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# Society of Family Planning Clinical Recommendation: Management of hemorrhage at the time of abortion \*



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#### ABSTRACT

Hemorrhage after abortion is rare, occurring in fewer than 1% of abortions, but associated morbidity may be significant. Although medication abortion is associated with more bleeding than procedural abortion, overall bleeding for the two methods is minimal and not clinically different. 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 for practices around postabortion hemorrhage is extremely limited. The Society of Family Planning recommends preoperative identification of individuals at high risk of hemorrhage as well as development of an organized approach to treatment. Specifically, individuals with a uterine scar and complete placenta previa seeking abortion at gestations after the first trimester should be evaluated for placenta accreta spectrum. For those at high risk of hemorrhage, referral to a higher-acuity center should be considered. We propose an algorithm for treating postabortion hemorrhage as follows: (1) assessment and examination, (2) uterine massage and medical therapy, (3) resuscitative measures with laboratory evaluation and possible reaspiration or balloon tamponade, and (4) interventions such as embolization and surgery. Evidence supports the use of oxytocin as prophylaxis for bleeding with dilation and evacuation; methylergonovine prophylaxis, however, is associated with more bleeding at the time of dilation and evacuation. Future research is needed on tranexamic acid as prophylaxis and treatment and misoprostol as prophylaxis. Structural inequities contribute to bleeding risk. Acknowledging how our policies hinder or remedy health inequities is essential when developing new guidelines and approaches to clinical services.

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#### 1. Background

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https://doi.org/10.1016/j.contraception.2023.110292 0010-7824/© 2023 Published by Elsevier Inc. Since abortion was legalized in 1973, abortion-related mortality and morbidity have declined sharply [1,2]. Abortion in the United States is a very safe procedure, with minor complications occurring in an estimated 8 per 1000 abortions, major complications occurring in 0.7 per 1000 abortions, and mortality occurring in 0.7 per 100,000 legal abortions per year [3]. The most common causes of mortality have changed over time. In the decade after legalization, anesthetic complications accounted for the highest percentage of deaths. Hemorrhage is the most common cause of abortion-related mortality in the second trimester, accounting for 33% and 40% of deaths that occur after second-trimester abortion [4]. In the first trimester, infection is the most common cause of abortion-related mortality (31%), with hemorrhage accounting for 14% of deaths [2].

Hemorrhage after abortion has been variably defined across studies, making comparisons of incidence, risk factors, and treatment difficult. Definitions of postabortion hemorrhage include







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"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. Several recent studies have used clinical definitions such as these [5,6].

Estimates of hemorrhage after vacuum aspiration in the first trimester range from 0 to 3 per 1000 cases [3,7–9]. Although hemorrhage immediately after first-trimester abortion is rare, delayed bleeding is more common. While two large, registry-based cohort studies found that 1% to 2% of patients who underwent first-trimester procedural abortion had bleeding that necessitated a visit or secondary surgical intervention [10,11], a review of over 50,000 abortions found the prevalence of hemorrhage after first-trimester procedural abortion to be 1.3 per 1000 [12]. The registry-based studies lacked a consistent definition of bleeding and likely represented overestimates of excessive bleeding after first-trimester abortion. Hemorrhage after procedural abortion is more common in the second trimester than in the first, with estimates ranging from 0.3 to 10 per 1000 cases [10–15].

#### 2. Clinical questions

2.1. What are the common causes of hemorrhage at the time of abortion?

Known etiologies include perforation, cervical laceration, retained tissue, abnormal placentation, atony, and coagulopathy (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., the causes of severe hemorrhage in order of frequency among 42 people requiring uterine artery embolization were atony (52%), abnormal placentation (17%), cervical laceration (12%), perforation (7%), lower uterine segment bleeding without atony (5%), and disseminated intravascular coagulopathy (DIC; 5%) [16].

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 1000 to 3 per 1000 [3,9,11,12,17–19], with higher frequencies occurring in training settings and at later gestational durations [6,10,15,16,19]. In a study of concurrent laparoscopic sterilization during first-trimester abortion, suspected and actual

#### Table 1

Cause of hemorrhage	Risk factors	
Atony	Prior cesarean delivery [13] Use of halogenated anesthetic agents [100] Gestational duration ≥20 wk [13] Increasing maternal age [13]	
Cervical laceration	Surgical inexperience [21,118] Inadequate cervical dilation [15,103] Nulliparity [103] Gestational duration ≥20 wk [13,103]	
Perforation	Surgical inexperience [15,21,118] Inadequate cervical dilation [21] Nonuse of intraoperative ultrasound [22] Increased gestational duration [21]	
Abnormal placentation Coagulopathy	Uterine scar [80] Personal or family history of bleeding [35,119] Fetal demise [40]	
Retained tissue	Intraoperative ultrasound [101] Surgical inexperience	

perforations were 2 per 1000 and 15 per 1000 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 dilation and evacuation procedures, the use of osmotic dilators significantly decreased the risk of perforation [21]. In a study comparing perforation before and after a clinical policy change, intraoperative ultrasound during dilation and evacuation was shown to decrease the risk of perforation [22]. The use of a sound prior to abortion has been associated with increased risk of perforation [8,23].

Cervical lacerations are reported to occur in as many as 3% of second-trimester abortions [13,24] 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 delivery 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 deliveries [24].

While retained tissue can lead to hemorrhage, most studies examine the association of retained tissue with reaspiration, not hemorrhage [14,17,19]. Because reaspiration may be done for pain concerning for hematometra, these studies likely overestimate hemorrhage incidence. Reaspiration is rare, occurring in 0.2% to 2% of first-trimester abortions [3,19]. In the second trimester, a suction procedure is more common after medication abortion than procedural abortion [25], usually for retained placenta and not hemorrhage. Provider inexperience has been associated with retained tissue [15].

Abnormal placentation includes placenta previa as well as placenta accreta spectrum (PAS), which includes increta, percreta, and accreta. Although placenta previa has not been associated with postabortion hemorrhage [26,27], placental invasion into and beyond the myometrium can lead to severe hemorrhage. PAS is estimated to occur in as many as one in 533 deliveries [28], and its incidence continues to rise as cesarean deliveries become more common [29–31]. Cesarean scar ectopic pregnancies, in which implantation occurs in scar tissue from a prior cesarean delivery, also carry a risk of hemorrhage at the time of uterine aspiration [32]. Their incidence is estimated at one in 1800 to one in 2216 based on older data [33], but as with PAS, it may increase as the prevalence of prior cesarean delivery among reproductive-age individuals increases.

Atony, characteristically defined as hypocontractility of the uterine body and fundus, is a common cause of hemorrhage. In a review of nearly 3000 procedural abortions in the second trimester, older age and later gestational duration were identified as independent predictors of atony [13]. The increased risk of hemorrhage associated with previous cesarean delivery 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 [13].

Individuals 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. Kaneshiro et al. explored the risk of bleeding with first-trimester abortion among four people using anticoagulants and six controls. Although the 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 [34]. The two most common bleeding disorders are von Willebrand disease and hemophilia. The prevalence of von Willebrand disease among people with menorrhagia is as high as 20% [35], and in these people, detailed histories of bleeding with procedures, especially deliveries, should be elicited. Other bleeding disorders include platelet dysfunction and factor deficiencies, conditions that are rare on a population level. Procedural abortion is generally recommended over medication abortion for individuals with bleeding disorders and can safely be done in outpatient settings. In the first trimester, anticoagulation can continue without interruption, given the low bleeding risk. Holding anticoagulation before later abortion should be individualized based on the risks of interruption and risks of bleeding with the procedure [36].

DIC is a rare complication of abortion and can occur either as a result of hemorrhage or due to other/unknown causes. When 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 and ultimately producing a hypocoagulable state. Hypofibrinogemia is a hallmark of pregnancy-related idiopathic DIC and, in the obstetric literature, is predictive of severe hemorrhage [37]. 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 [38], is characterized by a systemic inflammatory response with concomitant cardiovascular collapse and DIC [39]. Spontaneous fetal demise (as opposed to induced fetal asystole) is a risk factor for both hemorrhage and DIC, conferring a nearly three times higher odds of hemorrhage and 12 times higher odds of DIC. However, the overall incidence of DIC in the setting of fetal demise is low (2%) [40].

### 2.2. Which patients may have an increased risk of experiencing hemorrhage at the time of abortion?

Algorithms for identifying those at high risk of hemorrhage may be useful, allowing necessary preparations to minimize blood loss. We present an algorithm for identifying and classifying individuals at risk of hemorrhage from an abortion, with suggestions for directed preparative and preventive techniques according to risk category (Fig. 1). It is intended as a guide for assessing 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 the history of cesarean deliveries, to accommodate clinical judgment and variations in resources. A person with moderate risk factors may need referral to a higher-acuity center, given limitations of a particular site. Clinicians must also consider risks associated with delaying procedures when referring out. Declining to provide care for a person in the moderate- or high-risk group may be deemed an unacceptable risk.

Clinicians use many strategies to prevent hemorrhage, but only a few have been studied. In general, the health care team should help individuals obtain an abortion as early as possible in pregnancy, as morbidity and mortality increase with each additional week of gestation [2]. Clinicians should take a detailed history from all people presenting for abortion, including a review of obstetric complications. Gestational duration is commonly confirmed by ultrasound, but emerging evidence exists for safety of abortion without such confirmation, specifically in the first trimester for people with a known last menstrual period and regular menses [41,42]. While clinical practices vary, we recommend checking a preoperative hemoglobin or hematocrit level for individuals undergoing later abortion to appropriately assess and manage blood loss (GRADE 1B). We suggest consideration of preoperative hemoglobin for first-trimester medication or procedural abortion in individuals with a history of anemia (GRADE 2B).

Prior cesarean deliveries place individuals at higher risk of overall complications from second-trimester abortion, with one study demonstrating seven times higher odds of complications among people with two or more cesarean deliveries [13]. Black individuals have higher rates of cesarean delivery compared with people of other races [43], and these differences in cesarean delivery rates exist within a context of structural inequities and systemic racism. The three most common complications associated with prior cesarean delivery include hemorrhage, atony, and cervical laceration.

Elevated body mass index (BMI; > 30 kg/m<sup>2</sup>) has been posited to be associated with increased blood loss with dilation and evacuation [44,45]; however, Lederle et al. reviewed 4520 dilation and evacuation procedures and found that BMI was not associated with dilation and evacuation complications, including hemorrhage [46]. Although the evidence suggests that elevated BMI is not associated with increased risk of complications, including anesthesia complications [47], elevated BMI remains a major reason for delay due to referral [48].

The vast majority of patients undergoing first-trimester procedural abortion will be appropriate candidates for an outpatient procedure [49]. Similarly, most second-trimester procedural abortions can be safely completed in the outpatient setting, a practice that is reflected in a survey of second-trimester abortion providers where a minority reported providing services in a hospital-based site [50]. A small proportion of patients are at significantly increased risk of hemorrhage (Fig. 1), and strong consideration should be given to referring them to a higher-acuity site. We recommend referral to a higher-acuity site for people with a diagnosis of or concern for PAS or cesarean scar ectopic pregnancy (GRADE 1B). While most patients in the moderate risk category can receive care in an outpatient setting, we encourage clinicians to use their clinical judgment in deciding whom to refer. Delays in care result in procedures occurring later in pregnancy, which places patients at higher risk for complications. This increased risk may outweigh the need to refer.

While we lack data on how structural inequities, anti-Black racism, and toxic stress affect an individual's risk of hemorrhage with dilation and evacuation, we do know that the racial and ethnic disparities observed in maternal health morbidity and mortality unequivocally affect abortion care delivery. These must be considered in bleeding risk assessment. Black individuals have higher rates of cesarean delivery [43] and have three to four times higher risk of pregnancy-related death [51]. Although rare, Black individuals have three times the risk of abortion-related mortality compared with White individuals [2]. The use of race-based calculators that identify race instead of racism as a risk factor worsens these disparities. The original Eunice Kennedy Shriver National Institute of Child Health and Human Development Vaginal Birth After Cesarean (VBAC) calculator, for example, used Black and Hispanic race as an indicator that decreases the estimated likelihood of successful VBAC [52]. In turn, clinicians were less likely to offer Black and Latinx patients a trial of labor after cesarean delivery, thus worsening disparities in cesarean delivery rates. The number of cesarean deliveries one has had is directly related to the risk of bleeding at the time of abortion. While the updated National Institute of Child Health and Human Development VBAC calculator no longer includes race and ethnicity, it still serves as an example of how disparities in obstetric care and delivery can lead to further disparities in abortion outcomes. Acknowledging how our policies hinder or remedy health inequities is essential when developing new guidelines and strategies for our clinical services.

#### Mitigating hemorrhage risk

### 2.3. What are considerations specific to hemorrhage in the setting of medication abortion?

Medication abortion in both the first and second trimesters is associated with more bleeding than with procedural abortion [53–56]; however, the absolute amount of bleeding with medication



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

abortion is low and only of clinical importance for patients at increased risk of hemorrhage or preexisting anemia. Thus, we recommend the decision to undergo medication or procedural abortion be patient driven (GRADE 1A).

Defining hemorrhage after first-trimester medication 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 medication abortion was 15% [54], 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 people undergoing medication abortion, only 0.1% experienced hemorrhage requiring transfusion [57]. In a study of over 10,000 medication abortions, hemorrhage occurred in 1.4 per 1000 [12]. A growing body of evidence supports the overall and hemorrhage-related safety of nocontact medication abortion—that is, screening by phone and administration of medications without a physical examination or ultrasound [58,59].

Because medication abortions are unsupervised, individuals who are anemic may not be ideal candidates. The average drop in hemoglobin is 0.7% [60], and most studies of medication abortion exclude those with a hemoglobin under 10 g/dL. While clinicians should exercise caution in offering medication abortion in the setting of anemia, the threshold of anemia that poses excessive risk is unclear. Most people undergoing medication abortion will have an uncomplicated course, and the decision to offer medication abortion should be left to the clinician in consultation with the patient. Individuals who are anticoagulated or have bleeding disorders should be directed toward procedural abortion, which allows their bleeding to be monitored in a more controlled fashion. Counseling prior to medication 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 [4,61].

Hemorrhage associated with second-trimester medication abortion occurs most often in the setting of retained placenta [25]. In a retrospective review of more than 1000 cases of mid-trimester medication abortions using mifepristone and misoprostol, surgical intervention for a retained placenta was required in 8% of cases [62]. Smaller studies have reported both lower [63] and higher incidences of retained placenta [64–66] 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%) [56,63,67] than older induction techniques using intra-amniotic administration of saline, prostaglandin, and ethacridine lactate [53,63]. Mifepristone with misoprostol is associated with optimal efficacy, affecting delivery in the shortest time [68].

Individuals with placenta previa are not candidates for vaginal deliveries at term and are typically considered poor candidates for medication abortions in the second trimester. Those who have a low-lying placenta do not warrant the same concern and should not

#### Table 2

Frequency of placenta accreta by number of cesarean deliveries and presence of placenta previa [80].

Cesarean delivery	With placenta previa (%)	Without placenta previa (%)
First	3.3	0.03
Second	11	0.2
Third	40	0.1
Fourth	61	0.8
Fifth	67	0.8
Sixth or more	67	4.7

be discouraged from choosing a medication abortion. In Europe, however, where later procedural abortion is very limited, several case series discuss outcomes of medication 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 [69]. In another, one of seven women undergoing medication abortion with gemeprost required a transfusion [70]. Two studies reported no hemorrhage when fetal asystole was induced before medication abortion in patients with placenta previa, but the sample sizes were too small to draw conclusions (n = 6 and n = 2, respectively) [69,71]. Based on limited evidence, procedural abortion is superior to medication abortion for avoiding hemorrhage in the setting of a placenta previa. If an individual strongly prefers medication abortion or procedural abortion is unavailable, clinicians should discuss the increased risk of bleeding and hemorrhage. Induction of fetal asystole prior to medication abortion in the setting of a previa may decrease the risk of hemorrhage, though insufficient evidence exists to make a recommendation.

### 2.4. Are patients who have a spontaneous fetal demise at a higher risk for hemorrhage?

There is no evidence that embryonic demise or early pregnancy loss is associated with an increased risk of hemorrhage. In one large trial comparing bleeding patterns after procedural vs medication treatment of early pregnancy failure, fewer than 1% of patients (4/ 563) required a blood transfusion, all in the medication management arm [72]. Older studies describe an association between secondtrimester fetal demise with a retained fetus [73] and coagulopathy, with one study reporting that DIC may result in 20% to 25% of cases when the demised fetus is retained for more than 5 weeks [74]. Several case reports describe patients with fetal demise who subsequently developed DIC, sometimes associated with AFE [75]. Hematologic changes have been reported in people with fetal demise, including increased thrombin generation and platelet activation [76], and could explain why DIC and fetal demise may be associated.

With more widespread use of ultrasound, the occurrence of prolonged intrauterine fetal demise is less common. However, the interval between demise and treatment is often unknown. Some clinicians will obtain a coagulation panel prior to a procedure in the setting of fetal demise; however, there is no evidence to support this practice, as coagulation parameters are almost always normal. Early detection of bleeding and suspicion for DIC as a cause is paramount, as early correction of coagulopathy can prevent hemorrhage from worsening. Specifically, evidence from the obstetric literature indicates that early administration of fibrinogen prevents severe postpartum hemorrhage [77].

A study of 242 patients undergoing second-trimester abortion examined the effect of fetal demise on maternal morbidity [78]. Fetal demise did not increase overall morbidity, but transfusions occurred more frequently (5.8% vs 0.8%, p = 0.07). Among 92 patients undergoing dilation and evacuation for fetal demise and 4428 having the procedure for another indication, fetal demise was associated with two times higher odds of hemorrhage and 12 times higher odds of

DIC. The overall incidence of DIC in the setting of fetal demise at the time of dilation and evacuation, however, was low (2%) [40]. We suggest using a lower threshold to intervene for bleeding in the setting of procedural abortion for spontaneous fetal demise as the risk of hemorrhage is increased (GRADE 2C).

### 2.5. What measures should be taken before and during abortion when abnormal placentation or cesarean scar ectopic pregnancy is suspected?

Abnormal placentation, such as placenta accreta, increta, and percreta, characteristically seen in people with a prior uterine scar, has the potential to cause massive hemorrhage during second-trimester procedural abortion [79]. Over the past 30 years, the incidence of PAS has increased fourfold, with approximately three per 1000 deliveries affected, largely due to the increased number of cesarean deliveries. In a person with one prior cesarean delivery, the risk of placenta accreta increases from 0.2% in the absence of placenta previa to 11% in its presence, a 50-fold increase (Table 2) [80]. Other independent risk factors for placenta accreta include advanced maternal age, multiparity, prior uterine surgeries or curettage, and Asherman syndrome [81].

Hemorrhage typically occurs at the time of placental detachment or removal. Diagnosing placenta accreta preoperatively is associated with significantly decreased blood loss at the time of delivery [82] 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 indicate an undiagnosed placenta increta. Three case reports describe placenta increta diagnosed after patients presented for prolonged bleeding after first-trimester abortion, all treated successfully without hysterectomy. Two individuals received embolization [83,84], and one underwent hysteroscopic and laparoscopic resection [85]. We recommend clinicians identify placental location in all people with a uterine scar who are presenting for second-trimester abortion and, if a complete previa is seen, perform a detailed evaluation with ultrasound (GRADE 1A).

Ultrasound detection of PAS has improved over time, largely as a result of the use of color Doppler instead of gray scale [86,87]. In a 2009 study of diagnostic criteria for placenta accreta using threedimensional power Doppler, sensitivity and specificity were as high as 97% and 92%, respectively [87]. 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 delivery or prior myomectomy over 5 years [88]. 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. We recommend ultrasound as the imaging modality for the evaluation of placenta accreta, but the absence of ultrasound findings does not preclude a diagnosis of PAS. Clinical risk factors are equally important as predictors of PAS (GRADE 1A) [89].

Uterine artery embolization (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 a high suspicion for placenta accreta. In a case series in which eight people with suspected PAS were treated with UAE prophylactically, four required hysterectomy [90]. In another case series, one patient with suspected placenta increta received prophylactic UAE and still required subsequent hysterectomy [16]. 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 readily available; therefore, we suggest that the decision to use preoperative UAE be made on a case-by-case basis by the clinician (GRADE 2B). Mifepristone and methotrexate as adjuvant treatment have also been reported in the setting of medication abortion with incomplete removal of the placenta and are strategies that may decrease the risk of hysterectomy [91,92].

Similar to PAS, cesarean scar ectopic pregnancy is diagnosed by ultrasound, and uterine curettage is one of many options (including systemic or intrasac methotrexate, UAE, hysteroscopy, laparoscopy, transvaginal resection) for treatment [93]. A case series of 232 individuals reported on treatment with ultrasound-guided suction curettage for 191 (82.3%) [94]. Clinicians used prophylactic misoprostol 800 mcg rectally for all patients and placed a Shirodkar cervical suture below the level of the internal os prior to suction for embryos ≥8 weeks' gestation with cardiac activity and for nonviable pregnancies with moderate or highly vascular color Doppler (82 patients). They tied the suture if bleeding was heavy or persistent and removed it at a 1-week follow-up visit. The authors found that vascularity assessed by color Doppler was an important predictor of blood loss. A systematic review of treatment modalities for cesarean scar pregnancies found that uterine curettage alone had a 21% complication rate, and 52% needed additional treatment [93]. Complication rates and need for additional treatment were lower when curettage was combined with other treatments such as UAE and/or systemic methotrexate.

### 2.6. What measures can clinicians take to prevent hemorrhage at the time of abortion?

In a National Abortion Federation provider survey from 2013, 72% of respondents reported routinely using prophylactic medications for bleeding during second-trimester abortions [50], including methylergonovine (64%), misoprostol (54%), oxytocin (44%), vasopressin (37%), and carboprost (6%). Several studies have since been published regarding the use of prophylactic medications. A randomized controlled trial (RCT) of prophylactic methylergonovine at 20 to 24 weeks demonstrated an increase in bleeding outcomes among the methylergonovine group [5]. Specifically, balloon tamponade was more common in the methylergonovine group vs placebo (14% vs 7%), and the mean postprocedural blood loss was higher in the methylergonovine group (126 mL vs 76 mL). Among abortions occurring at 22 to 24 weeks, additional uterotonic medication administration was more frequent in the methylergonovine group (47% vs 31%). We recommend avoiding the use of methylergonovine as a prophylactic agent for procedural abortion at 20 to 24 weeks (GRADE 1A).

Oxytocin does not lead to a significant decrease in blood loss with first-trimester abortion [95,96]. However, there is evidence for decreased blood loss in the second trimester. An RCT demonstrated decreased median measured blood loss with oxytocin vs placebo (152 vs 317 mL) as well as decreased rates of blood loss over 500 mL and over 1000 mL for abortions between 18 and 24 weeks [6]. Intervention for bleeding, this study's primary outcome, was lower in the oxytocin group compared with the placebo group (7.3% vs 16.7%), but this finding was not statistically significant. We recommend the use of prophylactic oxytocin in settings where increased bleeding is of concern (GRADE 1A).

RCTs of misoprostol compared with or in addition to osmotic dilators for cervical preparation before second-trimester abortion evaluated dilation. The few that have evaluated blood loss have found either no difference or a clinically insignificant difference [97,98].

The use of vasopressin in the paracervical block is an intraoperative measure that has been shown to decrease blood loss with dilation and evacuation in a double-blinded, randomized trial [99]. The effect was most pronounced with later gestations. We recommend the routine use of vasopressin during procedural abortion (GRADE 1B) but recognize that the cost may be prohibitive. The use of halogenated anesthetic gases also increases the risk of hemorrhage due to atony, and the use of such agents is discouraged [100].

Two studies have evaluated ultrasound guidance during abortion. Investigators randomized 230 participants having a first-trimester abortion at a teaching hospital in the United Kingdom to having a procedure with or without continuous ultrasound guidance [101]. Defining hemorrhage as > 500 mL blood loss, they found no difference in hemorrhage with the use of ultrasound. Participants who had procedures with ultrasound had less blood loss (103 mL vs 139 mL, p < 0.001), though that difference is likely not clinically significant. Five cases of reaspiration were reported in the group without ultrasound vs none in the group with ultrasound. Although a clinician may wish to use ultrasound during first-trimester abortion, there is no rationale supporting routine use [101]. The effect of ultrasound guidance on hemorrhage or blood loss with second-trimester abortion is unknown. One study described differences in perforation in a training setting by comparing cases before and after a policy change made the use of ultrasound routine [22]. The study found a decreased perforation rate (0.2% vs 1.4%) with routine use of intraoperative ultrasound. To the extent that perforation is associated with the potential for hemorrhage, the results are informative. In a 2013 survey of second-trimester abortion providers, 79% reported routinely using ultrasound, an increase from 51% in the 2002 survey [50,102]. While there are insufficient data to recommend the routine use of ultrasound in secondtrimester abortion, we suggest that clinicians consider its use when anticipating multiple passes with forceps (standard procedural abortion) and in training settings (GRADE 2B).

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

Strong evidence supports routine cervical preparation for procedural abortion at 20 to 24 weeks decreases procedural risk, likely through decreasing the incidence of cervical laceration and possibly that of hemorrhage [13,15,103]. Limited evidence supports specifically recommending osmotic dilators as the best method of cervical preparation for abortions at 20 to 24 weeks. In an RCT of 75 participants undergoing dilation and evacuation between 19 weeks and 23 weeks 6 days' gestation, Shaw et al. compared procedure times among three groups: (1) mifepristone and misoprostol; (2) mifepristone, misoprostol, and osmotic dilators; and (3) misoprostol and osmotic dilators [104]. The mifepristone and misoprostol arm had the longest median procedure time (18.5, 12, and 13 minutes, respectively; p < 0.005). More participants in this arm experienced cervical lacerations (5 of 27, vs 0 of 27 and 1 of 21; p = 0.03), but estimated blood loss did not differ between groups. Between 13 and 20 weeks' gestation, clinical practices regarding cervical preparation vary. Clinicians use same-day preparation with misoprostol and/or synthetic osmotic dilators (Dilapan-S); natural osmotic dilators placed the day prior to procedure; or a combination of misoprostol and osmotic dilators [50]. There is evidence that same-day cervical preparation results in more cases with inadequate cervical dilation [105], but a review of 6000 procedural abortions at 12 to 16 weeks of gestation with same-day misoprostol for cervical ripening reported few complications (three perforations [0.04%] and one case of hemorrhage [0.02%]) [106]. Although there is insufficient evidence to recommend one modality for cervical preparation for dilation and evacuation before 20 weeks, there is clinical consensus that any ripening modality is better than none [107].



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

#### Treatment of hemorrhage

## 2.8. What are the steps to evaluate and treat hemorrhage during an abortion procedure?

Developing an organized approach is crucial to effectively evaluating and treating postabortion hemorrhage, as we describe in Figure 2. The first step in the approach to bleeding is a physical examination, of which the three key components are visual and digital inspection to identify cervical laceration or perforation; bimanual examination to assess uterine tone; and ultrasound to assess for retained tissue or reaccumulation of blood. Some clinicians find 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 to 10 mm cannula to 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. If there is a cervical laceration, a clinician should evaluate the location and extent of the laceration by digital examination and correlate with the recollection of the person who performed the abortion procedure. If needed, the clinician should call for assistance to obtain optimal visualization. Direct pressure and/or application of silver nitrate is appropriate for small lacerations on the surface of the cervix while ferric subsulfate (Monsel's solution) may be needed for larger lacerations and lacerations inside the cervix. Surgical repair with absorbable sutures is preferred for external cervical lacerations that are bleeding or are > 1 cm. If bleeding is persistent after repair of a high cervical tear, the clinician should evaluate for a uterine artery laceration.

In the absence of evidence of a cervical laceration or perforation, we recommend initiating uterine massage. This is often done in conjunction with the bimanual examination during the assessment phase. Administration of uterotonic therapy is a logical next step either during uterine massage or if massage fails to control bleeding. While treatment measures are employed, it is important to continually return to assessment measures, such as bimanual examination and ultrasound, if available, to direct the next therapeutic steps. Uterotonic agents are a mainstay of primary treatment, with a retrospective cohort study reporting that 41% of cases of uterine atony were successfully treated with uterotonics alone [13]. We recommend immediate administration of uterotonics if massage alone fails (GRADE 1B), with methylergonovine maleate and misoprostol appropriate first-line treatments. Methylergonovine maleate and misoprostol are commonly used uterotonic medications for the treatment of postabortion hemorrhage [50]; oxytocin and carboprost are less commonly used. Little evidence exists to recommend starting with a particular agent, although methylergonovine maleate effects the most rapid response. Vasopressin, while not a uterotonic agent, also effects a rapid response and is a reasonable first-line medication to treat hemorrhage. If the hemorrhage is severe or does not resolve with a single uterotonic agent, additional or repeat doses of uterotonics can be administered.

For methylergonovine maleate, intramuscular administration of 0.2 mg is most common. Frequency of dosing is controversial, though many clinicians repeat the dose after 20 minutes for a maximum of two doses. Of note, the recommendation in the postpartum setting is to allow 2 to 4 hours between doses [108].

Misoprostol is an effective uterotonic in cases of postabortion hemorrhage, although the optimal route and frequency of dosing are unknown. In the setting of hemorrhage, doses of 800 to 1000 mcg are recommended. The time to peak concentration is most rapid with oral and sublingual administration, though sublingual administration effects the highest serum concentration [109]. Compared with oral administration, vaginal administration achieves a higher peak concentration but is usually not feasible in the setting of hemorrhage during procedural abortion. Rectal administration is associated with rapid onset but lower peak concentration and lower uterine tone and activity than buccal or vaginal administration [110]. Based on their pharmacokinetics, sublingual and buccal administration is preferable to rectal administration and, in an awake patient, should be the chosen route.

Oxytocin is considered an effective uterotonic. Traditionally, oxytocin was thought to be less effective because of fewer uterine oxytocin receptors in the second trimester [111]. However, an RCT found that prophylactic oxytocin at the time of dilation and evacuation is associated with lower blood loss but no difference in interventions for bleeding [6]. There is no evidence to guide its use in the treatment of postabortion hemorrhage. When used, it is typically given as 10 units intramuscularly or 10 to 40 units intravascularly. Although vasopressin has not been evaluated as a treatment for

hemorrhage during procedural abortion, 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. If practicing in a resource-limited setting, appropriate management may require transfer to a higher acuity facility or more prompt use of available measures to manage hemorrhage. 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. All members of the care team should be alerted to the possibility of resuscitation needs and surgery.

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 for DIC is high, administration of fibrinogen concentrate is an acceptable first step, even without laboratory evidence. In the setting of rapid bleeding, transfusion of red blood cells, fresh frozen plasma, and/or cryoprecipitate can also be initiated without laboratory evidence of DIC. Laboratory results will then guide further need for transfusion of fibrinogen, red blood cells, fresh frozen plasma, cryoprecipitate, and platelets.

Tranexamic acid (TXA) inhibits plasminogen activation, thus inhibiting the breakdown of fibrinogen, and is an evidence-based treatment for postpartum hemorrhage [112]. Based on evidence from the postpartum literature, many providers are now using TXA in the postabortion setting, both as prophylaxis and treatment. There is insufficient evidence to recommend for or against the use of TXA in the setting of hemorrhage at the time of abortion. Given data supporting its use in postpartum hemorrhage, we suggest it as a safe and effective agent for prophylaxis and treatment for hemorrhage at the time of abortion (GRADE 2C). TXA is commonly administered intravenously as 1000 mg either 30 minutes before the procedure over 10 minutes when used as prophylaxis or as a push when used as treatment. It can also be administered intramuscularly. We anticipate more research on the role of TXA as prophylaxis and treatment for abortion-related hemorrhage.

Reaspiration is appropriate if there is evidence of retained tissue or reaccumulation of blood on ultrasound. We recommend that clinicians place a Foley or Bakri balloon to tamponade the endometrium if retained tissue or hematometra is not suspected and the etiology is thought to be atony or lower uterine segment bleeding (GRADE 1B). This off-label use of the Foley balloon was first reported in 1995 [113] and is supported by a case series of treatment for cervical ectopic pregnancies [114], as well as a retrospective cohort study of second-trimester procedural abortion complications between 2004 and 2007 in which it was used in 37 of 78 patients with hemorrhage from uterine atony [13]. Once the Foley balloon is proximal to the cervix, it may be inflated to between 30 cc and 80 cc with normal saline. 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 the successful use of the Bakri in controlling hemorrhage after abortion [115,116]. Although the Bakri can hold up to 500 cc, the two case reports describe inflating the balloon to lower amounts (120-250 cc) with successful tamponade. 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 to 24 hours, both for tamponade and while the patient stabilizes. When balloon tamponade results in rapid hemostasis and the patient is hemodynamically stable, a shorter course of 1 to 12 hours is often sufficient. While a balloon is in place, clinicians should regularly evaluate for continued bleeding, either around the balloon or through the tubing. Uterotonics may be administered while the balloon is in place (Fig. 2). While there is no evidence regarding antibiotic administration with the balloon in place, clinicians may consider it in cases of longer placement (12–24 hours). After deflating the balloon, allow time to evaluate any increase in bleeding and reinflation if necessary.

#### Tertiary treatment

Interventions such as UAE, laparoscopy, laparotomy, and hysterectomy may be necessary if 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 [16,90,117]. In the largest of these series, Steinauer et al. reported 100% success in treating 42 patients with UAE for refractory hemorrhage from atony, cervical laceration, DIC, and lower uterine segment bleeding [16]. In cases of placenta accreta, UAE was successful in treating 43% of cases (four of seven women eventually needed hysterectomy). Two complications of UAE were noted: one contrast reaction treated with diphenhydramine and one femoral embolus requiring emergent embolectomy. Because it is associated with less morbidity and mortality than laparotomy and hysterectomy, we recommend attempting UAE prior to more invasive measures where available (GRADE 1B). In specific circumstances, UAE can serve as an adjunct treatment to laparotomy. Steinauer's series also described two cases in which postabortion hemorrhage was initially controlled with UAE, followed by laparotomy. 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, as when viscera are 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. Often, laparotomy is required to treat hemorrhage due to perforation. 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. Hysterectomy after abortion is rare, and while recent data are lacking, an older report describes that hysterectomies occur in 1.4 of every 10,000 abortions in the United States [21] and, when they do occur, are most often associated with perforation. The decision to proceed to hysterectomy should be made 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 abortion-related hemorrhage and should be performed rapidly when all other treatments have failed.

#### 3. Clinical recommendations

Please see Appendix 1 for a key to interpreting GRADE.

• While clinical practices vary, we recommend checking a preoperative hemoglobin or hematocrit level for individuals undergoing later abortion to appropriately assess and manage blood loss (GRADE 1B).

- We suggest consideration of preoperative hemoglobin for firsttrimester medication or procedural abortion in individuals with a history of anemia (GRADE 2B).
- We recommend referral to a higher-acuity site for people with a diagnosis of or concern for PAS or cesarean scar ectopic pregnancy (GRADE 1B).
- We recommend the decision to undergo medication or procedural abortion be patient driven (GRADE 1A).
- We suggest using a lower threshold to intervene for bleeding in the setting of procedural abortion for spontaneous fetal demise as the risk of hemorrhage is increased (GRADE 2C).
- We recommend clinicians identify placental location in all people with a uterine scar who are presenting for second-trimester abortion and, if a complete previa is seen, perform a detailed evaluation with ultrasound (GRADE 1A).
- We recommend ultrasound as the imaging modality for the evaluation of placenta accreta, but the absence of ultrasound findings does not preclude a diagnosis of PAS. Clinical risk factors are equally important as predictors of PAS (GRADE 1A).
- Preoperative UAE may be more useful in settings where emergent UAE is not readily available; therefore, we suggest that the decision to use preoperative UAE be made on a case-by-case basis by the clinician (GRADE 2B).
- We recommend avoiding the use of methylergonovine as a prophylactic agent for procedural abortion at 20 to 24 weeks (GRADE 1A).
- We recommend the use of prophylactic oxytocin in settings where increased bleeding is of concern (GRADE 1A).
- We recommend the routine use of vasopressin during procedural abortion (GRADE 1B) but recognize that the cost may be prohibitive.
- While there are insufficient data to recommend the routine use of ultrasound in second-trimester abortion, we suggest that clinicians consider its use when anticipating multiple passes with forceps (standard procedural abortion) and in training settings (GRADE 2B).
- We recommend immediate administration of uterotonics if massage alone fails (GRADE 1B), with methylergonovine maleate and misoprostol as appropriate first-line treatments.
- Given data supporting tranexamic acid's use in postpartum hemorrhage, we suggest it as a safe and effective agent for prophylaxis and treatment for hemorrhage at the time of abortion (GRADE 2C).
- We recommend that clinicians place a Foley or Bakri balloon to tamponade the endometrium if retained tissue or hematometra is not suspected and the etiology is thought to be atony or lower uterine segment bleeding (GRADE 1B).
- Because UAE is associated with less morbidity and mortality than laparotomy and hysterectomy, we recommend attempting it prior to more invasive measures in settings where available (GRADE 1B).

#### 4. Recommendations for future research

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 use a consistent definition that is clinically meaningful. Research on methods to decrease the risk of hemorrhage at the time of abortion is warranted, and we highlight three potential areas.

First, research is needed regarding the use of TXA in preventing and treating postabortion hemorrhage. Administration of TXA for postpartum hemorrhage is now widely recommended after a large international, multisite trial documented decreased maternal mortality with its use [112]. TXA has long been used as a treatment in nonobstetric traumatic hemorrhage. Its role in postabortion hemorrhage is unclear, as no studies have evaluated its use. However, providers are starting to use it based on evidence from the obstetrics literature. Studies evaluating its efficacy for prophylaxis and treatment of hemorrhage at the time of abortion are needed.

Second, research evaluating the role of preoperative misoprostol as a prophylactic uterotonic agent are warranted. Misoprostol is commonly used as a cervical preparation agent, and studies have reported on bleeding outcomes. However, few studies have evaluated misoprostol with bleeding and/or hemorrhage as the primary outcome. Evidence regarding its effectiveness in preventing hemorrhage would be useful when given for another indication, such as for cervical preparation, or in a setting where it would not otherwise be given.

Third, research on the effects of structural inequities in care are warranted, specifically as they affect abortion care, risk of postabortion hemorrhage, and associated morbidity. As providers who care for people at the time of abortion, our responsibility for preventing and treating abortion-related hemorrhage must begin with recognizing the legacy and persistence of racism against Black, Indigenous, and People of Color. Moreover, while algorithms and prescribed guidance for prevention and treatment can serve as a way to address inequities in care, they can also exacerbate them. We encourage abortion researchers to investigate the ways that our clinical policies and recommendations hinder or remedy health inequities. We encourage abortion providers to examine their approach to hemorrhage management through a lens of equity.

#### 5. Sources

We used the MEDLINE database to identify references published between 1955 and December 2021. We searched the database for the following terms: abortion, hemorrhage, abortion complications, and bleeding. Abstracts of all languages were included. The abstracts were reviewed, and relevant articles were obtained. Citations from these journals were reviewed, as well as contemporary textbooks. We searched PubMed and Google Scholar for English-language 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. A comprehensive systematic review was not performed.

#### 6. Intended audience

These Clinical Recommendations are intended for the Society of Family Planning members, family planning clinicians, reproductive health service clinicians, family planning and reproductive health researchers, and policy makers.

#### Author contribution

The guidelines were prepared by Jennifer L. Kerns, MD, MS, MPH; Katherine Brown, MD, MAS; Siripanth Nippita, MD, MS; and Jody Steinauer, MD, PhD; and reviewed and approved by the Clinical Affairs Committee on behalf of the Board of Directors of the Society of Family Planning.

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The Society for Maternal-Fetal Medicine endorses this document.

#### **Appendix A. Supporting information**

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.contraception.2023.110292.

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