI, 42%-88%). In 7 of 32 cases, sonography and MRI had discordant diagnoses: sonography was correct in 5 cases, and MRI was correct in 2. There was no statistical difference in sensitivity (P = .25) or specificity (P = .5) between sonography and MRI. The authors concluded that both sonography and MRI have fairly good sensitivity for prenatal diagnosis of placenta accreta; however, specificity does not appear to be as good as reported in other studies. In the case of inconclusive findings with one imaging modality, the other modality may be useful for clarifying the diagnosis [32].

Interventional radiology

Over the last 30 years a new angiographic approach (uterine arterial embolization under fluoroscopic guidance) has emerged as an effective prophylactic

measure and treatment of postpartum hemorrhage [2]. However, it requires antenatal diagnosis of abnormal placentation, highly experienced personnel and facilities for interventional vascular radiology. Interventional radiology is usually used as an elective measure in a known or suspected case of placenta accreta for which cesarean hysterectomy is contemplated [30,32].

Masamoto et al. studied the effectiveness of elective use of aortic balloon occlusion in cesarean hysterectomy for placenta previa percreta [31]. The authors concluded that an aortic balloon is easy to insert and should be considered as a viable option for management of major hemorrhage in patients with placenta previa percreta [32].
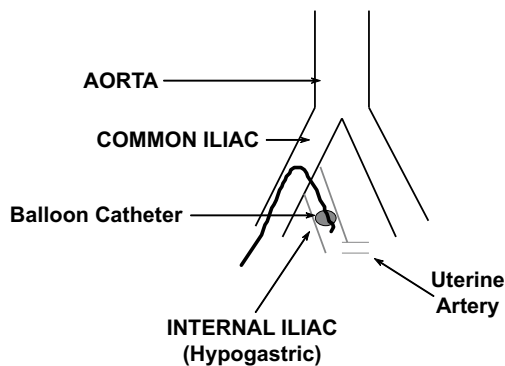

Figure 2.   Internal iliac (hypogastric) artery occlusion balloon

Kuczkowski and Eisenmann encountered a 27-year-old otherwise healthy parturient with the diagnosis of placenta percreta who required elective cesarean hysterectomy under nitrous oxide (60%)-based general anesthesia [9]. Internal iliac (hypogastric) artery occlusion balloons (Cook Inc, Bloomington, IN, USA) were placed preoperatively as per University of California, San Diego routine protocol through the femoral arteries for selective catheterization of the anterior division of the internal iliac arteries bilaterally [9] (Figure 2). The balloons were inflated with 3 ml of air each intraoperatively to control the bleeding. Because of the emergent need for arterial occlusion nitrous oxide was discontinued only 2-3 minutes prior to balloon inflation. Nevertheless, following the surgery and anesthesia the right internal iliac occlusion balloon was found ruptured (as confirmed by the interventional radiologist). The authors concluded that the most likely etiology of an internal iliac artery occlusion balloon

rupture described in their report was nitrous oxide [9]. The authors recommended that it might be prudent to avoid administration of nitrous oxide in pregnant patients with internal iliac artery occlusion balloons in situ undergoing cesarean hysterectomy under general anesthesia [9].

Obstetric management

Peripatum hemorrhage is a life-threatening emergency in obstetrics [3]. Placenta accreta still remains the leading indication for peripartun cesarean hysterectomy. Unfortunately, many obstetricians have little or no experience with performance of obstetric hysterectomy, and many anesthesiologists are not aware of anesthetic implications of this condition. A multicenter review showed that the average blood loss for emergent cesarean hysterectomy due to abnormal placentation was 2,526 ml with an average transfusion requirement of 6.6 units of blood [12]. The mean blood loss was greatly reduced in elective cases of hysterectomy and averaged 1,319 ml, with average blood replacement of 1.6 units. Zelop et al. in a report of 117 emergency peripartum hysterectomies noted that disseminated intravascular coagulation occurred in 27% of these cases [12].

Although recombinant activated factor VII (rFVIIa) has been used for the treatment of massive hemorrhage in non-obstetric patients, its application in obstetric patients is limited.

Mazouni et al. studied the differences in the management of suspected cases of placenta accreta in France and Argentina [18]. A total of 52 women suspected of having placenta accreta underwent ultrasound and placental magnetic resonance imaging evaluations at the centers in France and Argentina between May 2003 and October 2006. The use of imaging technologies was similar in France and Argentina and conservative surgical treatment was predominant in both groups. The placenta was left in situ in 64.7% of cases at the French center whereas resection of the placenta and surrounding invaded tissues were performed in 91.4% of cases in Argentina. The authors concluded that the same diagnostic tools were used in both countries, however, but there were differences in diagnostic accuracy and in the types of surgical procedures performed [18].

Araki et al. reported on the use of self-blood collection device - Cell Saver5+ (Haemonetics Japan Ltd, Tokyo) for massive bleeding of 25,500 ml in the par-

turient with abnormal placentation [19]. The authors concluded that Cell Saver can be safely used to treat life threatening bleeding in patients undergoing cesarean hysterectomy despite the concerns for the amniotic fluid embolism [19].

Bauer and Bonanno reviewed the current management strategies of patients with placenta accreta [24]. The authors concluded that it is critical to make the diagnosis before delivery because preoperative planning can significantly decrease blood loss and avoid substantial morbidity associated with placenta accreta. Aggressive management of hemorrhage through the use of uterotonics, fluid resuscitation, blood products, planned hysterectomy, and surgical hemostatic agents can be life-saving for these patients. Conservative management, including the use of uterine and placental preservation and subsequent methotrexate therapy or pelvic artery embolization, may be considered when a focal accreta is suspected; however, surgical management remains the current standard of care [24].

Flood et al. conducted a study designed to identify changing trends in peripartum hysterectomy in a single large obstetric population over the last 40 years [25]. A retrospective cohort study was performed from 1966-2005 of patients who had peripartum hysterectomy in any of the 3 Dublin obstetric hospitals. There were 872,379 deliveries during the study period, among which 358 women underwent peripartum hysterectomy (0.4/1000 deliveries). In a comparison of the study decades 1966-1975 with 1996-2005, peripartum hysterectomy decreased from 0.9 per 1000 deliveries to 0.2 of 1000 deliveries. Although the overall cesarean delivery rate has increased from 6-19% during these 2 decades, the percentage of peripartum hysterectomy that occurs in the setting of a previous cesarean delivery has increased from 27-57% (P < .00001). Indications for peripartum hysterectomy have changed significantly in this time period, with "uterine rupture" as the indication for peripatum hysterectomy decreasing from 40.5-9.3% (P < .0001) and placenta accreta as the indication increasing significantly from 5.4-46.5% (P < .00001). The authors concluded that peripartum hysterectomy has decreased over the last 4 decades. However, alongside the rising cesarean delivery rate, there has been a marked increase in the incidence of placenta accreta [25].

Eller et al. conducted a retrospective cohort study designed to determine which interventions for managing placenta accreta were associated with reduced maternal morbidity [28]. Cases of placenta accreta were identified using standard ICD-9 codes for placenta accreta, placenta praevia, and caesarean hysterectomy. Seventy-six cases of placenta accreta were identified. When accreta was suspected, scheduled cesarean hysterectomy without attempting placental removal was associated with a significantly reduced rate of early morbidity compared with cases in which placental removal was attempted (67 versus 36%, P=0.038). Women with preoperative bilateral ureteric stents had a lower incidence of early morbidity compared with women without stents (18 versus 55%, P=0.018). Hypogastric artery ligation did not reduce maternal morbidity. The authors concluded that scheduled cesarean hysterectomy with preoperative ureteric stent placement and avoiding attempted placental removal are associated with reduced maternal morbidity in women with suspected placenta accreta [28].

Anesthetic management

Chestnut et al. suggested that epidural anesthesia might be an appropriate choice for some patients with abnormal placentation [10]. However, the decision to administer regional anesthesia should be individualized, and made only after review of the pertinent history, physical examination and appropriate laboratory/imaging data. Extensive invasion of urinary bladder or other pelvic structures and/or significant potential for major intraoperative bleeding still favors general anesthesia.

Chestnut and Redick reviewed their experience with epidural anesthesia for elective cesarean hysterectomy in 25 patients, 7(28%) required intraoperative conversion to general anesthesia because of inadequate operating conditions and/or patient discomfort [11].

Regardless of the anesthetic technique used, two large bore intravenous catheters, arterial line and possibly central line should be inserted in patients undergoing cesarean section for abnormal placentation [2-4]. Two to four units of packed red blood cells should be immediately available. Vasoactive drugs such as phenylephrine, ephedrine, dopamine and epinephrine should be immediately available [13]. Consideration should be given to the use of the cell saver and acute normovolemic hemodilution. While both of these techniques remain controversial for the parturient, recent data attest to their safety and efficacy. Additionally the use of the bilateral hypogastric artery balloon catheters may

be indicated when major bleeding is suspected. These balloons are inserted preoperatively in the radiology department usually under local anesthesia with some intravenous sedation.

Kato et al. reported on anesthetic management (7-year single-center experience) of patients with placenta accreta presenting for cesarean section [29]. In a retrospective chart review study the authors identify twenty two cases of placenta accreta. Sixteen of the 22 patients required cesarean hysterectomy. The amount of blood loss in the 22 cesarean hysterectomy patients ranged from 590 to 10,500 ml. Neuraxial anesthesia was employed in 11 of these cases. In 6 patients regional anesthesia was converted to general anesthesia due to massive bleeding. In most of these cases 2 large-bore intravenous peripheral lines and arterial lines were placed prior to surgery. The authors concluded that multidisciplinary approach and advance planning are the keys to good outcome in patients with placenta accreta [29].

Kuczkowski described a 36-year-old gravida 3 para 2 with a long history of infertility, myomectomy and two prior cesarean sections who was admitted to the hospital at 32 weeks' gestation with painless vaginal bleeding [21]. An ultrasound scan revealed a single female fetus in an oblique presentation and a partial placenta previa. Maternal serum alpha-fetoprotein was elevated and MRI studies confirmed partial placenta previa with posterior invasion of lower uterine segment.

A second episode of vaginal bleeding occurred at 36 weeks and a subsequent amniocentesis documented fetal lung maturity. The decision was made to proceed with elective repeat cesarean section, with a high likelihood of cesarean hysterectomy [21].

An hour prior to the planned surgery the patient was taken to the Department of Interventional Radiology and under local anesthesia a 5.0 cm by 1.8 cm balloon on an 8.5 French catheter was introduced into the aorta, and sited just above the bifurcation (Figure 2). The balloon was checked for occlusion and subsequently deflated. Central venous (right internal jugular vein) and arterial access (right radial artery) was established in holding area. The patient was taken to the operating room and continuous lumbar epidural block with 2% lidocaine at L2-3 interspace was easily induced in sitting position. A T4 sensory level of anesthesia was established and surgery began [21].

Intraoperatively following the delivery of her fetus (Apgar scores of 9 and 9 at 1 and 5 minutes, respectively) the placenta was confirmed to have grown through the uterine wall, and clearly would not separate from the uterus. Therefore, no attempt was made to separate the placenta from the uterine wall. Bleeding was not excessive, the placenta was left in situ and Cesarean hysterectomy was carefully embarked upon. Her post-operative recovery was uneventful and she was discharged home with her baby on the fifth post-operative day [21].

Kuczkowski and Miller reported on a 21-year-old gravida 3 para 2 with a history of two prior cesarean sections who was admitted to the hospital at 34 weeks' gestation with the diagnosis of placenta percreta invading the bladder and anterior abdominal wall [2]. The decision was made to proceed with elective repeat cesarean section and cesarean hysterectomy. Similar management strategies (as above) were used with good outcome [2].

Conclusion

Peripatum hemorrhage remains a cause of significant maternal morbidity and mortality. Abnormal placentation is becoming more common, a sequelae to the rising caesarean section rate [1-4,13-15,21]. The diagnosis of abnormal placentation may lead to life threatening complications and significantly impact the obstetric and anesthetic management of these parturients [13]. The obstetricians and the obstetric anesthesiologist must know, on-the-spot, how to deal with this problem. Accurate diagnosis and appropriate management of obstetric hemorrhage can reduce maternal morbidity and mortality worldwide.

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