10 CHAPTER 10
First-trimester aspiration abortion

Karen Meckstroth MD, MPH, and Maureen Paul MD, MPH

LEARNING POINTS

- When using misoprostol for preprocedure cervical preparation, 400 μg vaginally 3 to 4 hours prior to aspiration abortion is the optimum regimen.
- Clinicians may perform aspiration abortion very early in pregnancy, even before ultrasound reveals a gestational sac, if meticulous tissue examination and appropriate follow-up are employed to ensure complete evacuation of the pregnancy.
- The uterine aspirate must be examined to identify chorionic villi, gestational sac or membranes, and in the later first trimester, fetal parts.
- Perioperative antibiotics reduce infection with aspiration abortion, even in low-risk women.

Introduction

Approximately one in five pregnancies worldwide end in abortion. The likelihood that a woman will have an abortion is similar if she lives in a developed or developing area of the world. Western Europe has the lowest abortion rate in the world (12 per 1,000 women aged 15 to 44). The rate is 17 in Northern Europe and 21 in Northern America [1]. In 2005, approximately 1.2 million women obtained abortions in the USA, making abortion one of the most common medical procedures provided to women of reproductive age [2].

Approximately 90% of abortions in the USA occur during the first trimester. Advances in pregnancy testing, ultrasonography, and medical and surgical abortion techniques have accelerated the trend toward earlier abortion care, with the proportion of abortions obtained during the first 6 weeks of gestation doubling from 14% in 1992 to 29% in 2005 [3]. The remarkable safety and technical simplicity of early modern induced abortion place it well within the scope of practice of diverse types of clinicians. Although nonphysicians are often proscribed from providing abortions in the USA (Chapter 4), data from around the world indicate that appropriately trained clinicians can provide first-trimester aspiration or medical abortion with an impressive safety record [4–9].

Virtually all modern first-trimester surgical abortions are accomplished by vacuum aspiration [3], with dilation and sharp curettage (D&C) confined to some countries where abortion is illegal. Manual vacuum aspiration (MVA), once a technology more common in low-resource settings, is now widely used and often preferred by providers in developed countries [10]. Even in developing countries with restrictive abortion laws, increasing use of MVA and medical abortion methods has reduced abortion-related mortality [11,12].

This chapter focuses on vacuum aspiration throughout the first trimester, which has been variably defined as ending at 12 or 13 completed weeks of gestation. The chapter addresses current practices, acceptable variations in technique, and approaches to uterine evacuation in very early pregnancy. Although we use the terminology *surgical abortion* at times, *aspiration abortion* more accurately reflects the procedure [13].

Historical perspective

Vacuum methods for uterine evacuation were first described in the latter half of the 19th century. In 1872, Sir James Young Simpson, the Scottish obstetrician to Queen Victoria, fashioned a "tube resembling in length and size a male catheter, with a large number of thickly-set small orifices stretching along for about two inches from its extremity." Attaching "an exhausting syringe" to this primitive cannula, Simpson used "a few strokes of the piston of the syringe" to perform the first reported endometrial aspiration [14]. More than 50 years passed before this method was applied to pregnancy interruption: in 1927, Bykov, a Russian physician, used a handheld syringe to induce menstruation [15].

Management of Unintended and Abnormal Pregnancy, 1st edition. By M Paul, ES Lichtenberg, L Borgatta, DA Grimes, PG Stubblefield, MD Creinin
 ISBN: 9781405176965.

In 1934, Hungarian Bela Lorinez added electric suction for sampling endometrium [16].

Greater dissemination of the vacuum aspiration technique began in the late 1950s. Shortly after China removed restrictions on abortion in 1957, two case series of induced abortion by electric vacuum aspiration appeared in *The Chinese Journal of Obstetrics and Gynecology* [17,18]. In the 1960s, clinicians from Eastern Europe and Great Britain reported favorable experiences as well. The Czechoslovakian physician Vojta [19] and the British tandem Kerslake and Casey [20] published their series in US journals; the latter are credited with introducing this technique in North America. In the early 1970s, California psychologist Harvey Karman introduced inexpensive, disposable, flexible plastic cannulae for aspiration abortion that were smaller and more pliable than their metal counterparts. Karman and Potts [21] reported their success using a manual aspiration method for early abortion in 1972.

Vacuum aspiration soon became the most common method of first-trimester abortion in the USA and other developed countries, proving superior to traditional D&C in speed, comfort, and safety [22–24]. During the past decade, several developing countries have introduced manual vacuum aspiration for abortion as well, in keeping with the World Health Organization's recommendation that suction methods replace sharp curettage as the safe standard for first-trimester surgical abortion [25].

Safety—morbidity and mortality

As a result of abortion surveillance efforts initiated in the USA by the Centers for Disease Control and Prevention (CDC) in the late 1960s, "We have come to know more about legally induced abortion than any other operation"[26]. The CDC collects data on abortion incidence and demographics from state health departments, and it ascertains abortion-related deaths using numerous sources. Reporting is voluntary, and depending on the year, three or four states (including California where more than 23% of US abortions occur) do not provide abortion data to the CDC [3]. Organizations such as the Guttmacher Institute perform additional surveillance, integrating surveys of all known abortion providers with CDC data.

Notwithstanding these limitations, CDC surveillance clearly demonstrates a dramatic drop in abortion-related mortality following nationwide legalization of abortion. The case-fatality rate for legal induced abortion decreased approximately 80% between 1972 and 1980, from 4.1 to 0.7 deaths per 100,000 abortions, and it has remained essentially stable since [3]. Today, the risk of death from legal induced abortion is less than that from an injection of penicillin [27] and substantially below the risk of carrying a pregnancy to term (Fig. 10.1). Infection and anesthesia complications comprise the most frequent causes of death from

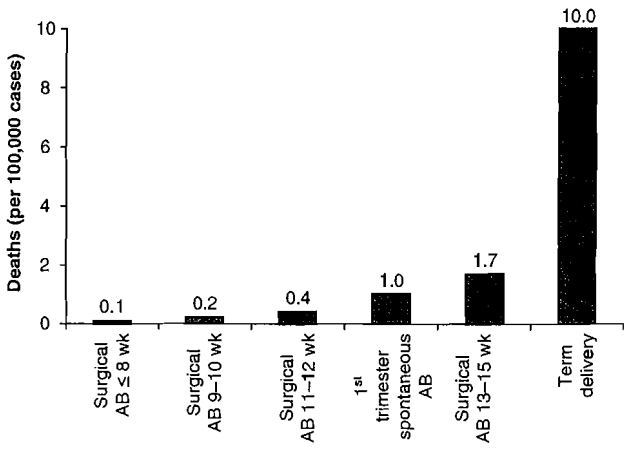


Figure 10.1 USA mortality rates (deaths per 100,000 induced abortions, spontaneous abortions, or deliveries). AB = abortions; wk = weeks. (Data from Bartlett et al [28], Saraiya et al [29], Christiansen and Collins [30], Grimes [31].).

first-trimester aspiration abortion in the USA (Fig. 10.2) [28]. When abortions take place under unsafe conditions, as they do for half of the abortions worldwide, deaths and serious complications are much more common (Chapter 2). The CDC discontinued its research on nonfatal complications of abortion in the early 1980s, after its numerous large prospective studies clearly documented the safety of legal induced abortion. Subsequent studies by various investigators that include newer surgical or medical approaches have confirmed that serious complications from early abortion are rare (Chapter 15). Of women having first-trimester surgical abortions, 97% report no complications; 2.5% have minor complications that can be handled at the medical office or abortion facility; and less than 0.5% have more serious complications that require some additional surgical procedure or hospitalization [32].

Data on long-term sequelae provide reassurance as well (Chapter 16). Accumulated research on first-trimester vacuum aspiration shows that it poses virtually no risk of infertility, ectopic pregnancy, spontaneous abortion, or preterm or low-birth-weight delivery [33–36]. Less extensive evidence suggests that repeat aspiration abortion poses no

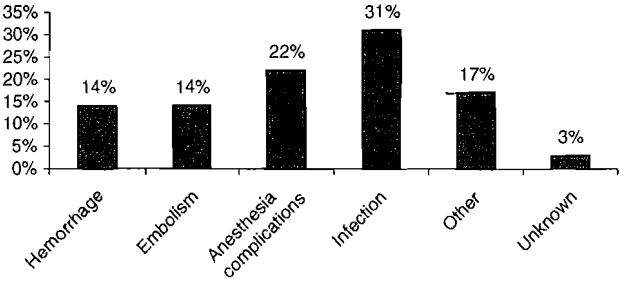


Figure 10.2 Causes of death for first-trimester aspiration abortion in the USA, 1988–1997. (Data from Bartlett et al [28].).

additional risk [37]. Exhaustive reviews by US and British government expert panels have found no association between abortion and breast cancer, and no data indicate that abortion is a risk factor for other types of cancer [37]. In repeated studies since the early 1980s, leading experts and organizations such as the American Psychiatric Association have concluded that abortion does not pose a hazard to women's mental health [38].

Service settings

Worldwide, laws often specify where abortions may take place and who may perform them. In Great Britain and India, for example, abortions must take place in government hospitals or authorized health care facilities. Most abortions in the USA are provided in freestanding clinics; in 2005, only 5% occurred in hospitals, down from 22% in 1980, and only 2% took place in physicians' offices [2]. First-trimester aspiration abortions performed in an office or clinic are as safe as those performed in hospitals [39] and considerably less expensive [2,40].

The freestanding clinic model holds some benefits for patients and clinicians including uniformly pro-choice staff, cost, efficiency, and a supportive, high-volume training environment [8]. This service model, however, marginalizes abortion from mainstream medical care and may make providers and patients more susceptible to antiabortion harassment and violence [8,41]. Integration of early abortion services into primary care practice settings mitigates these drawbacks and optimizes continuity of care. Hospitals offer a critical alternative for women who have serious medical conditions or require intensive anesthesia, and they serve as the primary venue for abortion care in many countries.

Aspiration abortion using local anesthesia with or without oral or moderate ("conscious") intravenous (IV) sedation can be provided safely and appropriately in outpatient settings with only modest changes, if any, in infrastructure and supplies. Although the National Abortion Federation (NAF) and the American College of Obstetricians and Gynecologists (ACOG) do not recommend specific appointment timelines, the British Royal College of Obstetricians and Gynaecologists (RCOG) advises that assessment appointments for abortions occur within 5 days of contact and maximally within 2 weeks. Ideally, abortion should be available within 7 days of the woman's decision to proceed [42].

The type and number of staff needed depends in part on the methods of abortion offered, available pain management options, and abortion volume. Clinics with higher patient volumes usually employ dedicated health educators or counselors who explore the abortion decision with patients and provide verbal and written information regarding the procedure, its alternatives, and the benefits and risks of each (Chapter 5). In smaller settings, medical assistants, nurses, or physicians may assume these responsibilities. In the USA, some states require that patients receive specific information before abortion and dictate the type of staff who can convey the information (Chapter 4).

The American Society for Anesthesiologists and NAF issue guidelines for IV sedation that delineate minimum personnel requirements, patient monitoring, and recovery requirements [43,44] (Chapter 8). The Joint Commission on Accreditation of Healthcare Organizations also provides requirements for sedation and anesthesia. Relaxation or pain medications that induce milder sedation, such as oral benzodiazepines and narcotics, entail less regulation because of their lower risk.

Numerous resources are available for providers who are considering starting abortion services (Appendix). The NAF website (www.prochoice.org) includes annually updated clinical guidelines, training modules, and patient education handouts, and the World Health Organization's *Safe Abortion: Technical and Policy Guidance for Health Systems* [25] is an excellent global resource. The Guttmacher Institute website (www.guttmacher.org) details requirements and laws governing abortion provision in the various states.

Aspiration versus medical abortion

Most women seeking abortion perceive a choice of methods as extremely important [45]. Women who are permitted to choose aspiration or medical abortion have high satisfaction rates with both methods [45,46]. In countries such as France, Scotland, and Sweden, where both options have been available for over a decade, 50 to 60% of eligible women elect medical abortion over aspiration abortion (Chapter 9). In the USA, aspiration abortion remains the most common method of early pregnancy termination, although use of medical abortion is increasing. In 2005, early medical abortions accounted for 14% of all US nonhospital abortions (compared with 6% in 2001) and 22% of nonhospital abortions at 9 weeks' gestation or less [2]. Fifty-seven per cent of US abortion providers offered medical abortion services in 2005, a 70% increase from 2001 [2].

Given that both early medical and aspiration methods are highly effective and safe, the decision usually turns on personal preferences. Some women opt for medical abortion because they like that it is noninvasive and offers more privacy and control. Others prefer aspiration because it is quick, predictable, and may be combined with sedation or anesthesia (Table 10.1). Although a few conditions render women ineligible for medical abortion (Chapter 9), aspiration abortion has no contraindications given the appropriate setting. Medical abortion, however, may be the best option in some situations such as very early pregnancy, marked obesity that limits visualization of the cervix [47], or obstructive uterine fibroids that make access to the pregnancy difficult or infeasible [48–50]. When efficacy is defined according to frequency of continuing pregnancies, early aspiration abortion

Table 10.1 Characteristics of early abortion methods.

Aspiration Abortion	Medical Abortion
Highly effective	Highly effective
Procedure brief	Abortion process takes one to several days to complete (sometimes longer)
Involves invasive procedure	Avoids invasive procedure (aspiration) if successful
Allows option of sedation or general anesthesia	Avoids anesthesia
Usually requires only one visit	May involve two visits or more
Lighter perceived bleeding	Heavier perceived bleeding
Requires clinical setting	May occur in privacy of home

and medical abortion using contemporary evidence-based regimens have similar efficacy [6,51]. Safety of medical versus aspiration abortion is difficult to compare because the causes of adverse events differ, but both methods have low rates of complications (Chapters 9 and 15).

Patient preparation

Before providing an abortion, the clinician must assure that the patient has considered her options, wants to have an abortion, and has given voluntary and informed consent for the procedure (Chapter 5). Each patient will need information about the abortion methods available at her gestational age, the risks and benefits of each method, and pain management options. Discussing contraceptive methods beforehand allows the patient to choose and consent to a method if she so desires; preprocedure consent for contraception is particularly important if the patient will receive sedation or desires insertion of an intrauterine system or transdermal implant immediately following the abortion (Chapter 14).

Depending on the setting, providers may use menstrual history and bimanual examination or ultrasonography to estimate gestational age (Chapter 6). Nearly all US members of the National Abortion Federation have ultrasound machines on-site, and 91% perform dating ultrasounds routinely before first-trimester aspiration abortion [52]. Although routine ultrasound is not required for provision of safe early suction abortion, its use is recommended in patients with uncertain menstrual dates, indeterminate pelvic examinations, size/dates discordance, and in cases of suspected ectopic pregnancy. When preprocedure ultrasound has not documented an intrauterine pregnancy, the provider must consider the possibility of ectopic pregnancy (Fig. 10.3).

The medical history may identify allergies to medications, latex, or antiseptic solutions used in abortion care as well as medical conditions that warrant preprocedure management. Laboratory evaluation typically includes confirmation of pregnancy (through urine pregnancy testing or sonography), determination of Rh(D) antigen status, and hematocrit or hemoglobin, at least in areas where anemia is prevalent. Patients with acute or chronic illnesses may require more extensive assessment (Chapter 7). Most providers defer bimanual examination to the time of the aspiration procedure, especially when they use routine ultrasonography. Confirming the size and flexion of the uterus helps the provider to direct instruments along the appropriate axis and anticipate conditions, such as large leiomyomata, that may present challenges (Chapter 13).

Cervical preparation

The degree of cervical dilation required to accomplish first-trimester suction abortion varies with gestational age. Most North American providers dilate the cervix mechanically using tapered Pratt or Denniston dilators, although in early gestation, a small cannula may pass without dilation. Some clinicians advocate routine use of osmotic dilators prior to first-trimester aspiration abortion based on early evidence that it may reduce the risk of cervical injury and possibly uterine perforation, at least for less experienced providers [53,54]. In a more recent case series of 170,000 first-trimester abortions performed by experienced physicians using Pratt dilators alone, cervical lacerations occurred in only 1 in 1,000 cases [55]. Cervical preparation with pharmacologic agents, such as prostaglandin analogs or progesterone antagonists, has also become increasingly common, especially in the later first trimester. No studies have been large enough to compare complication outcomes [56]. The low risk of cervical injury and perforation must be balanced against added cost, discomfort, and inconvenience for the patient.

Guidelines from professional organizations support use of cervical preparation before late first-trimester aspiration abortion; some advocate earlier use for nulliparous women or adolescents, because a higher rate of cervical injury has been reported in adolescents [56]. The WHO recommends cervical priming for all women younger than age 18 years, nulliparous women over 9 weeks' gestation, and all women over 12 weeks' gestation [25]. The RCOG advises cervical priming for women who are less than age 18 years or more than 10 weeks' gestation [42]. The Society of Family Planning Clinical Guidelines recommend cervical priming for all women at 12 to 14 weeks' gestation, with consideration of priming for all adolescents [56]. NAF does not recommend cervical priming after a particular week of gestation in the first trimester [44].

Pharmacologic preparation

Misoprostol, a prostaglandin E_1 analog, is commonly employed for cervical ripening. Other analogs, such as dinoprostone and gemeprost (not available in the USA), are more expensive yet no better than misoprostol for cervical ripening [57,58]. When providers in Europe, Scandinavia,

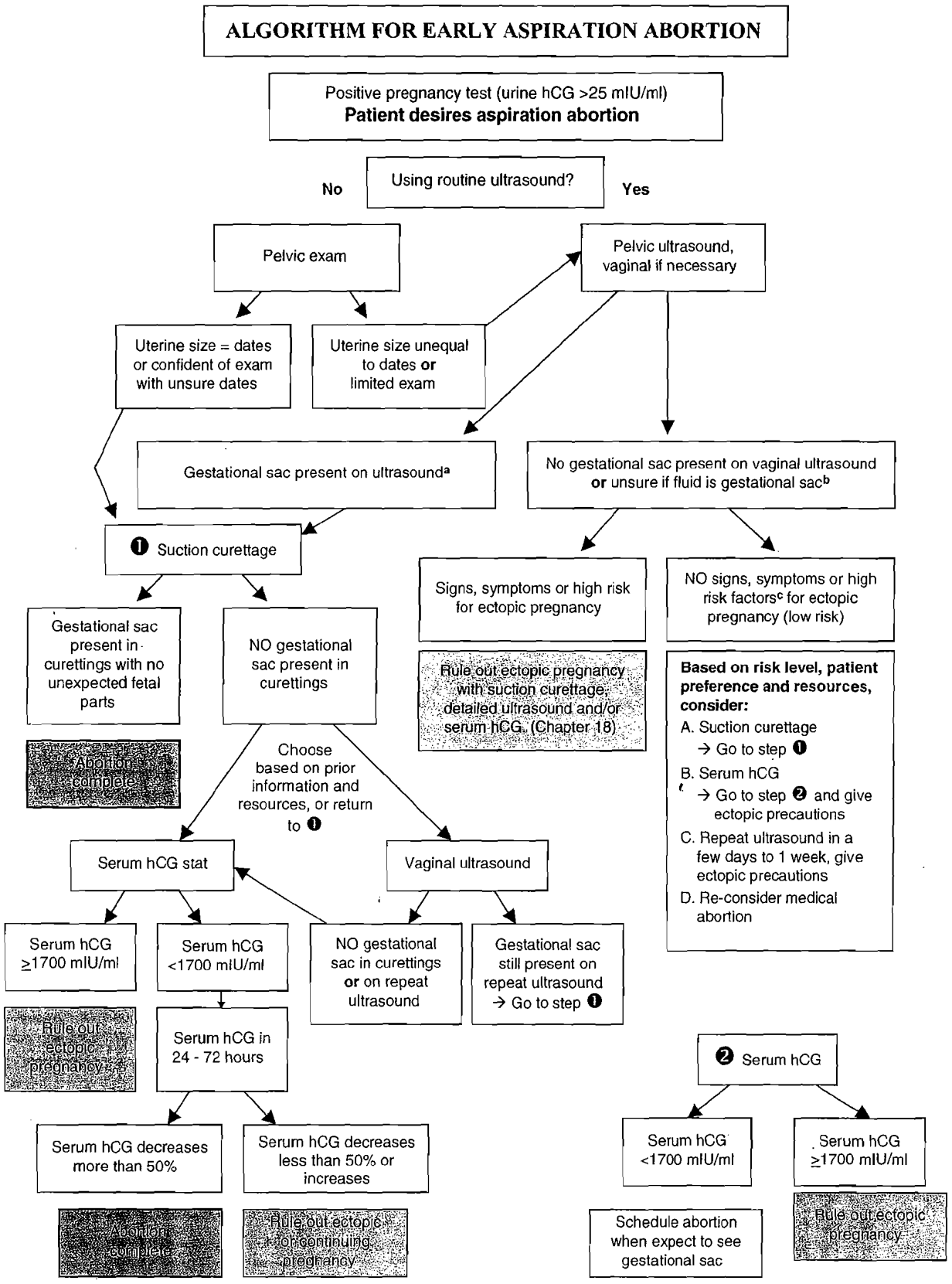


Figure 10.3 Algorithm for early aspiration abortion. [a]Gestational sac is confirmed when yolk sac is visualized. [b]When feasible, evaluate for adnexal masses and for presence of free peritoneal fluid. [c]May also choose to consider moderate or minor risk factors for ectopic pregnancy.

and other countries use gemeprost, a 1-mg vaginal suppository is placed vaginally for 3 to 12 hours prior to abortion. Mifepristone also effectively primes the cervix if used 36 to 48 hours prior to the procedure [59–61]. After 48 hours, mifepristone may cause more cervical dilation than misoprostol used for 2 to 4 hours [62]; however, its use for cervical priming is limited as a result of the long preparation time, high cost, and lack of availability in some settings.

Researchers have evaluated several routes of misoprostol administration. The appropriate route takes into account efficacy, side effects, and patient and staff preferences. The many studies of misoprostol for cervical priming define efficacy by a variety of outcome measures including baseline cervical dilation, need for mechanical dilation, force required for mechanical dilation, and duration of procedure. Studies that evaluate patient acceptance have found that women generally prefer 1-day procedures to 2-day and prefer misoprostol to laminaria [63,64]. Studies have not been large enough to detect a difference in complication rates.

When using vaginal misoprostol, the optimum regimen is 400 μg given 3 to 4 hours prior to the procedure. This conclusion derives from studies that demonstrate the following:

- Vaginal misoprostol is equally or more effective than oral administration and causes fewer side effects [63,65].
- Vaginal misoprostol 200 μg is inferior to 400 μg [66–69].
- Doses higher than 400 μg result in higher rates of side effects such as pain, bleeding, and fever [67,68].
- Vaginal misoprostol 600 μg for 2 hours is inferior to 400 μg for 3 hours [68,69].
- More than 4 hours of vaginal misoprostol does not improve dilation and causes increased bleeding and passage of products of conception prior to the procedure [63,70].

Misoprostol 400 μg is also effective when given orally 8 to 12 hours prior or sublingually 2 to 4 hours before the procedure [56]. However, sublingual dosing results in higher rates of nausea, vomiting, and diarrhea as compared to vaginal dosing [71]. Although buccal misoprostol is effective for cervical priming prior to second-trimester abortion [72,73], it has not been evaluated for cervical priming in the first trimester. Although the mechanism of action of misoprostol involves induction of endogenous prostaglandins, one study found that using nonsteroidal antiinflammatory drugs (NSAIDs) for pain relief did not alter the efficacy of misoprostol for cervical ripening [74].

Osmotic dilators

Osmotic dilators absorb water from the surrounding tissues and gradually increase in diameter to dilate the cervix (Appendix, Fig. A-13). All osmotic dilating devices induce endogenous prostaglandins and some additionally create radial force on the cervix [75,76]. A trained provider must place the dilators during a speculum exam. Women may experience pain with placement necessitating local cervical anesthesia, especially if multiple dilators are placed. More than one osmotic dilator is rarely needed, though, in the first trimester. Three types of osmotic dilators are used in abortion care: laminaria (*Laminaria digitata, Laminaria japonica*); Dilapan-S™ (GelMed International, Czech Republic), and Lamicel® (no longer available in the USA). Chapter 11 reviews osmotic dilators in detail.

Setup and equipment

First-trimester suction abortions are performed in operating rooms, outpatient surgical centers, clinics with procedure rooms, and regular office examination rooms.

Room setup

The room setup typically includes an examination or operating table, seating, focused lighting, a table or stand, and appropriate equipment and supplies. For women who are awake, a calm warm atmosphere may facilitate relaxation and comfort during the procedure.

The treatment table should provide comfortable support for the patient in lithotomy position. Tables equipped with knee stirrups allow the patient to relax her legs as the crutches hold them apart, although foot stirrups also function well in awake patients. Where resources permit, a hydraulic table affords the clinician a more comfortable posture and provides flexibility in patient positioning. Lighting concentrated in the provider's work area minimally disturbs the patient. Better lighting is occasionally necessary for patient monitoring, particularly when general anesthesia is administered. Supplies for postprocedure tissue examination may be located in the treatment room or at a station in a nearby room. Backlighting, such as an x-ray view box, and a clear dish in which to suspend the tissue facilitate visualization (Fig. 10.4).

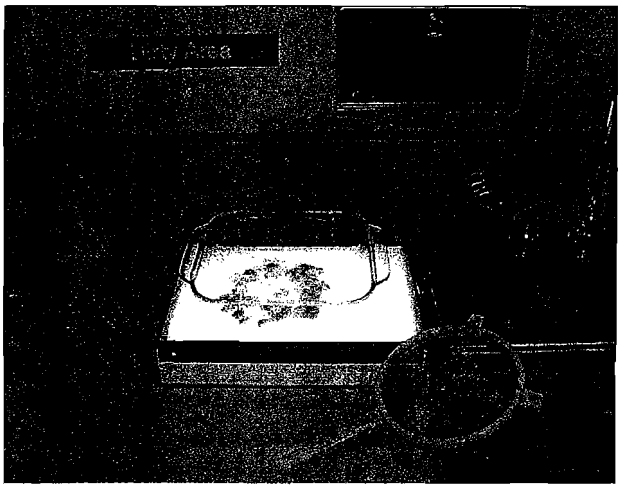


Figure 10.4 Tissue examination area with a backlight and glass dish.

Manual versus electric suction

Use of manual vacuum aspirators (MVA; also called manual uterine aspirators or Karman syringes), once associated with resource-poor settings, has become increasingly common in developed countries in the past decade. These small handheld devices create up to 60 mmHg of suction, and they are quiet, small, and easy to transport. About 50% of US abortion providers use MVAs, particularly during the earliest weeks of pregnancy [52]. There is no clear gestational age limit in the first trimester at which MVAs are no longer appropriate. After 9 weeks' gestation, the MVA must be emptied a few times, so some providers prefer to switch to the electric machine. Other providers routinely use the MVA up to 14 weeks' gestation. MVA involves lower costs and service delivery resources [77].

A recent systematic review of randomized trials comparing MVA with electric vacuum aspiration (EVA) found no differences in complete abortion rates or patient satisfaction. At less than 50 days' gestation, women having MVA procedures experienced less blood loss and reported less severe pain, whereas women undergoing EVA had shorter procedure times [78]. Several of the trials included in this review are in Chinese and have not yet been translated into English. US trials have not demonstrated a difference in immediate complications [79] or pain between the two methods [10,80]. In several comparative studies, women reported the absence of noise as an advantage of MVA [10,81,82]. In one study, women who had EVA reported that the noise associated with the electric pump increased their pain, although pain scores did not differ [82]. Some clinicians who use MVA have commented that women ask for "the quiet procedure," indicating their preference for this aspect of MVA [81].

MVA devices

The components of an MVA aspirator include a cylinder, plunger, and valves (Fig. 10.5). The aspirator accommodates various sizes of cannulae, although some aspirator-cannulae combinations require adapters. Aspirators are clean but not usually sterile when shipped, and they do not need to be sterile for use (although the cannula that enters the uterus must be sterile). The reusable models require high-level disinfection between each patient, and some models are designed to tolerate steam sterilization techniques. There are a number of MVA manufacturers worldwide including Ipas (Chapel Hill, NC) and MedGyn (Lombard, IL) that sell MVA instruments in the USA. In 2004, EngenderHealth published the *Practical Guide for Selection of MVA Instruments* [83], which details instrument handling, cleaning, and processing as well as compatibility with various cannulae. The package inserts for the devices also detail methods of disinfection and sterilization as well as assembly.

Use of MVA

With most manual vacuum aspirators, the provider closes the valves and pulls on the plunger to create a vacuum (Fig. 10.6). Some providers prefer to seat the cannula firmly into the aperture of the syringe before inserting it into the uterus, whereas others choose to insert the cannula into the uterus and then attach the prepared syringe. Once the cannula is situated inside the uterus, the clinician releases the valves and evacuates the uterine contents using the same movements as described in a later section for other first-trimester procedures. With other MVA syringes, the provider creates the vacuum after inserting the cannula into the uterus; these devices have a locking plunger that prevents loss of pressure during the procedure.

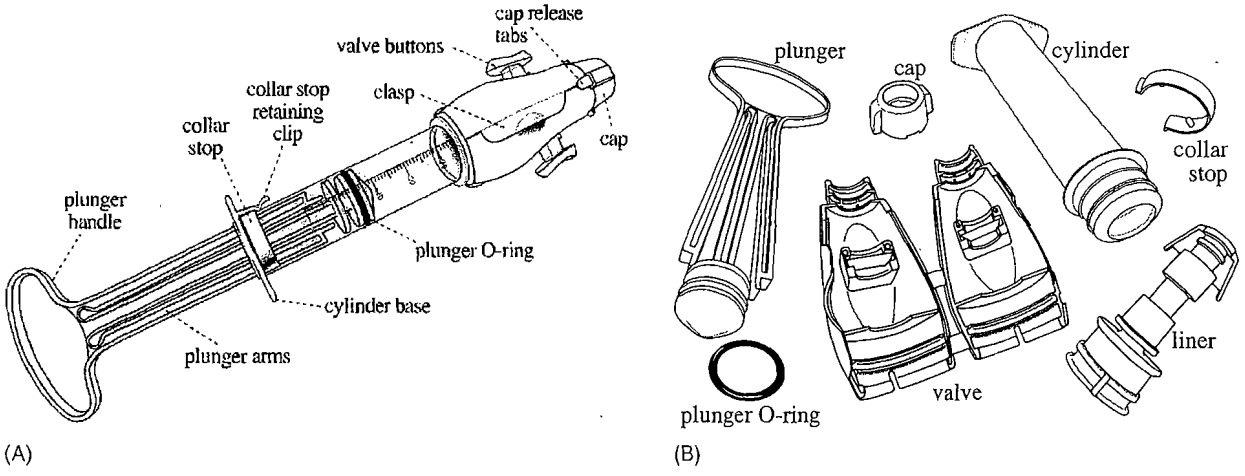
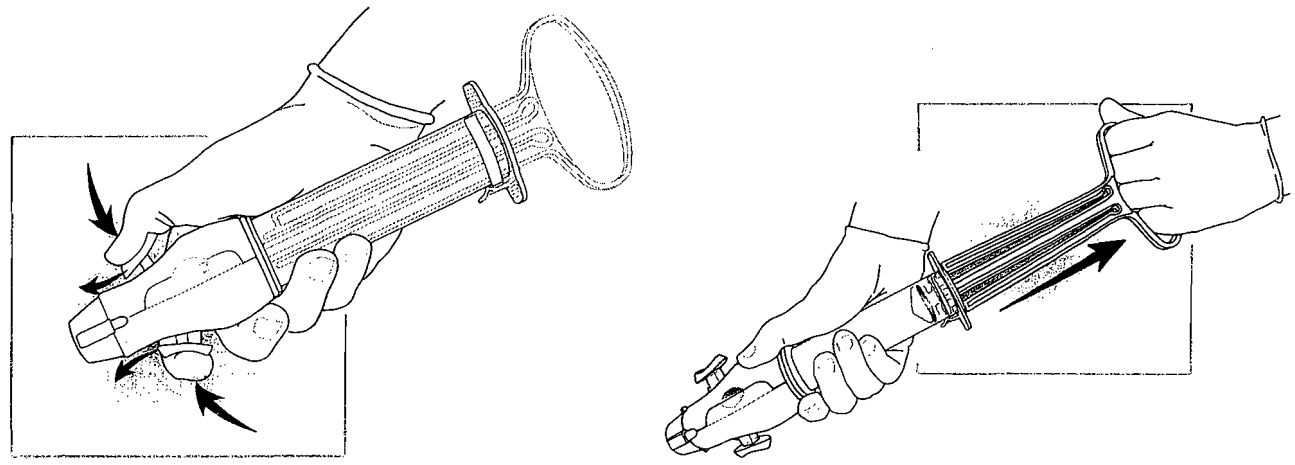


Figure 10.5 (A) Ipas manual vacuum aspirator (MVA Plus) consisting of a cylinder, plunger, and valves. This model and other aspirators accommodate flexible and rigid cannulae of various types and sizes. (B) The device comes apart for cleaning or sterilizing and must be reassembled. Used with permission from Ipas.



(A) (B)

Figure 10.6 Use of a manual vacuum aspirator: to create a vacuum, the provider closes the valves by pushing the buttons down and forward (A) and then pulls the plunger back until the plunger arms snap outward and catch on the wide sides of the cylinder base (B). Never grasp the aspirator by the plunger arms, and be sure that both plunger arms are secured over the edges of the cylinder to prevent them from slipping back inside the cylinder. A collar stop prevents the plunger from pulling out of the cylinder. Because the clear plastic cylinder pulls apart from the white plastic valve cap for cleaning and emptying, the provider should hold the cylinder to prevent separation while creating the vacuum. Used with permission from Ipas.

Electric aspiration machine

Electric aspiration machines have become quieter over the years, but they still create a low rumbling noise. One end of a plastic hose connects to a bottle on or in the aspiration machine, and the other end has a rotating handle that accommodates the sterile cannula. Single-use or reusable hoses are available. Reusable hoses require high-level disinfection. Some facilities use adjustable wall suction attached to collection bottles, which functions similarly to a portable electric machine.

Instruments and supplies

A standard surgical tray containing only a small number of instruments suffices for termination of most first-trimester pregnancies (Appendix, Fig. A-1). Selection of particular instruments depends largely on provider preference. Keep the tray as simple as possible, and place the instruments in a standard configuration so that they can be located quickly. This predictability increases efficiency, keeps noise from instrument handling to a minimum, and is especially helpful during difficult or emergent cases. Instruments commonly included on a first-trimester aspiration abortion tray include the following:

- Speculum
- Tenaculum, usually single-toothed or atraumatic
- Ring-type forceps
- Set of graduated cervical dilators, commonly Pratt sizes 13 to 39 French
- Gauze sponges or cotton balls
- Antiseptic solution in a small basin

Additionally, a syringe and needle will be needed for administration of cervical anesthesia. Instruments that are used occasionally can be sterilized and stored separately in or near the procedure room so that they are readily available when needed.

Specula

Commonly used specula include adult Graves and its modifications, juvenile, and Pederson models. The Weisman-Graves and Moore-Graves specula have shorter blades that permit the cervix to be drawn closer to the perineum. Narrow blade designs, like Pederson and juvenile specula, may be more comfortable and effective in cases of extreme patient guarding or a narrow introitus. Open-sided or tri-blade models are useful in special circumstances. Specula with a more obtuse angle between the blade and handle can be helpful for women with anterior cervices or large buttocks (Appendix, Figs. A-2 to A-4).

Tenacula

Providers commonly use single-toothed tenaculum for first-trimester vacuum abortion [52]. Some clinicians prefer designs with blunt teeth or grooves, such as Allis or Bierer vulsellum tenacula. They cause tears less often but may slip off the cervix more readily if strong traction is applied. Ring-type forceps function well on fleshy, parous cervices (Appendix, Fig. A-6).

Dilators

Most providers use graduated and finely taped dilators, including Pratt dilators (Appendix, Fig. A-1) and their plastic equivalents, the Denniston dilators [52]. The curved tips of these models are particularly helpful when the endocervical canal is angled or tortuous. Pratt dilators are sized by the French designation, which refers to the circumference of the dilator in millimeters, and they increase by 2-mm increments. Dividing by pi (approximately 3) provides the diameter of the dilator in millimeters. Denniston dilators are sized by the largest diameter in millimeters, and they increase by 1-mm increments. Blunter designs, like Hegar or Hanks dilators, are less favored because they require greater force to dilate the cervix [84,85].

Cannulae

Disposable plastic suction cannulae come in flexible (e.g., Karman) and curved or straight rigid models (Appendix, Fig. A-9). Rigid plastic cannulae increase in diameter by 1-mm increments from 6 to 16 mm; flexible cannulae increase in a similar fashion from 4 to 12 mm. Nondisposable metal cannulae rarely are used; they come in only five diameters ranging from 8 to 16 mm and require sterilization before reuse. Cannulae from various manufacturers are not always compatible with MVA devices; although most combinations maintain pressure, some lose pressure rapidly [83,86]. Adapters on flexible cannulae are usually removable, so switching the adaptor may alleviate loss of suction if it occurs.

Forceps

A ring-type forceps is useful for retraction, to hold gauze sponges, and to tamponade a bleeding cervical laceration or tenaculum site (Appendix, Fig. A-6). In some cases of late first-trimester evacuation, standard sponge forceps or their heavier modifications are used as an adjunct to suction. When cervical dilation is snug, placental tissue or, in later gestations, the calvarium may have difficulty passing through the cannula. In these cases, the clinician can use the forceps to bring the tissue to the cervical os and remove it. Both ring-type and polyp forceps require at least 12 mm of cervical dilation to introduce them through the cervix.

Box A Supplies for Initial Office Management of Hemorrhage

- Supplies to provide IV fluids
- Uterotonics (Methergine, prostaglandin F2α, and/or misoprostol)
- Vasopressin (for cervical injection if not used routinely)
- Foley catheter with 30-cc balloon; small diameter, large syringe; sterile water to fill balloon
- Vaginal packing gauze

Uterine curettes

Routine use of metal uterine curettes is decreasing in first-trimester abortion practice [52]. Metal curette sizes start at a few millimeters in width and gradually increase (Appendix, Fig. A-12). No studies have examined the benefits or risks of routine sharp curettage following suction aspiration.

Gauze

Surgeons are often familiar with sponge-sticks made by carefully wrapping a large gauze sponge around a ring forceps. Because awake patients may experience considerable discomfort from passing large gauze through the vagina, use of cotton balls or smaller gauze may be preferable.

Syringe and needle

A standard 10-cc syringe and small-gauge (e.g., 21- to 25-gauge), 1.5-inch needle typically suffice for cervical anesthesia injections. A larger syringe may compromise visibility and a shorter needle limits the depth of injections, although use of a spinal needle circumvents these limitations. Some practitioners prefer a "control" syringe with finger loops to accomplish injections comfortably using one hand.

Emergency supplies

In addition to the typical supplies found in medical settings for airway management and treatment of anaphylaxis, abortion providers need emergency supplies for management of hemorrhage (Box A). Additional supplies depend on the type of anesthesia (Chapter 8).

Ultrasound

Ultrasound machines with basic features generally suffice for abortion services. A sector transducer "abdominal probe" of 3- to 5-MHz permits documentation of an intrauterine pregnancy at 7 weeks' gestation and greater for many women. A 5- to 10-MHz vaginal probe improves visualization of earlier pregnancies or retroverted uteri, allows evaluation of the adnexae if necessary, and permits more detailed assessment of the endometrium when retained tissue is suspected.

Determining which personnel are allowed to perform ultrasound examinations remains a controversial issue within institutions and is sometimes specified by hospitals or insurance policies. Only persons who have had adequate didactic and supervised hands-on experience should perform ultrasound examinations. Ultrasound examinations require permanently recorded images.

Pain control

Anesthesia options reflect available resources, patient and provider preferences, and risk assessment (Chapter 8). Regardless of the method used, the objective is to provide comfort and relaxation sufficient for patient satisfaction and completion of the abortion safely. Pain perception and response are extremely complex, interwoven into the psychological and social context, and vary widely among individuals. One Indian study found that when women were permitted to choose between the two extremes of general and local anesthesia, 60% chose general and 40% chose local. General anesthesia patients reported that having no pain (95%) or anxiety (38%) were the best features, whereas those having local anesthesia liked being ambulatory (26%), avoiding side effects (26%), and feeling awake (21%) [87].

Although offering a range of pain management options is ideal, not all facilities are equipped to provide deeper levels of sedation. A 2002 survey of NAF member facilities examined first-trimester pain management preferences for each clinic by determining the method employed for 40 to 100% of procedures. Of those clinics that expressed a preference, 46% used local cervical anesthesia with or without oral premedication, 33% combined local anesthesia with IV moderate ("conscious") sedation, and 21% offered deep sedation or general anesthesia [52]. Chapter 8 reviews these methods in detail, and they are only briefly summarized here.

- *Local Cervical Anesthesia*: No one method of cervical anesthesia clearly stands out as most effective. Most North American providers use 1% lidocaine [52], and they show a modest preference for paracervical injection at four or more sites (Chapter 8). Studies that demonstrate improved pain control with larger volumes of medication [88] and deeper injections [89] suggest that deposition of sufficient medication at the nerve site is at least part of the mechanism of analgesia.
- *Oral Medications*: In the office setting, nonsteroidal antiinflammatory drugs (NSAIDs), oral or sublingual benzodiazepines, or oral narcotics commonly are combined with local anesthesia. In randomized trials, preoperative naproxen sodium demonstrated decreased pain compared to placebo [90], and ibupofen proved superior to tramadol (Ultram™) in reducing postoperative pain [91]. Although a low-dose benzodiazepine (lorazepam 1 mg) does not appear to help with pain in women who desire relaxation [88,92], it does decrease periprocedure anxiety [92]. Higher doses of oral or sublingual benzodiazepines (i.e., 1 to 3 mg of lorazepam) are used in clinical office settings for abortion, but they have not been evaluated in controlled trials.
- *Moderate ("Conscious") Sedation*: Typical regimens for moderate sedation in the outpatient setting include parenteral fentanyl, 50 to 100 μg, and midazolam, 1 to 3 mg (Chapter 8). Studies differ as to whether moderate sedation improves pain with abortion compared to local anesthesia alone, although it does appear to improve satisfaction with the experience [93,94]. Moderate sedation has not been compared to oral pain and relaxation medications.
- *Deep Sedation or General Anesthesia*: When local cervical anesthesia with mild relaxation or sedation is not sufficient to prevent agitation and abrupt movements, injury can result. Therefore, deep sedation or general anesthesia may be beneficial for extremely anxious patients or in cases of technically challenging procedures.

Principles of surgical technique

Adherence to principles of sound surgical technique enhances the safety of abortion. These principles include techniques to reduce the risk of infection, meticulous and gentle instrumentation, and sufficient knowledge and skills to perform the surgery efficiently and safely.

Wearing sterile gloves does not assure asepsis, because contamination occurs as soon as the gloved hands contact the patient. In addition, eradicating the natural microflora of the vagina is impossible. Therefore, providers typically employ a "no-touch" technique in surgical abortion practice: whether wearing sterile or nonsterile gloves, the clinician avoids touching the parts of instruments that will enter the uterus. For example, holding dilators in their midportion avoids contaminating the tips that pass into the uterine cavity (Fig. 10.7). Establishing a separate area on the field for sterile instruments ensures that other items that have contacted the provider's hands or the patient do not touch the

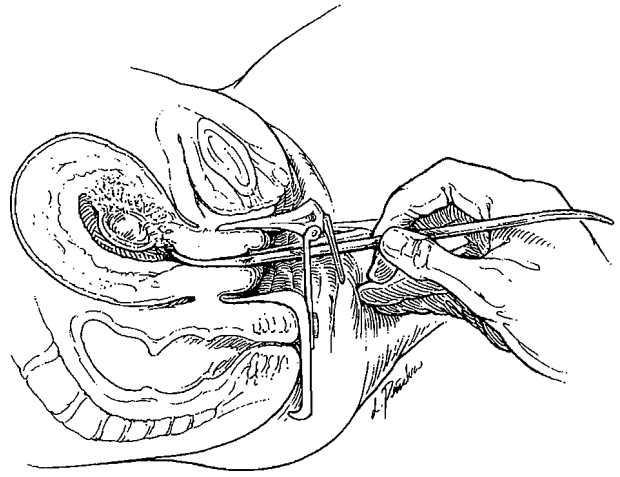


Figure 10.7 Dilation of the cervix with a Pratt dilator. Note that the provider holds the dilator in its midportion and avoids touching the tip of the dilator that enters the sterile uterine cavity ("no-touch" technique). The fourth and fifth fingers rest against the perineum and buttocks to prevent the dilator from thrusting forward as it passes through the internal os.

cannula or dilator tips. Taking care that instruments are inserted directly into the cervix without touching the vaginal sidewalls is also important.

Gentle manipulation of tissue helps to avoid trauma to the cervix or uterus. Forcible dilation of a noncompliant cervix can result in lacerations or perforations, and vigorous metallic curettage may produce intrauterine scarring, albeit rarely (Chapter 15). If the cervix is stenotic or rigid and a small-sized cannula will not complete the evacuation safely, delaying the procedure to effect cervical preparation with osmotic dilators or ripening agents is a better alternative than using excessive force.

The skill and experience of the provider are important determinants of the safety of abortion [54,95]. In most cases, first-trimester aspiration abortion is a simple procedure with low morbidity; even less experienced operators may perform several hundred cases before encountering a serious complication. Although abortion training opportunities for physicians have increased over the past decade in the USA, they still remain inadequate [96]. Providers must remain cognizant of their skill levels, experience, and limitations and know when to ask for help or to refer difficult cases.

Skills in abortion care also encompass the ability to communicate effectively with patients (Chapter 5). Confidence and comfort are enhanced when the provider acts professionally, conveys warmth and empathy, provides useful information, and addresses the patient's questions and concerns. During the abortion procedure, informing awake patients of what sensations to expect and reminding them to breathe deeply and rhythmically help prevent sudden movements that may jeopardize safety (Chapter 8).

Vacuum aspiration procedure

Providers use a variety of techniques to perform first-trimester abortions. This section provides a general description of first-trimester vacuum aspiration using cervical anesthesia, followed by a discussion of variations in technique used routinely or in particular situations. Administration of sedation or analgesia should occur about 30 to 90 minutes prior to the procedure for oral medications and immediately prior to the procedure for IV medications.

1 Align the patient's hips just beyond the edge of the table. For very heavy patients, the knee-chest position may facilitate visualization of the cervix. In the unusual case of an extremely anterior cervix that defies visualization, placing the patient in Trendelenburg position via an adjustable table may help.
2 Perform a gentle bimanual examination to assess the position, size, and contour of the uterus. Note the angle between the cervix and body of the uterus, which may approach 90 degrees in cases of extreme anteflexion or retroflexion. Substantial size/dates discrepancy or anatomic abnormalities warrant ultrasound if one was not already performed.
3 Insert a speculum gently into the vagina and open the blades to visualize the cervix. In very overweight women, the speculum handle will commonly sit between the cheeks of the buttocks unless a speculum with a wider angle is used.
4 Using a squeeze or spray bottle, cotton ball, or gauze swab, cleanse the cervix with antiseptic solution such as povidone-iodine or chlorhexidine.
5 Anesthetize the tenaculum site, either by injecting 2 to 5 cc of local anesthetic solution into the lip of the cervix or performing a complete block of the anterior lip (e.g., 5 cc each at 2 o'clock and 10 o'clock on the cervical face). Position the tenaculum either horizontally or vertically with the inferior tooth near the cervical canal, being sure to grasp the stroma of the cervix and not only the epithelium.
6 Applying gentle traction to the cervix, administer cervical anesthesia (Chapter 8).
7 Perform cervical dilation. Using a "no-touch" technique, grasp a small tapered dilator in its midportion and hold it much like a pencil (Fig. 10.7). Applying traction on the tenaculum to straighten the angle between the cervical canal and the uterine cavity, carefully insert the smaller end of the dilator to a depth just beyond the internal cervical os. Resting the fourth and fifth fingers against the perineum and buttocks during insertion prevents the dilator from thrusting forward as it overcomes the resistance of the internal os (Fig. 10.7). Some experienced providers prefer to rotate the dilator within the canal (Fig. 13.2) rather than inserting it directly. As the instrument traverses the endocervical canal, sense the smooth surface of the glandular mucosa. Deviation from this sensation, especially if accompanied by a subtle shearing sensation, suggests creation of a false channel (Fig. 13.6). Continuing to apply pressure in the wrong direction can result in perforation. Only when the direction of the canal is certain should dilation proceed using progressively larger dilators to achieve an opening sufficient to accommodate a plastic cannula of appropriate size.
8 Insert a rigid or flexible plastic cannula through the internal os, positioning it in the mid to upper fundus. As a general rule of thumb, use a cannula with a diameter in millimeters that approximates the gestational age in weeks (e.g., a 7-mm cannula for a 7-week gestation). If you are using Pratt dilators that are measured in circumference, multiply the cannula size by 3 (pi) to determine the largest Pratt dilator size necessary to achieve sufficient dilation (e.g., dilation to a size 21 or 23 Pratt will accommodate a 7-mm cannula). Avoid touching the end of the cannula that enters the uterus to anything except the cervical os. Attach the cannula to the suction machine tubing either before or after insertion.

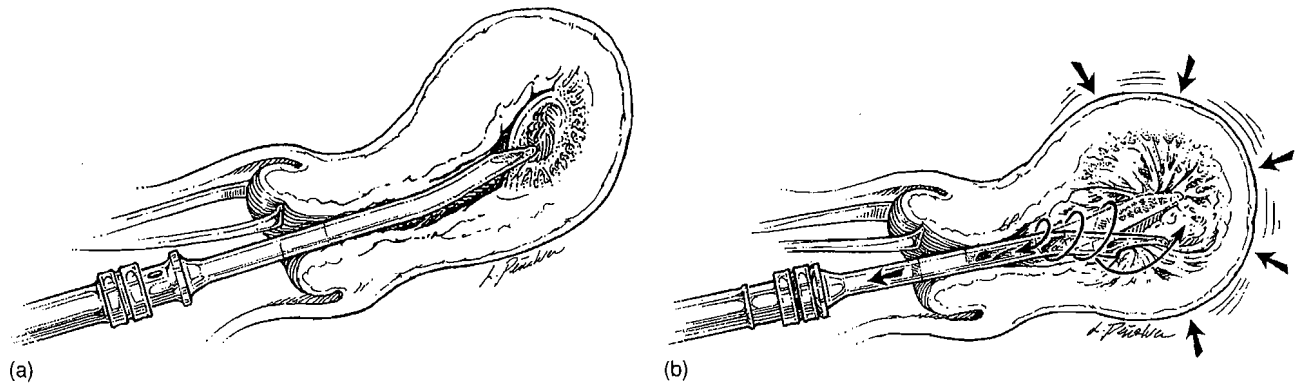


Figure 10.8 Technique of electric vacuum aspiration. (A) The cannula is placed in the mid to upper fundus before suction is created. (B) After closing the thumb valve to create suction, the provider rotates the cannula while gradually withdrawing it to the internal os. The motion is repeated until evacuation is complete.

9 Aspirate the uterine contents. If using electric vacuum, close the thumb valve on the hose and turn on the vacuum machine, assuring that it achieves a negative pressure of at least 55 to 60 mmHg. Evacuate the uterus by rotating the cannula while gradually and gently withdrawing it to the internal os (Fig. 10.8); advance the cannula and repeat this motion until flow of tissue through the cannula and hose ceases. Back-and-forth motions promote rapid evacuation, but they require the provider to remain cognizant of the depth of the fundus and create more movement that the patient may detect. Signs of complete evacuation include bubbles in the cannula and hose; contraction of the uterus around the cannula, making rotation increasingly difficult; and a "gritty" sensation when the cannula moves against the endometrial surface. At this point, withdraw the cannula from the cervix, releasing the pressure with the thumb valve as the tip of the cannula reaches the external os.
10 Remove the tenaculum and inspect the cervix for bleeding, then withdraw the speculum. Reassure the patient before you leave the room or before she moves to a recovery area.
11 Examine the fresh tissue aspirate as described in a later section.

Sometimes the flow through the cannula stops because the products are too large to pass. The provider can usually restore flow by releasing pressure with the thumb valve and quickly restoring it by closing the valve. If this technique fails, release and restore the vacuum while advancing the cannula a few centimeters into the cavity and then withdrawing it in a pumping motion. If the cannula still remains plugged, simply withdraw the cannula, releasing vacuum at the external os, and use a ring forceps to remove any material that is wedged in the end of the cannula or lodged at the external os. Final suctioning after the uterus has involuted may require a slightly smaller cannula to allow for unimpeded motion.

Failure to detect the gritty sensation that typically signals an empty uterine cavity may indicate retained products of conception, myomata, or uterine anomalies. If the curette reveals a slick area of uterine wall, repeat suctioning of the area often demonstrates retained placental fragments.

Variations in technique

Cleansing the cervix

Not all providers cleanse the cervix with dilute antiseptics prior to surgical abortion. Vaginal scrubbing does not notably decrease bacterial counts in the endocervix [97]. Two randomized studies of cervical cleaning with chlorhexidine did not demonstrate a difference in postabortal infection [98,99]. The infection rate in the 2005 study by Varli et al was 2.4% with cleaning and 2.1% without [99]. Prophylactic antibiotics were not used in either study.

Placement of tenaculum

When the uterus is retroflexed, some providers feel that placing the tenaculum on the posterior lip allows for more effective traction. Other providers feel that anterior placement is still preferable for a retroflexed uterus, as the tenaculum can be used to torque the uterus and allow easier access to the posterior wall. No studies have evaluated if any specific technique is more advantageous.

Uterine sounding

A small proportion of providers routinely uses a uterine sound to measure fundal depth prior to evacuation [52]. This practice, however, carries risk. In an early study of abortion complications in over 37,000 women, 23% of perforations were associated with uterine sounding, although the incidence of recognized perforations was low (0.16%)[100]. A 13-year retrospective review of patients who sustained perforations during first-trimester abortions found that the suction cannula represented the most common perforating

instrument (25%), followed by the uterine sound (23%) and the dilator (20%) [101].

The uterine sound, however, has value as an adjunct in performing aspiration abortion. Because a metal sound is visualized easily with real-time ultrasound, it is a useful marker for locating elusive pregnancy sacs in abortions complicated by congenital or acquired anomalies. Some providers use a sound to identify and evaluate suspected uterine perforations, especially in conjunction with ultrasound. Documenting that a perforation does not exist or is small often permits experienced clinicians to complete uterine evacuation immediately and safely.

Choice of cannula

Providers' preferences vary for desired size and type of cannula. A 2002 survey of North American abortion providers found that, for first-trimester abortions after 7 weeks' gestation, 54% dilate to a diameter in millimeters corresponding to the number of gestational weeks, whereas 37% dilate 1 to 2 mm more [52]. A minority of clinicians prefers to dilate to 1 to 3 mm less than the gestation age to minimize discomfort in awake patients. A relatively larger cannula facilitates the ease and speed of uterine evacuation and may permit more intact tissue to facilitate gross examination. A smaller cannula may cause less discomfort and often slides without resistance (especially as the uterus involutes). Some products of conception may not fit through a smaller cannula, in which case pulling the cannula through the cervix with a small amount of suction often brings the tissue through the cervical os where the provider can remove it with ring forceps. No studies have compared rigid and flexible cannulae. Rigid cannulae have a slightly larger internal aperture and a larger single opening at the tip. Providers have varying opinions regarding which cannulae permit them to best feel the gritty texture of the empty uterus.

Mechanical dilation

A small Pratt dilator usually passes with no resistance, even in the early first trimester, and a larger dilator may pass initially with a soft or previously dilated cervix or a later gestation. Some providers prefer to attempt to pass a small cannula without dilation or pass successively larger cannulae instead of dilators. In most cases, providers dilate incrementally in order to expand the cervix gradually. When the internal os is compliant, however, clinicians can skip dilator sizes. A minority of abortion providers uses blunt dilators some or all of the time. Blunt dilators increase in size more rapidly than tapered dilators, requiring fewer instrument passes.

Some reports suggest that cervical resistance notably drops when mechanical dilation achieves a diameter of approximately 11 mm; whether this occurrence represents minor cervical injury or is of clinical import is unknown [102]. No controlled trials have compared outcomes after lesser versus greater mechanical dilation in first-trimester abortion; at the same time, no epidemiologic evidence supports an increased risk of cervical incompetence after first-trimester vacuum aspiration abortion (Chapter 16).

Providers use a variety of techniques when the internal os is difficult to locate (Chapter 13). These approaches include increased cervical traction, repeat pelvic examination to reassess the angle of the canal, and probing gently at varied angles to locate the os. In difficult cases, abdominal ultrasound usually provides a clear view of the cervix and dilator, allowing for safe dilation under direct vision (Chapter 13).

When the cervical canal or internal os is tight, providers may use special, thinner instruments including ultrathin dilators, plastic or metal sounds, IV catheter sheaths, lacrimal duct probes, or plastic os finders (Appendix, Fig. A-7). Applying sterile lubricant or a detergent antiseptic to the dilator helps reduce resistance. Once a dilating instrument successfully passes the internal os, allowing it to reside in the canal for a short time facilitates subsequent dilation. In some cases of difficult dilation, the provider can evacuate the uterus using a smaller cannula than is ordinarily employed. Failing these maneuvers, osmotic dilators or cervical ripening agents (e.g., misoprostol) are effective in softening and expanding the cervix; their use delays the abortion for only a few hours. In very rare cases of extremely difficult dilation in an early pregnancy, a 1- to 2-week wait will almost always result in a more compliant cervix. Medical abortion is also an alternative for women with early pregnancies.

Suction technique

Providers vary in positioning the cannula within the uterine cavity; some prefer placing it at the top of the fundus whereas others choose the midfundus. Outcomes have not been statistically compared. The same is true for differences in the rotary or back-and-forth motions employed during aspiration. Most providers apply a combination of the two motions. Some clinicians prefer a technique of serial side-by-side strokes with the cannula placed flush to the walls of the uterus.

Modulating control of suction pressure during aspiration is another variation in technique. By adjusting the sliding sleeve on the thumb valve or turning the dial on the aspiration machine, the clinician can modify vacuum pressure from zero, when the valve is open, to the usual upper range of 55 to 75 mmHg. Intermediate levels may allow for freer motion of the cannula as the uterine cavity begins to involute. Switching to a smaller cannula during uterine involution also achieves this objective. When using a manual suction device, pulling back the plunger part way prior to cocking the valves (or placing the cannula, depending on the device) reduces the level of suction. The amount of suction

also decreases as the MVA chamber fills with the products of conception and blood.

Confirming a complete procedure

Although the cannula is the primary instrument of curettage, nearly 50% of North American providers determine completeness of evacuation by gentle sharp curettage followed by final suctioning [52]. In most cases meticulous suctioning suffices to empty the uterus. No data suggest that additional sharp curettage lessens the risk of retained products or failed attempted abortion, and sharp curettage causes more pain than suction curettage [103].

Perioperative ultrasound

Only 21% of North American specialists use intraoperative ultrasound routinely during first-trimester aspiration abortion, although most use it for difficult cases [52]. Ultrasound can help the practitioner determine the direction of the endocervical canal during dilation, locate intrauterine gestational sacs in uteri distorted by congenital or acquired anomalies, or assess complete evacuation. In addition, ultrasound may provide confirmation of suspected uterine perforation and enable experienced operators to complete evacuation in the face of such injuries. In the later first trimester or with multifetal pregnancies, intraoperative ultrasound may speed the procedure by identifying what tissue remains and when complete evacuation has occurred.

Few studies have assessed the value of perioperative ultrasound for first-trimester aspiration abortion. One randomized trial from a teaching hospital in the UK found a 4% rate of immediate complications in 108 women who had ultrasound-guided early aspirations versus 16% in 107 women who had their procedures without ultrasound [104]. Complications were ill defined in this study, and the reported rates were substantially higher than those found in most surgical abortion studies [55,105]. In a recent randomized trial from Israel, Debby et al [106] allocated 809 women who had aspiration abortions at 7 to 14 weeks' gestation to routine postprocedure ultrasound with immediate reaspiration for an endometrial thickness of 8 mm or more or no postoperative ultrasound. Women in the no ultrasound group were significantly more likely to undergo subsequent procedures for suspected retained tissue, although the indications for this intervention remain unclear. Other investigators have found endometrial thickness a poor predictor of retained products in the days following first-trimester aspiration abortion [107–109]. An Israeli group has developed a special speculum and device that permits real-time vaginal sonography during uterine procedures. One report of use during 45 first-trimester abortions noted no complications and favorable responses from the nine participating physicians [110]. The device may be especially helpful in cases of difficult dilation or a distorted endometrial cavity.

Prophylactic uterotonics and vasoconstrictors

Although uterotonic medications are useful in the emergent management of hemorrhage, few data support their routine use during first-trimester abortion. Two first-trimester abortion studies found that intraoperative administration of IV oxytocin only minimally decreased blood loss when used at or after 9 weeks' gestation [111,112]. A 1998 review found no evidence supporting the routine use of methylergometrine to reduce blood loss during first-trimester abortion [113]. The advantages of vasopressin therapy in controlling blood loss are greater in late first-trimester abortion and beyond [114]. However, intracervical administration of low-dose, dilute vasopressin at the time of first-trimester vacuum abortion may reduce the incidence of reaspiration for postoperative bleeding and cramping [115]. Moreover, in a randomized trial of women undergoing operative hysteroscopy, administration of dilute vasopressin decreased the force required for mechanical dilation [116]. One to six units of vasopressin are typically added to the local anesthetic solution. Sands et al [117] reported a reduced incidence of postabortal hematometra with routine administration of intramuscular ergonovine 0.1 mg immediately after first-trimester surgical abortion.

Very early abortion

Very early abortion became possible with the introduction of plastic cannulae that permitted diameters smaller than the 8-mm width feasible with metal. Advantages include early relief from the symptoms and anxiety of undesired pregnancy and more psychological comfort with terminating an early pregnancy. According to CDC data, the proportion of US abortions occurring during the earliest weeks of gestation has increased steadily since 1992 [3]. Surveys by the Guttmacher Institute indicate that the proportion of US providers offering abortion at 4 weeks' gestation rose from 7% in 1993 to 40% in 2005 [2]; the latter figure is similar to that found in a large survey of NAF member clinics conducted in 2002 [52].

With the use of modern technologies of pregnancy detection, meticulous technique, and appropriate follow-up, no gestational age may be too early to attempt aspiration abortion. One large case series of aspiration abortions performed at less than 6 weeks' gestation by a single practitioner using a uniform protocol found a continuing pregnancy rate of only 0.1%, although the rate of follow-up was not reported [118,119]. A later observational study with rigorous follow-up of patients having abortions before 6 weeks' gestation by multiple providers at Planned Parenthood clinics found a continuing pregnancy rate of 2% [120]. These rates compare favorably with those reported after early medical abortion, and they are lower than early surgical reports showing failed abortion rates exceeding 4% [121,122]. Early detection of ectopic pregnancies with this approach is a distinct

clinical advantage and contributes to its cost-effectiveness [118,119].

In very early pregnancies, identifying the gestational sac on tissue examination may prove difficult. In one case series of aspiration abortions at less than 6 weeks, gestational tissue was identified in 50% of pregnancies in which the gestational sac was not seen on preprocedure vaginal ultrasound examination [118]. Failure to identify products of conception warrants further workup for possible ectopic pregnancy or continuing pregnancy as described in a later section.

Examining tissue

Examination of the uterine aspirate is an integral aspect of aspiration abortion and has numerous benefits. It allows the provider to ascertain that the major elements of the pregnancy are removed and helps to distinguish intrauterine from ectopic pregnancies. The clinician may also detect abnormalities that warrant microscopic evaluation. For example, while villous edema is quite common with nonviable or genetically abnormal pregnancies, this finding requires evaluation by a pathologist to rule out hydatidiform mole or choriocarcinoma (Chapter 19). Systematic and thorough inspection of the tissue minimizes delayed complications of abortion.

Identifying villi alone in the absence of membranes or a gestational sac is insufficient to confirm an intrauterine gestation or complete abortion. Sometimes the provider can obtain a sampling of villi without removing the gestational sac. Villi may be present in the uterine aspirate in about half of interstitial ectopic pregnancies; this unusual type constitutes about 2% of all ectopic pregnancies. It is not known whether ectopic pregnancies that are located more distally (e.g., ampullary, isthmic) are capable of shedding villi through the uterotubal junction where they can be captured by aspiration. Moreover, identification of products of conception does not rule out the rare case of heterotopic pregnancy.

Typically, the surgeon or appropriately trained clinic staff carries out the tissue examination. Useful items for tissue examination include a standard kitchen strainer, a clear glass dish (e.g., glass baking dish), backlighting, and when necessary, microscopic magnification. Placing the glass dish on an x-ray view box or a photographic slide viewer provides excellent backlighting of the tissue (Fig. 10.4).

Often, the examiner suspends the tissue in water to assist visualization. To accomplish this, transfer the tissue from the vacuum bottle or syringe to the strainer. Rinse the tissue under running water. Float the tissue in a backlit glass dish that is filled with ¼ to ½ inch of water. Some practitioners use an isotonic solution (normal saline) or add acetic acid (household vinegar) to enhance identification of the tissue or prevent osmotic damage when pathologic or genetic analysis is planned. Light shining up through the bottom of the container helps distinguish the following elements:

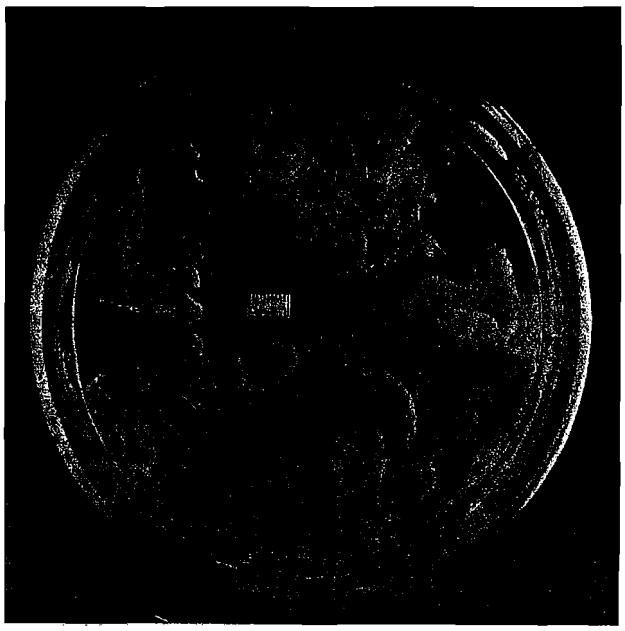


Figure 10.9 Postabortion examination of the uterine aspirate from an 8-week pregnancy. Suspending the tissue in water helps distinguish the various pregnancy elements. Note the thin, transparent gestational sac lined by frond-like villi (a). The decidual tissue is reddish brown or gray and heavier, sinking to the bottom of the dish (b). The decidua capsularis appears as an opaque sheet with hemorrhagic areas (c). See Plate 10.1.

decidual tissue, which is clear, light-colored, or reddish brown; the decidua capsularis, an opaque sheet with hemorrhagic areas; the thin and transparent gestational sac; and chorionic villi, which are transparent with frond-like projections (Fig. 10.9). Very small embryo-fetal parts may be apparent at 9 weeks' gestation and become easier to identify thereafter. Typically, a 6-week intact sac is about the size of a dime (Fig. 10.10); a 7-week sac, a nickel; and an 8-week sac,

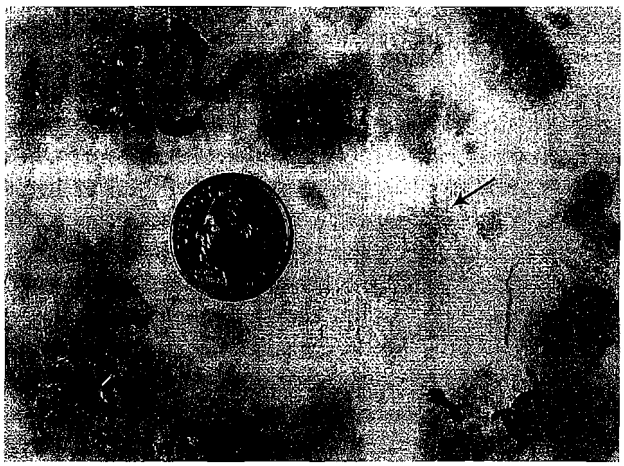


Figure 10.10 Gestational sac (arrow) evacuated from a patient with a 6-week pregnancy is about the size of a dime. See Plate 10.2.

Figure 10.11 Eight-week gestational sac (a) adjacent to a sheet of decidua capsularis (b), floated in water. See Plate 10.3. (Courtesy of Dr. Jerry Edwards.)

a quarter (Fig. 10.11). Often, however, the sac is fragmented, appearing as separate pieces of transparent membranes.

Rather than straining, rinsing, and floating the tissue, some providers find that they can identify the tissue from early pregnancies easily when the aspirate is placed directly into the dish. The small amount of blood outlines the chorionic villi, and even small degrees of hydropic change present with many nonviable or genetically abnormal pregnancies become visible (Fig. 10.12).

Because of individual variation in the amount of decidua, weighing the tissue is not a good predictor of complete removal of the gestation [123]. Photographing or videotaping the gestational tissue offers an inexpensive way to document what is seen in the aspirate, particularly when the tissue is not sent routinely for pathological examination. The additional use of a handheld lens, colposcope, or dissecting microscope may be helpful, especially in very early gestations [118,124]. The provider can suspend tissue in a drop of saline, apply a coverslip, and examine it microscopically under low power (×100). Villi are usually easy to recognize at this magnification (Figs. 10.13, 10.14, 10.15).

Figure 10.13 Photomicrograph of gestational sac at approximately 4 weeks LMP. Note how delicate and frond-like the villi appear compared to the decidual glands depicted in Plate 10.7. See Plate 10.5. (Courtesy of Dr. Jerry Edwards.)

Unless required by local regulations, many facilities do not routinely send the aspirate for outside pathological examination. With sufficient experience, the expertise of abortion providers in detecting pregnancy elements in fresh aspirates often exceeds that of pathologists who examine the tissue after fixing [125]. However, routine pathological testing provides a permanent record by a dispassionate expert. Pathologic examination is warranted whenever hydropic villi are

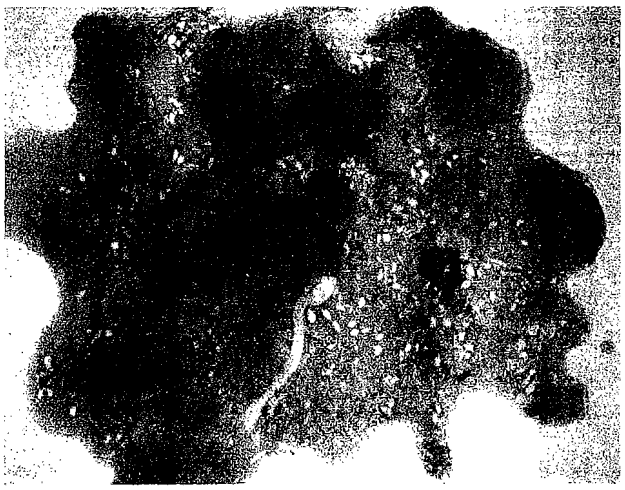


Figure 10.12 Unrinsed hydropic villi from an 11-week pregnancy with trisomy 18. See Plate 10.4.

Figure 10.14 Photomicrograph of decidual capsule (left) that has been opened to reveal the early gestational sac (right). See Plate 10.6. (Courtesy of Dr. Jerry Edwards.)

Figure 10.15 Decidual glands as shown in this photomicrograph must not be confused with gestational tissue. See Plate 10.7. (Courtesy of Dr. Jerry Edwards.)

detected and in certain cases of suspected ectopic pregnancy. If necessary, pathologists can use immunochemical stains for human chorionic gonadotropin (hCG), human placental lactogen, and cytokeratin to distinguish trophoblasts from decidua [126] or perform specialized tests to facilitate the diagnosis of early molar pregnancy [127] (Chapter 19).

Procedures for inconclusive tissue examination

Failure to confirm an intrauterine gestation by gross tissue examination warrants evaluation for possible ectopic pregnancy (Chapter 18) or a continuing early pregnancy (Fig. 10.3). If an ultrasound machine is available on-site, perform a sonogram to look for a persistent intrauterine pregnancy, uterine anomalies, or adnexal findings consistent with a tubal pregnancy (Chapters 6 and 18). If a persistent gestation is noted, repeat uterine aspiration.

If intrauterine pregnancy remains unconfirmed, draw an immediate blood sample for determination of hCG level (Fig. 10.3). Patients whose initial serum hCG level exceeds that of the laboratory's discriminatory zone (usually 1500 to 2000 mIU/ml) require prompt evaluation for possible ectopic pregnancy. If the patient has an initial serum hCG below the discriminatory zone and is asymptomatic, she may return for a follow-up hCG measurement 24 to 72 hours later. A decline in hCG levels of 50% or greater during this time period indicates complete abortion, and further testing is unnecessary [118,119]. If the level is increasing, the rate of rise coupled with endovaginal ultrasound helps to distinguish a continuing intrauterine pregnancy from an ectopic gestation. A level that falls by less than 50% warrants evaluation for possible ectopic pregnancy. Most of the ectopic pregnancies detected by this method are early and unruptured, rendering them suitable for treatment with methotrexate rather than surgery (Chapter 18). Some providers send the tissue for a pathological examination in addition to or in lieu of following serum hCG levels [128]. In some settings, this practice may yield results nearly as rapidly as blood draws 2 to 3 days apart. Even detailed pathological examination, however, may not identify an intrauterine pregnancy if a tiny sac adheres to an instrument and is not present in the specimen. In this case, women may be treated unnecessarily for ectopic pregnancy.

Postprocedure care

Patients who have uneventful first-trimester vacuum aspiration abortions with local anesthesia require only short recovery periods; administration of general anesthesia or deep sedation may necessitate longer observation. Key elements of postprocedure care include monitoring of bleeding, pain management, provision of desired contraception, and verbal and written discharge instructions with emergency contact information. Instructions should include when and whom to contact in case of concerning symptoms. Contraception counseling and provision at the time of the abortion help to prevent pregnancies that can occur shortly after abortion and obviates the need for a follow-up visit to obtain contraception (Chapter 14). Although many providers schedule routine follow-up visits 2 to 3 weeks following first-trimester aspiration abortion, the benefits of this practice remain unproven [129]. The NAF *Clinical Policy Guidelines* do not recommend a routine follow-up visit [44]. The Royal College guidelines recommend that providers offer a routine follow-up visit in 2 weeks, although it adds that the visit is optional if complete abortion is confirmed on the day of the procedure [42].

Few data exist to determine the necessity of Rh(D) immunoprophylaxis after early induced abortion [130]. Given its possible advantages and low risks, however, both the ACOG [131] and the RCOG [42] recommend that all unsensitized Rh(D)-negative women receive Rh(D) immune globulin within 72 hours postabortion. Standard practice in the USA includes a 50-μg dose prior to 13 weeks' gestation and a 300-μg dose thereafter.

Periabortal antibiotic prophylaxis reduces the risk of infection after aspiration abortion, regardless of risk factors [132]. Universal prophylaxis costs less and is at least as effective as screen-and-treat strategies [133–135]. Many antibiotic regimens have proven effective for this purpose, and the optimum prophylactic regimen remains unclear [132,136]. The ACOG makes no specific recommendation, although it refers to doxycycline 100 mg orally 1 hour preoperatively followed by 200 mg after the procedure as "one of the most effective and inexpensive regimens reported in a meta-analysis"[136]. The RCOG advises a treatment regimen of metronidazole 1 gm rectally at the time of abortion, followed by a 7-day course of doxycycline or a single 1-gm dose of azithromycin [42]. Doxycycline remains

the preferred antibiotic among North American abortion providers with regimens ranging from 1 to 7 days [52].

Conclusion

First-trimester aspiration abortion is one of the safest procedures provided for women of reproductive age. Its use in lieu of dilation and sharp curettage has reduced abortion-related morbidity worldwide. Clinicians employ many variations of technique to accomplish first-trimester aspiration abortion safely in clinics, offices, and hospitals. Manual vacuum aspiration is portable, requires less equipment, and equals electric suction in efficacy and safety. Although most providers use mechanical dilation alone for early first-trimester aspiration, cervical preparation with osmotic dilators or pharmacologic ripening agents may facilitate procedures in the later first-trimester or in adolescents. Tissue examination, appropriate follow-up instructions, and contraception counseling are integral to aspiration abortion practice.

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