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Clinical Guidelines

Management of postabortion hemorrhage

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Abstract

Hemorrhage after abortion is rare, occurring in fewer than 1% of abortions, but associated morbidity may be significant. Hemorrhage can be caused by atony, coagulopathy and abnormal placentation, as well as by such procedure complications as perforation, cervical laceration and retained tissue. Evidence on which to make recommendations regarding risk factors and treatment for postabortion hemorrhage is extremely limited. Although medical abortion is associated with more bleeding than surgical abortion, overall bleeding for the two methods is minimal and not clinically different. Identifying patients who may be at increased risk of hemorrhage can help reduce blood loss with abortion. Specifically, women with a uterine scar and complete placenta previa seeking abortion at gestations greater than 16 weeks should be evaluated for placenta accreta. For women at high risk of hemorrhage, referral to a high-acuity center should be considered. We propose an algorithm for treating postabortion hemorrhage as follows: (1) assessment and exam, (2) massage and medical therapy, (3) resuscitative measures with laboratory evaluation and possible re-aspiration or balloon tamponade, and (4) interventions such as embolization and surgery. The Society of Family Planning recommends preoperative identification of women at high risk of hemorrhage as well as development of an organized approach to treatment. Further studies are needed on prophylactic use of uterotonic medication, intraoperative ultrasound and optimal delivery of the placenta after second-trimester medical abortion.

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Keywords: Abortion hemorrhage; Abortion complications; Surgical abortion; Medical abortion; Bleeding

Since abortion was legalized in 1973, abortion-related mortality and morbidity have declined sharply [1]. Abortion in the United States is a very safe procedure, with minor complications occurring in an estimated 8 per 1,000 abortions, major complications occurring in 0.7 per 1,000 abortions, and mortality occurring in 0.7 per 100,000 legal abortions per year [2]. The most common causes of mortality have changed over time. In the decade after legalization, anesthetic complications accounted for the highest percentage of deaths. Today, hemorrhage is the most common cause of abortion-related mortality in the second trimester, accounting for 33% and 40% of deaths following second-trimester induction termination and dilation and evacuation (D&E) [3]. In the first trimester, infection is the most common cause of abortion-related mortality (33%), with hemorrhage accounting for 14% of deaths.

Hemorrhage after abortion has been variably defined across studies, making comparisons of incidence, risk factors and treatment difficult. Definitions of postabortion hemorrhage include “greater than 250 mL blood loss,” “greater than 500 mL blood loss,” “requiring hospitalization” and “requiring

transfusion.” A clinically relevant definition would include both a clinical response to excessive bleeding, such as transfusion or admission, and/or bleeding in excess of 500 mL.

Estimates of hemorrhage after vacuum aspiration in the first trimester range from 0 to 3 per 1,000 cases [2,4–6]. Although hemorrhage immediately after first-trimester abortion is rare, delayed bleeding is more common. Two recent, large, registry-based cohort studies found that 1–2% of patients who underwent first-trimester surgical abortion had bleeding that necessitated a visit or secondary surgical intervention [7,8]. These studies lacked a consistent definition of bleeding, and likely represent overestimates of excessive bleeding after first-trimester abortion. Hemorrhage after surgical abortion is more common in the second trimester than the first, with estimates ranging from 0.9 to 10 per 1,000 cases [9–13].

Etiologies

Known etiologies include perforation, cervical laceration, retained tissue, abnormal placentation, atony and coagulopathy

Table 1
Causes of postabortion hemorrhage and associated risk factors

Cause of hemorrhage	Risk factors
Atony	Prior cesarean section [11] Use of halogenated anesthetic agents [54] Gestational age \geq 20 weeks [11] Increasing maternal age [11]
Cervical laceration	Surgical inexperience [19,92] Inadequate cervical dilation [13] Nulliparity [57] Gestational age \geq 20 weeks [11,57]
Perforation	Surgical inexperience [13,19,92] Inadequate cervical dilation [19] Non-use of intraoperative ultrasound [21] Increased gestational age [16,19]
Abnormal placentation	Uterine scar [60]
Coagulopathy	Personal or family history of bleeding [93]
Retained tissue	Intraoperative ultrasound [55] Surgical inexperience [13]

(Table 1). Little is known about population-relative frequencies of each of these causes because of the low incidence of hemorrhage, inconsistent definitions of hemorrhage and a paucity of studies. In a case series from 2008 by Steinauer et al. of 42 women requiring uterine artery embolization (UAE) for severe hemorrhage, the causes of hemorrhage in order of frequency were atony (52%), abnormal placentation (17%), cervical laceration (12%), perforation (7%), lower uterine segment bleeding without atony (5%) and disseminated intravascular coagulopathy (5%) [14].

Perforation, a rare complication of abortion, can be dangerous if it leads to hemorrhage. Estimates of the frequency of perforation vary from 0.1 per 1,000 to 3 per 1,000 [2,6,10,15–18] with higher frequencies occurring in training settings and at higher gestational ages [6,10,15,16,19]. In a study of concurrent laparoscopic sterilization during first-trimester abortion, suspected and actual perforations were two per 1,000 and 15 per 1,000 perforations, respectively, indicating that the true frequency of perforation is likely higher than reported [20]. However, most perforations are small, not clinically significant and effectively managed conservatively. In a prospective study of over 67,000 D&Es, use of osmotic dilators significantly decreased the risk of perforation [19]. In a study comparing perforation before and after a clinical policy change, intraoperative ultrasound during D&E was shown to decrease the risk of perforation [21]. The use of a sound prior to abortion has been associated with increased risk of perforation [5,22].

Cervical lacerations are reported to occur in as many as 3% of second-trimester abortions [11,23] and, in most cases, do not lead to hemorrhage [11]. High, lateral lacerations in the area of the uterine arteries, however, can lead to hemorrhage. Prior cesarean section increases the risk of cervical laceration, with one retrospective study reporting twice as many cervical lacerations (6%) in second-trimester abortion patients with two or more prior cesarean sections [23].

While retained tissue can lead to hemorrhage, most studies examine the association of retained tissue with re-aspiration, not hemorrhage [12,15,18]. Because re-aspiration may be done for pain concerning for hematometra, these studies likely overestimate hemorrhage incidence. Re-aspiration is rare, occurring in 0.2–2% of first-trimester abortions [2,18,24]. In the second trimester, a suction procedure is more common after medical abortion than surgical abortion [25], usually for retained placenta and not hemorrhage. Provider inexperience has been associated with retained tissue [13].

Abnormal placentation includes placenta previa as well as placenta accreta, increta and percreta. Although placenta previa has not been associated with postabortion hemorrhage [26], placental invasion into and beyond the myometrium can lead to severe hemorrhage. Placenta accreta is estimated to occur in approximately 0.2% of deliveries [27], and its incidence continues to rise as cesarean sections become more common.

Atony, characteristically defined as hypocontractility of the uterine body and fundus, is a common cause of hemorrhage. In a review of nearly 3000 surgical abortions in the second trimester, older maternal age and greater gestational age were identified as independent predictors of atony [11]. The increased risk of hemorrhage associated with previous cesarean section may be due to atony, with some postulating that the uterine scar impairs the ability of the uterus to contract in a coordinated fashion. While atony of the uterine body or fundus may cause postabortion hemorrhage, lower uterine segment atony has also been described by clinicians after abortion [11].

Women who are taking anticoagulants or have bleeding disorders may be at increased risk of bleeding with abortion. Because of this concern, many clinicians discontinue anticoagulants before abortion, a practice that may increase a patient's overall risk, depending on the reason for anticoagulation. A study published in 2011 by Kaneshiro et al. that explored the risk of bleeding with first-trimester abortion among women who continued to take their anticoagulation medications included four women using anticoagulants and six controls. Although mean blood loss was higher in the group taking anticoagulants than among controls (70 mL vs. 22.5 mL), the difference was not clinically significant [28]. The two most common bleeding disorders are von Willebrand disease (VWD) and hemophilia. The prevalence of VWD among women with menorrhagia is as high as 20% [29], and in these women, detailed histories of bleeding with procedures, especially deliveries, should be elicited. Other bleeding disorders include platelet dysfunction and factor deficiencies, conditions sufficiently that are rare on a population level.

Disseminated intravascular coagulopathy (DIC) is a rare complication of abortion and can occur either as a result of hemorrhage or for unknown causes. In cases in which hemorrhage after abortion is not caused by a known etiology, idiopathic DIC should be considered. DIC is characterized

by massive activation of the coagulation system, resulting in an imbalance between procoagulant and anticoagulant factors, ultimately producing a hypocoagulable state. In cases of idiopathic DIC, the diagnosis of amniotic fluid embolism (AFE) should be considered. AFE, an exceedingly rare event with an incidence of 3.3 per 100,000 [30], is characterized by a systemic inflammatory response with concomitant cardiovascular collapse and DIC [31].

Treatment of hemorrhage

Algorithm

Developing an organized approach is crucial to effectively evaluating and treating postabortion hemorrhage, as we describe in Fig. 2. The first step in the approach to bleeding is a physical exam, of which the three key components are visual and digital inspection of the cervix to identify cervical laceration or perforation, bimanual examination to assess uterine tone, and ultrasound to assess re-accumulation of blood or retained tissue. Some clinicians have found the “cannula test” to be helpful in distinguishing lower uterine segment or high cervical bleeding (e.g., site of a previous scar or cervical laceration) from that of atony at the fundus. The cannula test is done by inserting an 8–10 mm cannula into the fundus and withdrawing it slowly to identify when bleeding through the cannula is briskest.

Primary treatment

In many cases, primary treatment measures will be effective and sufficient treatment. If there is a cervical laceration, the location and extent of the laceration should be evaluated through a digital exam and correlated with the recollection of the clinician who performed the abortion procedure. If needed, assistance should be called for in order to obtain optimal visualization. Small lacerations on the face of the cervix may be treated with direct pressure and/or application of silver nitrate. Larger lacerations and lacerations inside the cervix may necessitate ferric subsulfate (Monsel’s solution). Surgical repair with absorbable sutures is recommended for external cervical lacerations that are bleeding or are greater than 1 centimeter. If bleeding is persistent after repair of a high cervical tear, one should consider a possible uterine artery laceration.

In the absence of evidence of a cervical laceration or perforation, uterine massage should be initiated. Often this is done in conjunction with the bimanual exam during the assessment phase. Either during uterine massage or if uterine massage fails to control bleeding, administration of uterotonic therapy is a logical next step. While treatment measures are being employed, it is important to continually return to assessment measures such as bimanual exam and ultrasound, if available, in order to direct the next therapeutic steps.

Uterotonic agents are a staple of primary treatment, with a retrospective cohort study reporting that 41% of cases of

uterine atony were successfully treated with uterotonics alone [11]. Uterotonics should be administered immediately if massage alone fails. Methylergonovine maleate and misoprostol are commonly used uterotonic medications for postabortion hemorrhage [32,33]; oxytocin and carboprost are less commonly used. Little evidence exists to recommend starting with a particular agent. If the hemorrhage is severe or does not resolve with a single uterotonic agent, additional or repeat doses of uterotonics can be administered.

Methylergonovine maleate has a rapid onset (within 5 minutes) and, unless contraindicated, is appropriate as a first-line agent to manage postabortion hemorrhage. It can be administered intramuscularly or intravascularly as a 0.2 mg dose. Intramuscular administration is most common. Frequency of dosing is controversial, and in the case of serious hemorrhage, some clinicians repeat the dose every 5 minutes for a maximum of 5 doses. In the absence of evidence, clinical judgment should be exercised in determining the most appropriate dosing schedule.

Misoprostol is an effective uterotonic in cases of postabortion hemorrhage, although the route and frequency of dosing are unknown. In the setting of hemorrhage, doses of 800 to 1000 mcg are recommended [4]. The time to peak concentration is most rapid with oral and sublingual administration, though sublingual administration effects the highest serum concentration [34]. Compared with oral administration, vaginal administration achieves a higher peak concentration [34] but is usually not feasible in the setting of postabortion hemorrhage. Rectal administration is associated with rapid onset, but lower peak concentration, and lower uterine tone and activity than buccal or vaginal administration [35]. On the basis of their pharmacokinetics, sublingual and buccal administration may be preferable to rectal administration.

Oxytocin is considered an effective uterotonic, but its usefulness in controlling postabortion hemorrhage is unknown and may be lower than that of other uterotonics because a mid-trimester uterus has fewer oxytocin receptors [36]. When used, it is typically given as 10 U intramuscularly or 10 to 40 U intravascularly [4]. Although vasopressin has not been evaluated as a treatment for postabortion hemorrhage, its vasoconstrictive properties may aid in controlling bleeding when administered intracervically or paracervically.

Secondary treatment

When bleeding is excessive or refractory to massage and uterotonics, the clinician should move quickly to secondary treatment measures (Fig. 2). The following measures should be instituted without delay: placement of additional intravenous lines, fluid resuscitation and laboratory assessment including hemoglobin, coagulation parameters and a cross-match for possible blood transfusion. It is important to have blood and coagulation factors available in the setting of hemorrhage to properly manage DIC, a potential cause or effect of the hemorrhage. If clinical suspicion of DIC is high,

evidenced by a protracted clotting time, treatment with transfusion of red blood cells (RBCs) and fresh frozen plasma (FFP) should be started. Laboratory results will then guide further need for transfusion of RBCs, FFP, cryoprecipitate and platelets. If available, anesthesiologists should be alerted to the possibility of resuscitation needs and surgery. For providers at clinics without immediate availability of anesthesiologists or operating room facilities, it is important to develop clear protocols for resuscitation and transfer to nearby hospitals.

Re-aspiration is appropriate if there is evidence of retained tissue or re-accumulation of blood on ultrasound. If retained tissue or hematometra is not suspected, and the etiology is thought to be atony or lower uterine segment bleeding, the clinician can consider placement of a Foley or Bakri balloon to tamponade the endometrium. This off-label use of the Foley is supported by a case report from 1995 [37] as well as by a retrospective cohort study of second-trimester surgical abortion complications between 2004 and 2007 in which a Foley was used in 37 of 78 patients with hemorrhage from uterine atony [11]. Once the Foley balloon is proximal to the cervix, it may be inflated to between 30 cc and 80 cc with normal saline (NS). The Bakri balloon was specifically designed for postpartum hemorrhage and may also be used in the postabortion setting. Two case reports from 2007 and 2009 describe successful use of the Bakri in controlling hemorrhage after abortion [38,39]. Although the Bakri can hold up to 500 cc NS, the two case reports describe inflating the balloon to 250 cc [38] and 120 cc [39] with successful tamponade. A common strategy is an initial trial of a Foley with 30–40 cc of NS, increasing the volume to 80 cc as needed. These balloons should be filled only with normal saline and never with gas, as this may theoretically lead to an air embolus.

In cases of hemorrhage requiring transfusion, it is reasonable to leave the balloon in place for 12–24 hours, both for tamponade and while awaiting hemodynamic stability. In cases where balloon tamponade results in rapid hemostasis and the patient is hemodynamically stable, a shorter course of 2–12 hours is often sufficient. While a balloon is in place, the patient should be regularly evaluated for continued bleeding, either around the balloon or through the tubing. Uterotonics may be administered regularly while the balloon is in place (Fig. 2). While there is no evidence on which to make a recommendation regarding antibiotics with the balloon in place, clinicians may want to consider it more in cases of longer placement (12–24 hours) than in cases of shorter placement (2–12 hours). The balloon should be deflated slowly, leaving it in position so that if the bleeding resumes, it can be re-inflated easily.

Tertiary treatment

Intensive interventions such as uterine artery embolization (UAE), laparoscopy, laparotomy and hysterectomy may be necessary in the event that primary and secondary treatment measures are unsuccessful in controlling bleeding.

UAE as treatment for refractory postabortion hemorrhage has been described in several case series with a total of more than 70 cases [14,40,41]. The largest of these series, describing 42 patients who underwent postabortion UAE, reported 100% success in treating refractory hemorrhage from atony, cervical laceration, DIC and lower uterine segment bleeding [14]. In cases of placenta accreta, UAE was successful in treating 43% of cases (4 of 7 women eventually needed hysterectomy). Two complications of UAE were noted: one contrast reaction treated with diphenhydramine and one femoral embolus requiring emergent embolectomy. Because UAE is associated with less morbidity and mortality than laparotomy and hysterectomy, we recommend attempting UAE prior to more invasive measures in settings where UAE is available. In specific circumstances, UAE can serve as an adjunct treatment with laparotomy. Two cases are described in the literature in which postabortion hemorrhage was initially controlled with UAE, followed by laparotomy [14]. In one case, a perforation was identified and repaired by laparotomy. In the other case, laparotomy revealed a stable broad ligament hematoma and no perforation.

If interventional radiology is not available, the next step in treating hemorrhage refractory to primary and secondary measures should be laparotomy. Laparotomy is also indicated in cases of confirmed bowel injury, such as viscera identified in the aspirate or forceps, or in an unstable patient. Laparoscopy may be helpful in confirming a suspected perforation, and when performed by experienced surgeons, can be used to repair a perforation and inspect the bowel. Most often, hemorrhage from a perforation will likely require laparotomy to repair it, and possibly hysterectomy. Though not described in the abortion literature, it is reasonable to attempt to control bleeding with bilateral uterine artery ligation and/or a B-Lynch suture.

Hysterectomy should be considered only after other treatments have failed. Overall, hysterectomies occur in 1.4 of every 10,000 abortions in the United States [42] and when they do occur, are most often associated with perforation. The decision to proceed to hysterectomy should be made by the clinician by considering the severity of the hemorrhage and the clinician's ability to stabilize the patient with temporizing measures such as transfusion and UAE. Ultimately, hysterectomy is the definitive treatment for postabortion hemorrhage and should be performed rapidly when all other treatments have failed.

Clinical questions and recommendations

Which patients are at highest risk for hemorrhage and how can we decrease their risk and prepare to manage them?

Women at high risk of hemorrhage should be identified preoperatively so that necessary preparations can be made to minimize blood loss. We present an algorithm for identifying and classifying women at risk of hemorrhage from an

Hemorrhage risk group	Prevention and preparation measures
<p>Low risk</p> <ul style="list-style-type: none"> • No prior cesarean sections • Fewer than two prior cesarean sections and no previa or accreta • No bleeding disorder • No history of obstetrical hemorrhage 	<p>Measures for all</p> <ul style="list-style-type: none"> • Preoperative hemoglobin or hematocrit (only if history of anemia for first-trimester surgical) • Ultrasound for gestational age • Cervical preparation <ul style="list-style-type: none"> ◦ Dilators if >20 weeks ◦ Misoprostol or dilators if >13 weeks • Consider vasopressin in paracervical block
<p>Moderate risk</p> <ul style="list-style-type: none"> • ≥2 cesarean sections • Prior cesarean section and previa • Bleeding disorder • History of obstetrical hemorrhage not requiring transfusion • Increasing maternal age • Gestational age >20 weeks • Fibroids* • Obesity 	<p>All of the above, and consider...</p> <ul style="list-style-type: none"> • Consider transfusion consent • Uterotonic medications readily accessible • Consider intraoperative ultrasound guidance • Cervical preparation with dilators if >20 weeks
<p>High risk</p> <ul style="list-style-type: none"> • Accreta diagnosis or concern • History obstetrical hemorrhage requiring transfusion • Any of the “moderate risk” categories may be considered “high risk,” per discretion of the clinician 	<p>All of the above, and consider...</p> <ul style="list-style-type: none"> • Refer to center with transfusion capability, anesthesia, and interventional radiology • Transfusion and possible hysterectomy consents • Preoperative creatinine, coagulation panel • Type and cross ≥2 units

Fig. 1. Algorithm for classifying women as being at low, moderate or high risk for hemorrhage after abortion.

abortion, with suggestions for directed preparative and preventive techniques according to risk category (Fig. 1). It is important to emphasize that the algorithm is intended as a guide for assessing postabortion hemorrhage risk, but should not be considered prescriptive. Clinical judgment should be exercised when assessing risk. The risk categories were intentionally created with overlap, particularly with respect to history of cesarean sections, to accommodate clinical judgment and variations in clinical resources. Specifically, a clinician may wish to consider a moderate-risk patient high risk, given limitations of the procedure site.

Many strategies are used to prevent hemorrhage, but only a few have been studied. In general, efforts should be made to help women obtain an abortion as early as possible in their pregnancy, as morbidity and mortality increase with each additional week of gestation [1]. All women presenting for abortion should have a detailed history, including a review of obstetric complications, and physical examination. Ultrasound confirmation of gestational age is the standard of care [4], as dating by last menstrual period often leads to an underestimate of gestational age, in both the first

and the second trimester [43,44]. In order to appropriately assess and manage blood loss, a preoperative hemoglobin or hematocrit level should be obtained for all women undergoing second-trimester abortion, first-trimester medical abortion, and first-trimester surgical abortion if the woman has a history of anemia [4]. A blood type should be obtained for all patients undergoing abortion, as the current standard in the United States is to give anti-D immune globulin for all Rh D-negative patients, even for those at early gestations [45].

Prior cesarean sections place women at higher risk of overall complications from second-trimester abortion, with one study demonstrating odds of complications seven times as great among women with two or more cesarean sections as among those with none [11]. The three most common complications included hemorrhage, atony and cervical laceration. Obesity may be a risk factor for increased blood loss with D&E [46,47], though no well-designed studies have addressed this question. Women with bleeding disorders secondary to either anticoagulation therapy or bleeding diatheses should be identified through a detailed

history. Although limited evidence suggests that significant bleeding with first-trimester abortion among anticoagulated patients is not common [28], it may theoretically be more common during second-trimester abortion.

Although prophylactic uterotonics are used routinely by some providers, available evidence does not support their use. In a National Abortion Federation survey from 2002, providers reported using misoprostol and methylergonovine maleate in both first- and second-trimester abortions [32,33], but the circumstances of their use are unknown. Some clinicians routinely use oxytocin after second-trimester abortion [46], although detailed information on its use is limited. One study comparing first-trimester abortion complications before and after use of prophylactic methylergonovine maleate became routine showed a significant decrease in cases of uterine atony and re-aspiration [48]. Oxytocin does not lead to a significant decrease in blood loss after first-trimester abortion [49,50]. No studies have evaluated the prophylactic use of methylergonovine maleate or oxytocin in second-trimester abortions. Randomized, controlled trials of misoprostol in comparison with or in addition to osmotic dilation in the second trimester to evaluate cervical dilation have generally not evaluated blood loss. The few that have done so have found either no difference or a clinically insignificant difference [51,52].

The use of vasopressin in the paracervical block is an intraoperative measure that has been shown to decrease blood loss with D&E [53]. The decreased blood loss associated with vasopressin, demonstrated in a double-blinded, randomized trial, was most pronounced with later gestations [53], and the routine use of vasopressin during D&E is recommended [4]. Use of halogenated anesthetic gases also increases the risk of hemorrhage due to atony, and the use of such agents is now discouraged [54].

Ultrasound guidance during abortion has been evaluated by two studies. In a randomized, controlled trial in a teaching hospital in the UK, hemorrhage and overall blood loss in cases with ultrasound and in those without were compared [55]. Defining hemorrhage as greater than 500 ml blood loss, the study found no difference in hemorrhage with use of ultrasound. Lower blood loss was found with use of ultrasound (103 mL vs. 139 mL), though that difference is likely not clinically significant, despite being statistically significant. Five cases of re-aspiration were reported in the group without ultrasound versus none in the group with ultrasound. Although a provider may wish to use ultrasound during first-trimester abortion, there is no rationale for recommending its routine use [55]. The effect of ultrasound guidance on hemorrhage or blood loss with second-trimester abortion is unknown. One study in a training setting has described differences in perforation by comparing cases before and after a policy change made the use of ultrasound routine. To the extent that perforation is associated with the potential for hemorrhage, the results are informative. The study found a decreased perforation rate (0.2% vs. 1.4%) when intraoperative ultrasound was routinely used [21]. This

study, as well, was conducted in a training setting. In a 2002 survey of second-trimester abortion providers, 51% reported that they routinely use ultrasound, with an almost equal proportion using it only for difficult cases [33]. While there are insufficient data to recommend the routine use of ultrasound in second-trimester abortion, clinicians may want to consider its use when multiple passes with forceps (standard D&E) are anticipated, and in training settings.

The vast majority of patients undergoing first-trimester surgical abortion will be appropriate candidates for an outpatient procedure [56]. Similarly, most second-trimester surgical abortions can be safely completed in the outpatient setting, a practice that is reflected in a survey of second-trimester abortion providers, with only 2% reporting providing services in a hospital-based site [33]. A small proportion of women are at significantly increased risk of hemorrhage, and for these women, strong consideration should be given to referring them to a higher-acuity site. Women with a diagnosis of or concern for placenta accreta (or increta, percreta) or a history of obstetric hemorrhage requiring transfusion should be considered at high risk (Fig. 2), and referral to a high-acuity service is recommended. While most patients in the moderate risk category can be cared for in an outpatient setting, clinicians should be encouraged to use their clinical judgment in deciding whom to refer.

Is there evidence that cervical preparation in the second trimester decreases hemorrhage risk?

Level A evidence supports that routine cervical preparation for surgical abortion at 20–24 weeks decreases procedural risk, likely through decreasing the incidence of cervical laceration, and possibly that of hemorrhage [11,13,57]. Limited evidence supports specifically recommending osmotic dilators as the best method of cervical preparation for abortions at 20–24 weeks, though current studies are under way to evaluate the efficacy of misoprostol as cervical preparation. Clinical practice varies regarding cervical preparation at 13–20 weeks' gestation. Same-day preparation with misoprostol or Dilapan-S Dilapan, overnight dilators and a combination of misoprostol and dilators are regimens used for this gestational age range [33]. There is evidence that same-day cervical preparation results in more cases with inadequate cervical dilation [58], but a recent review of 6000 surgical abortions at 12–16 weeks' gestation with same-day misoprostol cervical ripening reported few complications (three perforations [0.04%] and one case of hemorrhage [0.02%]). Although there is insufficient evidence to recommend one modality for cervical preparation for this gestational age range, there is clinical consensus that any ripening modality is better than none [42,57].

What diagnostic measures should be taken before abortion when abnormal placentation is suspected?

Abnormal placentation such as placenta accreta, increta and percreta, characteristically seen in women with a prior

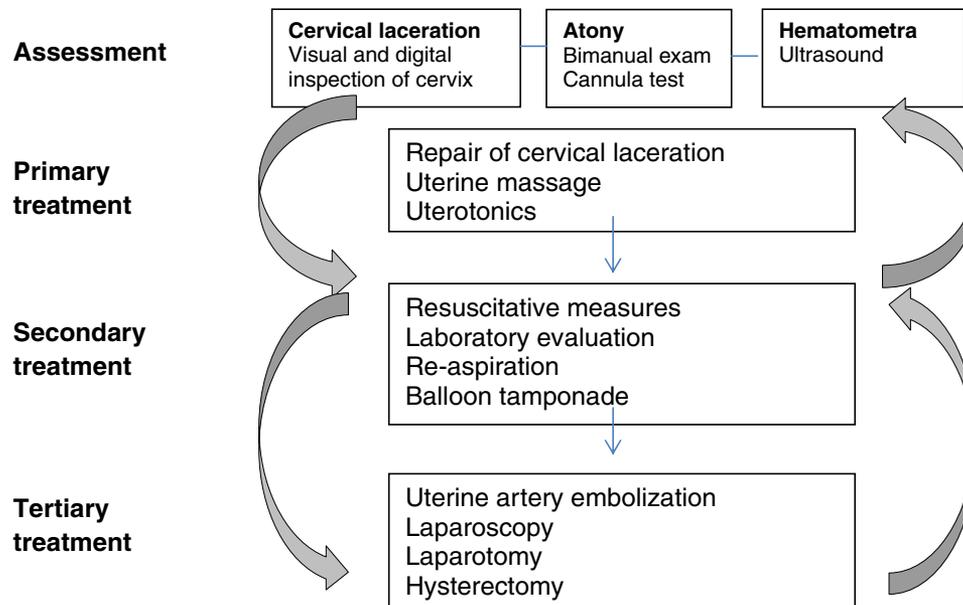


Fig. 2. Algorithm for a systematic approach to treatment of postabortion hemorrhage.

uterine scar, has the potential to cause massive hemorrhage during second-trimester surgical abortion [59]. Over the past 30 years, the incidence of placenta accreta has increased fourfold, with approximately 3 per 1,000 deliveries affected, largely due to the increased number of cesarean deliveries. In a woman with one prior cesarean section, the risk of placenta accreta increases from 0.03% in the absence of placenta previa to 3.3% in its presence, a 100-fold increase (Table 2) [60]. Other independent risk factors for placenta accreta include advanced maternal age, multiparity, smoking, uterine anomalies (including fibroids) and hypertensive disorders [61].

When hemorrhage occurs, it is typically seen at the time of placental detachment or removal. Diagnosing accreta preoperatively is associated with significantly decreased blood loss at the time of delivery [62] and likely at the time of second-trimester abortion. Hemorrhage with first-trimester abortion from placenta accreta is rare; however, prolonged bleeding after first-trimester abortion may be an indication of an undiagnosed placenta in creta. Three case reports describe placenta in creta diagnosed after patients presented for prolonged bleeding after first-trimester abortion, all treated

successfully without hysterectomy, two by embolization [63,64] and one with hysteroscopic and laparoscopic resection [65]. Placental location should be identified in all women with a uterine scar who are presenting for second-trimester abortion, and if a complete previa is seen, detailed evaluation with ultrasound is warranted.

Ultrasound detection of placenta accreta has improved over time, largely as a result of the use of color Doppler instead of gray-scale [66,67]. In a 2009 study of diagnostic criteria for placenta accreta using 3D power Doppler, sensitivity and specificity were as high as 97% and 92%, respectively [67]. Several studies have compared the sensitivity and specificity of ultrasound and magnetic resonance imaging (MRI) in diagnosing placenta accreta. One retrospective study examined the diagnostic accuracy among all cases of placenta previa or low-lying placenta with a prior cesarean section or prior myomectomy over 5 years [68]. Of the 453 cases sampled, 39 had placenta accreta confirmed by pathologic diagnosis. Ultrasound (gray-scale and color Doppler) correctly identified 30 of the 39 cases and correctly ruled out the diagnosis in 398 of 414 cases, for a sensitivity and specificity of 77% and 96%, respectively. MRI was done in 14 of the 16 cases with false positive ultrasound results, and correctly ruled out the diagnosis. Only one of the nine false-negative cases had evaluation with MRI leading to another false-negative diagnosis. Ultrasound is recommended as the imaging modality for evaluation of placenta accreta. In cases where the diagnosis is uncertain, MRI, where available, should be considered.

UAE is described in more detail for the management of postabortion hemorrhage, but some have suggested its use preoperatively to decrease blood loss when there is high suspicion for placenta accreta. In a case series in which eight

Table 2
Frequency of placenta accreta by number of cesarean sections and presence of placenta previa [60]

Cesarean section	Placenta previa	No placenta previa
First	3.3	0.03
Second	11	0.2
Third	40	0.1
Fourth	61	0.8
Fifth	67	0.8
≥ Sixth	67	4.7

women with suspected accreta were treated with UAE prophylactically, four required hysterectomy [40]. In another case series, one patient with suspected placenta increta received prophylactic UAE and still required subsequent hysterectomy [14]. Embolization in the emergent setting, where available, may be more successful because bleeding vessels can be directly targeted. Preoperative UAE may be more useful in settings where emergent UAE is not always available, though the decision of when to use it should be made on a case-by-case basis by the clinician.

What are issues specific to hemorrhage in the setting of medical abortion?

Medical abortion in both the first and second trimesters is associated with more bleeding than with surgical abortion [69–72]; however, the absolute amount of bleeding with medical abortion is low, and only of clinical importance for patients at increased risk of hemorrhage or pre-existing anemia. Defining hemorrhage after first-trimester medical abortion is more challenging, as blood loss is difficult to estimate. A large retrospective registry study published in 2011 erroneously found that the incidence of hemorrhage after first-trimester medical abortion was 15% [70], a number out of proportion to other reports, and reflective of an overly sensitive method of defining hemorrhage. In a large-scale prospective trial of more than 16,000 women undergoing medical abortion, only 0.1% experienced hemorrhage requiring transfusion [73].

Because medical abortions are unsupervised, women who are anemic may not be ideal candidates. The average drop in hemoglobin is 0.7% [74] and most studies of medical abortion excluded women with a hemoglobin under 10 g/dl. Caution should be exercised in offering medical abortion to anemic women, but the threshold of anemia is unclear. Most women undergoing medical abortion will have an uncomplicated course, and the decision to offer medical abortion should be left to the clinician in consultation with the patient. Women who are anticoagulated or have bleeding disorders should be directed toward surgical abortion, which allows their bleeding to be monitored in a more controlled fashion. Counseling women prior to medical abortion is vital to ensure that patients recognize when heavy bleeding is excessive, defined by many clinicians as soaking at least two pads per hour for two consecutive hours [3,75]. Compared with surgical treatment of early pregnancy failure, medical treatment is associated with increased bleeding [76].

Hemorrhage associated with second-trimester medical abortion occurs most often in the setting of retained placenta [25]. In a retrospective review of more than 1000 cases of mid-trimester medical abortions using mifepristone and misoprostol [25], surgical intervention for a retained placenta was required in 8% of cases [77]. Smaller studies have reported both lower [78] and higher incidences of retained placenta [79–81] with similar

regimens. Although retained placenta is not an uncommon complication of induction termination in the mid-trimester, associated hemorrhage is still rare. Misoprostol with or without mifepristone is associated with a lower incidence of hemorrhage (1–2%) [72,78,82] than older induction techniques using intra-amniotic administration of saline, prostaglandin and ethacridine lactate [69,78]. Mifepristone with misoprostol is associated with optimal efficacy, effecting delivery in the shortest time [83]. More limited data also provide evidence that this regimen is associated with less blood loss.

Women with complete placenta previa are not candidates for vaginal deliveries at term and are typically considered poor candidates for medical abortions in the second trimester. Low-lying and partial previas do not warrant the same concern and should not be used as a reason to discourage a woman from choosing a medical abortion. In Europe, however, where surgical abortion in the second trimester is very limited, several case series have been reported on women undergoing medical abortion in the setting of a placenta previa. In one report, four of nine women required transfusion and one required a hysterectomy for uncontrolled hemorrhage [84]. In another report, one of seven women undergoing medical abortion with gemeprost required a transfusion [85]. Two studies using feticide before medical abortion in the setting of a placenta previa reported no hemorrhage, but only six and two women were included, respectively [84,86]. Based on limited evidence, surgical abortion is superior to medical abortion for avoiding hemorrhage in the setting of a placenta previa. In cases where the patient strongly prefers medical abortion or surgical abortion is unavailable, the patient should be counseled as to the increased risk of bleeding and hemorrhage. Feticide prior to medical abortion in the setting of a previa may decrease the risk of hemorrhage, though insufficient evidence exists to make a recommendation.

What are special issues in the management of fetal demise that should be addressed to decrease hemorrhage?

There is no evidence that embryonic demise or early pregnancy failure in the first trimester is associated with increased hemorrhage. In one large trial comparing bleeding patterns after surgical versus medical treatment of early pregnancy failure, fewer than 1% of patients (4 of 563) required a blood transfusion, all in the medical management arm [76]. Older studies describe an association between second-trimester fetal demise with a retained fetus [87] and coagulopathy, with one study reporting that DIC may result in 20–25% of cases when the demised fetus is retained for more than 5 weeks [88]. Several case reports describe patients with fetal demise who subsequently developed DIC, sometimes associated with amniotic fluid embolism [89]. Supporting this are hematologic changes that have been reported in women with fetal demise, including increased thrombin generation and platelet

activation [90], a possible explanatory mechanism for any association between DIC and fetal demise. A recent study of 242 women undergoing second-trimester abortion examined the effect of fetal demise on maternal morbidity [91]. Fetal demise did not increase overall morbidity, but was associated with more transfusions (5.8% vs. 0.8%, $p = .07$). It is unclear if the results support an association between fetal demise and DIC, and the authors offered no explanation for the finding.

With more routine use of ultrasound, the occurrence of prolonged, retained fetus after fetal demise is less common. However, the interval between demise and procedure is often unknown. Although there is no evidence to recommend any preoperative measures in cases of fetal demise, some clinicians will obtain a coagulation panel prior to a procedure if the fetus has been retained for several weeks. Clinical judgment should be used in assessing women with fetal demise and their risk of bleeding.

Conclusions and recommendations

The following recommendations are based on good and consistent scientific evidence (Level A):

1. In women with a uterine scar and a placenta previa at 16 or more weeks' gestation, an evaluation for placenta accreta is strongly recommended. If a formal radiologic evaluation cannot be done, a provider experienced in ultrasound should evaluate for placenta accreta. Ultrasound is recommended as a first step in evaluating for placenta accreta. If the diagnosis is uncertain, MRI should be considered.
2. Bleeding is likely to be greater with medical abortion than with surgical abortion, although the rates of hemorrhage remain low. Counseling regarding surgical and medical methods can address this increased risk of bleeding.

The following recommendations are based on limited or inconsistent scientific evidence (Level B):

1. Obtaining a preoperative hemoglobin or hematocrit in all women undergoing second-trimester abortion and anemic women undergoing first-trimester medical abortion.
2. In training settings, the routine use of intraoperative ultrasound may decrease the risk of incomplete abortion with first-trimester surgical abortion and may decrease the risk of perforation with standard D&E.
3. Including vasopressin in a paracervical block may decrease blood loss from abortion.
4. Balloon tamponade can be an effective intervention for controlling brisk hemorrhage or hemorrhage refractory to massage and uterotonics and should be considered early in the process of bleeding and hemorrhage.
5. UAE can effectively control hemorrhage caused by many etiologies. Where available in a timely manner,

UAE should be considered before hysterectomy for management of postabortion hemorrhage in patients whose perfusion can be maintained during UAE.

6. Uterotonic medications can help control hemorrhage from atony. For actively bleeding patients, methylergonovine maleate, misoprostol and vasopressin are appropriate first-line treatments, with methylergonovine maleate and vasopressin effecting the most rapid response.
7. Limited evidence exists for the prophylactic use of methylergonovine maleate prior to first-trimester abortion in reducing the need for re-aspiration.

The following recommendations are based primarily on consensus or expert opinion (Level C):

1. Fetal demise with fetus retained for four or more weeks may be associated with an increased risk of DIC. Obtaining a preoperative coagulation parameter can be considered on an individualized basis, though this has not been studied.
2. For women at high risk of hemorrhage, referral to a hospital service or high-acuity center may decrease morbidity.
3. Oxytocin can be used as a uterotonic after second-trimester abortion.

Important questions to be answered

Although hemorrhage after abortion is rare, it is associated with significant morbidity and mortality. Definitions of hemorrhage across studies are inconsistent, and future research should adopt a consistent definition that is clinically meaningful. Research on methods to decrease the risk of postabortion hemorrhage is warranted, and we highlight three potential areas.

First, research is needed regarding the prophylactic use of uterotonic medications. Some clinicians routinely use these medications before, during or after the abortion despite the lack of evidence. A randomized, controlled trial with assessment of bleeding outcomes comparing different prophylactic uterotonics would best answer this question.

Second, the use of ultrasound during abortion should be evaluated. Although most first-trimester abortions done in the United States with high safety and efficacy are not done under ultrasound guidance, limited evidence suggests there may be a benefit to its use, particularly in training settings. There is a greater need to investigate the use of ultrasound in the second trimester, when there is a more significant risk of hemorrhage. This study could be accomplished either through a randomized, controlled trial in a setting where ultrasound is not the standard of care, or a multicenter observational cohort study where ultrasound is the standard of care.

Third, research studies on the optimal regimen for the delivery of the placenta after second-trimester medical abortion are needed. Medical abortion is associated with a greater risk of bleeding as compared to surgical abortion,

and many cases of excess bleeding occur in the setting of retained placenta.

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Sources

The MEDLINE database was used to identify references published between 1955 and December 2011. The database was searched for the following terms: abortion, hemorrhage, abortion complications, bleeding. Abstracts of all languages were included. The abstracts were reviewed and relevant articles obtained. Citations from these journals were reviewed, as well as contemporary textbooks. PUBMED and Google Scholar were searched in English for publications regarding abortion and contraception. In addition, reference lists of identified manuscripts were searched for any additional studies that might be relevant. We also searched the Cochrane Database of Systematic Reviews.

Authorship

These guidelines were prepared by Jennifer Kerns, MD, MPH, and Jody Steinauer, MD, MAS, and reviewed and approved by the Board of the Society of Family Planning.

Conflict of interest

Jennifer Kerns, MD, MPH, and Jody Steinauer, MD, MAS, report no significant relationships with industries relative to these guidelines. The Society of Family Planning receives no direct support from pharmaceutical companies or other industries.

Intended audience

This guideline is for Society of Family Planning fellows and any other health care professionals involved in the provision of care. This guideline may be of interest to other professional groups that set practice standards for family planning services. The purpose of this document is to review the medical literature on postabortion hemorrhage. This evidence-based review should guide clinicians, although it is not intended to dictate clinical care.