Surgical Abortion: Management, Complications, and Long-Term Risks

Warren M. Hern, M.D., M.P.H., Ph.D.

Director, Boulder Abortion Clinic

Assistant Clinical Professor
Department of Obstetrics & Gynecology
University of Colorado Health Sciences Center

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In the controversy surrounding abortion, the fact that it is a surgical operation in most instances often is ignored. The fact that it is the most common surgical operation performed in the United States, and probably in the world, is ignored. Its potential hazards are underrated, partly because we have become accustomed to the routine performance of exceptionally safe abortions by highly skilled physicians. The issues surrounding abortion—political, medical, ethical, and religious—are aimed variously at eliminating the procedure itself, eliminating reliance on the involvement of the medical profession, and sometimes even eliminating the practitioners themselves.

Abortion has been considered a stigmatized operation by the medical profession for centuries. Medical teaching centers have considered abortion too simple to merit serious instruction in its performance and provision as a medical service. Because the highest status in traditional obstetric and gynecologic programs is accorded to those who master the complexities of difficult obstetrics and major pelvic surgery, the simple act of emptying the uterus competently has not offered the student great rewards. In some programs, assignment to the abortion rotation is considered a type of academic and surgical purgatory to be tolerated with minimal compliance.

It is no wonder, then, that the practitioner thus oriented is inadequately prepared for the practical reality of the overwhelming demand for abortion services and the necessity of providing these services in everyday practice. It is no wonder that the complication rates for abortion sometimes are higher than they should be. The basic concepts of abortion performance are learned by accident, if they are learned at all. The fact is that these concepts are fundamental as basic surgical techniques.

The emphasis in this chapter is on the principles of operative technique throughout the range of abortion practice from 6 through 24 menstrual weeks of gestation. The emphasis also is on outpatient practice in a freestanding clinic or private office setting. Detailed step-by-step methods are described in specialized texts and reports.[1-3]

GENERAL PRINCIPLES OF ABORTION TECHNIQUE

The first step in any surgical procedure and the management of its complications is prevention. Good surgical techniques should be followed for any type of surgery, and tend to prevent complications. These include accurate preoperative diagnosis and evaluation, a high level of operator skill, sound sterile technique, atraumatic surgical technique, thorough removal of devitalized tissue, and careful postoperative supervision and follow-up.

Careful application of these principles can eliminate most sources of complications in surgical abortion. Although many believe that complications are inevitable, the best attitude is that all complications are preventable. Each complication must be examined to determine its source and possible means of prevention. The lessons thus derived should be applied immediately to the operating protocol.

PREOPERATIVE DIAGNOSIS AND EVALUATION

Preoperative diagnosis and evaluation of abortion patients means answering several of the following questions:

Is the patient pregnant?

What is the length of gestation in terms of actual fetal age?

Is the pregnancy complicated by the presence of uterine abnormalities, multiple gestation, hydatidiform mole, or other conditions?

Is the pregnancy complicated by the history or presence of concurrent medical or surgical conditions such as diabetes, neurologic disorders, previous cesarean delivery, or cardiovascular disease?

OPERATOR SKILL

A high level of operator skill is at least as important in abortion as in any other surgical endeavor. Abortion is a blind procedure that is performed by touch, awareness of the nuances of sensations provided by instruments, honesty, and caution. Competent orientation in the performance of an abortion is essential, but abortion, almost more than any other operation, demands experience to develop skill. Experience that is not interpreted honestly, however, becomes the mere repetition of mistakes. Practitioners must be brutally honest with themselves to make the necessary corrections from second to second while performing the procedure. Has the suction tip passed through the uterine wall? Is the material grasped with the forceps unyielding? Is this material uterine wall and not fetal tissue? Is the patient merely agitated, or is she having a severe vasovagal episode?

Certain competence in other aspects of pelvic surgery learned in residency training does not assure competence in abortion. Likewise, competence in first-trimester abortion by no means assures immediate competence in second-trimester operative technique.

Operative competence in abortion comes through observation of an experienced and highly competent practitioner, through performance of early, uncomplicated abortion under direct supervision until confidence and smoothness are gained, and through practice.

STERILE TECHNIQUE

Sterile technique is often abandoned or neglected in some aspects of abortion care, partly because the risks of poor technique are underestimated. Although the germ theory of disease has fallen on hard times, it unquestionably has relevance to abortion technique.

Each abortion, no matter how carefully it is performed, results in a contaminated uterine cavity. Most women overcome this contamination through natural body defenses against infection. However, a more prudent point of view is that the operator must do everything possible to keep contamination to a minimum. This approach implies the use of individually sterilized specula, autoclaved instruments, and face masks and sterile gloves. The *no-touch* technique is essential, as is scrupulous attention to intraoperative sterile technique. Even when abortions are performed by highly experienced operators, tissue is retained often enough to require assiduous attention to this point. A clot or devitalized tissue within the uterus is a superb culture medium for bacteria.

In the early 1970s, with the advent of outpatient abortion clinics, the no-touch technique became popular with abortion practitioners. This highly useful adaptation requires that the operator, after placement of the speculum and antiseptic cleansing of the vagina, touch only the grasping end or portion of the instrument on the sterile tray. After that part of the instrument is touched, it is kept away from the tips of any instruments that remain sterile an will be placed within the uterine cavity.

A common mistake seen in ambulatory clinics is the application of sterile operating room technique to this system; the result is complete contamination. For example, surgeons trained in operating room technique are accustomed to having the vagina and perineum prepared by a nurse or operating room technician before they enter the room. The surgeon dons a sterile gown and gloves, takes a sterile speculum from the tray, places it in a position in the patient's vagina after performing a bimanual examination, and proceeds with the operation. It does not matter whether the surgeon touches the speculum after that; it is sterile. The same operator need not pay attention to how the dilators are handled, because everything is sterile. The surgeon may touch the instruments on the end or in the middle or turn them around and back again with impunity.

Now place this operator in the outpatient clinic using a no-touch technique. The speculum is sterile and wrapped in its own package. The instrument tray is opened, and it is sterile inside. The patient has not been prepared in the standard operating room manner. After a bimanual examination is performed, the operator places the sterile speculum in the vagina, using at least one gloved

hand. Regardless of whether the operator uses one or two sterile gloves, the speculum is no longer sterile at this point; the perineum has not been treated with antiseptic. Suppose that the operator works in a clinic that uses sterile gloves from this point in the procedure. The operator dons sterile gloves, applies antiseptic to the vagina with a sponge forceps and gauze, and prepares to begin the procedure. Just before doing so, the operator stops to adjust the speculum with gloved hands. At that point, the operator might as well remove the gloves. The only reason for keeping them on would be to protect the operator from the patient's fluids; certainly, the gloves no longer serve their original function.

The no-touch technique practiced without gloves can be used in performing an abortion safely, but it is even more likely to result in contamination that endangers the patient. In outpatient abortion, the safest combination is a strict no-touch technique practiced with sterile gloves after the completion of initial (gloved) examination and antiseptic preparation. The increasing prevalence of human immunodeficiency virus infection and acquired immune deficiency syndrome makes this practice even more necessary for the protection of both the patient and the operator.

ATRAUMATIC TECHNIQUE

One of the first principles in medicine is not to harm the patient. Surgeons of all types properly emphasize the gentle handling of tissue to minimize trauma to the patient's body. There is no reason why this excellent concept should not be pursued vigorously in abortion.

The primary source of trauma to the pelvic organs in abortion arises from perforation of the uterus and a related injury, cervical laceration. These injuries vary widely in severity and principal cause, but many must be ascribed to methods of cervical dilation, especially in first-trimester abortion. In second-trimester abortion, uterine injury often arises from the use of crushing forceps but, again, these injuries frequently can be traced to inadequate cervical dilation.

Such an obstacle to the act of emptying the uterus as the internal os requires close attention. In early pregnancy and even beyond, the internal os generally resists dilation by force. If there is an alternative to brute strength, which tears tissue in a significant number of cases, why not use it?

In every major series of operative abortions, perforation of the uterus has been an important complication. Although perforation frequently is related to underestimation of gestational length, it is more likely to be related to uterine position and forcible dilation, especially in first-trimester abortion. The source of most perforations, forcible manual dilation, is obvious. There is an alternative to this method: dilation by means of *Laminaria* or other hygroscopic materials.[4]

Dilation of the cervix with *Laminaria japonicum* overnight or even for a few hours softens the cervix in addition to dilating it. The mechanism of this agent is incompletely understood, but it works.[5-9] The need for force in even supplemental manual dilation is reduced, the need for anesthesia is reduced, the procedure time is shorter, and wider dilation permits the easier use of instruments, such as curets, to assure uterine emptying. In second-trimester abortion, manual dilation is wholly inadequate.

In this case, atraumatic surgical technique does not mean that appropriate instruments may not be used. The curet is an indispensable instrument that, when used properly, can help to empty the uterus as no other instrument can. In addition, when handled properly, the curet is not much more likely to cause a perforation than is a flexible cannula.

The key to atraumatic use of the curet is the proper method of holding it. The instrument must be held gently between two fingers. The grip must be firm enough for control, but relaxed enough to permit the instrument to slip back through the fingers on encountering the uterine fundus or other resistance.

The use of an atraumatic tenaculum, such as the side-curve Kelly instrument with an Allis (5 × 6) tip, in accompaniment with *Laminaria* for dilation, will virtually eliminate cervical lacerations due to tenacula. With proper *Laminaria* dilation, this tenaculum needs to be closed only one stop, again minimizing trauma.

REMOVAL OF DEVITALIZED TISSUE

The purpose of an abortion is to empty the pregnant uterus of its contents. This principle may seem too elementary to state, but the frequency with which it is ignored requires its mention. The underlying surgical principle that is applied to abortion is thorough removal of devitalized tissue. The reputation for danger that abortion acquired in the United States, at least in the first half of the 20th century, was due to the many incomplete abortions that resulted in sepsis and death.

Modern applications of abortion technology sometimes overlook this important principle. Amnioinfusion patients are left to deliver the placenta on their own. Adherents of the "soft abortion" view abjure the use of curets, overlooking the fact that the Karmann cannula is not shaped like the inside of a uterus and cannot be placed with precision in the cornua, no matter how skillful the operator.

Several factors contribute to attainment of the goal of complete uterine evacuation. First, adequate dilation permits the use of appropriate instruments in both first-trimester and second-trimester abortion. Second, in first-trimester abortion, routine exploration and evacuation with forceps and curet after vacuum aspiration almost always yields tissue. The same is true for ring forceps exploration and curettage after second-trimester dilation and evacuation (D & E) abortion. The curet is a valuable tool for determining whether the uterine wall has been denuded of decidua and placental fragments, even after vacuum aspiration appears to be completed.

POSTOPERATIVE CARE

Careful postoperative supervision and follow-up are important in any type of surgery. The fact that abortion patients frequently feel well within a few minutes after the abortion does not minimize the necessity of such care.

For postabortion patients, vital signs should be observed and recorded at frequent intervals, including immediately after the procedure, while the patient is on the operating table; on arrival at the recovery room; and once before departure from the recovery room.

Tissue obtained during the abortion procedure must be examined immediately afterward by a competent person, if not by the physician. In all cases, it must be reviewed by the operating physician or a physician assigned to this task. The gross appearance of the tissue is far more informative for patient management than a laboratory slip obtained several days later. If the tissue is not consistent with the estimated length of gestation, the physician must evaluate the operative procedure to determine whether it was incomplete or irregular in some way.

If possible, follow-up arrangements must be made with the patient before she leaves, especially if the patient is from a distant community or cannot be contacted once she leaves. Good follow-up is the best way to prevent a minor postoperative complication from becoming major or even fatal.

SPECIAL CONSIDERATIONS IN SURGICAL ABORTION

Anesthesia

The choice of anesthesia is an important one and a subject that remains controversial among abortion service providers. The primary issue is whether general or local anesthesia is to be used for operative abortion, as opposed to amnioinfusion methods. The medical literature shows that local anesthesia has its risks, but most of them have to do with the inappropriate application of toxic amounts rather than inherent dangers of the local anesthetic agent itself. However, the dangers of general anesthesia are more significant. There appears to be no medical justification, other than uncontrolled epilepsy, severe mental retardation, or agitated psychosis, for the use of general anesthesia in abortion. Patient comfort and physician convenience are marginal indications for general anesthesia, considering the risks involved. The degree of bleeding experienced under general anesthesia is greater, the risk of perforation is greater, and the risk of death due to aspiration of vomitus, among other factors, appears to be greater. The risk of death for abortion performed under general anesthesia is two to four times greater than under local anesthesia, and the risk of major complication is up to four times greater under general anesthesia.[10-13] These risks may be even greater for second-trimester D & E abortion.

Local anesthesia offers many advantages over general anesthesia. First, the patient is alert, responsive, and communicative both during and immediately after the procedure. She is able to report important symptoms that may signal the occurrence or onset of serious complications in time to prevent them from becoming more serious or even fatal.

Second, generally, the patient feels well within minutes after the procedure, and has a clear head. This rapid recovery is an important advantage for patients who have driven long distances for the abortion and must drive home shortly after the procedure.

Third, the gag reflex is not diminished under local anesthesia, whereas it is suppressed with general anesthesia. Abortion patients may have many characteristics, but one of them is occasional difficulty in following instructions not to eat or drink anything for a fixed number of hours before the abortion procedure.

Fourth, patients who have had general anesthesia with previous abortions almost invariably have severe emotional problems dealing with the cur-

rent abortion, in both the preoperative and operative phases. This phenomenon has become obvious and wholly predictable. For mental health reasons alone, general anesthesia may be contraindicated for abortion procedures.

Fifth, the use of general anesthesia eliminates physician–patient interaction during the abortion and insulates the physician from the patient's emotional experience. This loss is a serious problem for physicians, and may make it extremely difficult for them to relate to the emotional problems encountered by abortion patients. It does nothing to enhance the physician's empathy for the patient's dilemma or the physician's understanding of the importance of this experience to the patient.

Some surgical procedures require general anesthesia. Open heart surgery, major abdominal surgery, and major orthopaedic surgery are among them; operative abortion is not.

Dilation and Evacuation

Since the 1972 report by Bierer and Steiner,[14] numerous accounts of dilation and evacuation (D & E) series have appeared in the literature.[1,15–18] One of the principal controversies among advocates of the D & E method is the manner of cervical dilation. The method described by Bierer and Steiner[14] and used by Barr[19] is manual dilation under anesthesia the day before the procedure, followed by placement of a number of *Laminaria* sticks. The *Laminaria* dilate the cervix overnight and permit the evacuation of the uterus with large forceps. Another protocol, described best by Hanson,[20] requires placement of several *Laminaria* in the cervix without manual dilation the afternoon before the abortion.

A protocol that I have adapted from the Japanese experience reported by Neubardt and Schulman[21] uses serial multiple *Laminaria* treatments over 2 days. Under this protocol, one or more *Laminaria* are placed in the cervix on day 1. They are removed and replaced by a larger number on day 2, and the uterus is evacuated with forceps on day 3 under paracervical block anesthesia. I use several variations of this method. Supplemental manual dilation is performed with oversize Pratt dilators or special Teflon dilators of my design.[2] With some patients, this procedure is augmented by intrafetal injection of digoxin 1.5 mg or hyperosmolar urea on day 1 or day 2.[3]

In addition to dilation, application of *Laminaria* frequently results in almost complete effacement of the cervix, leading to easy evacuation of the uterus through a widely dilated cervix. A variety of forceps, some also of my design, are used for the evacuation.[2]

Aside from operator skill, the most critical single factor in the safe performance of second-trimester D & E abortion is correct determination of fetal age. This knowledge permits adequate preparation of the patient materials for the procedure. Ultrasonographic examination is essential for consistently accurate diagnosis.[22,23]

The second most critical factor is adequate preparation of the cervix. This preparation includes dilation and softening over time. In some cases, acute mechanical dilation over a short time permits D & E abortion to be performed, but frequently it is less than optimum, and sometimes it is catastrophic.

A third factor is the availability of appropriate equipment and instruments for the performance of the procedure. Not having these instruments at critical points can result in unnecessary delays in completing the procedure, unnecessary blood loss, and unnecessary trauma to the patient.

In my opinion, the use of general anesthesia unnecessarily adds considerable hazard and risk to the performance of second-trimester D & E abortion.

RUPTURE OF MEMBRANES. When the serial multiple *Laminaria* technique is used, membranes frequently will be visible through the external os just before the D & E procedure, particularly if the fetal age is more than 15 or 16 menstrual weeks. Even if the membranes are not visible, an important question is whether they should be ruptured before evacuation of the uterus is initiated.

It has been my practice to rupture membranes with a ring forceps or amniohook just before the use of forceps in pregnancies that are beyond 14 menstrual weeks of gestation. Increasingly, I have performed this procedure under direct ultrasound visualization. This action offers several advantages.

First, it allows more or less complete drainage of amniotic fluid for measurement or separation. At the end of the procedure, fluid in the operating basin is almost all blood, and can be measured exactly. This measurement is important if the patient loses enough blood to require volume replacement. In all cases, the information is a matter of more than casual interest. It is an important outcome measure in determining the acute or potential morbidity of the operation.

Second, draining the amniotic fluid allows the uterus to contract, thereby helping to close the

large venous sinuses and reducing blood loss. The uterine contents are close to the lower uterine segment.

Third, removal of the fluid without a sudden hydrostatic change within the uterine cavity, along with closure of the venous sinuses, reduces the risk of amniotic fluid embolism. The danger of this outcome is heightened if abruptio placentae occurs while the uterus is full of amniotic fluid. Because amniotic fluid embolism is one of the major causes of morbidity and mortality in late abortion, this maneuver is an important means of preventing this potentially catastrophic complication.[24]

ADJUNCTIVE INFUSION METHODS. A variety of adjunctive infusion methods have been studied that potentially add to the safety of D & E abortion. These methods include amnioinfusion of a hyperosmolar urea solution and intrafetal injection of digoxin or another feticidal agent.[1,3] Comparative studies of these methods remain to be published.

MANAGEMENT OF COMPLICATIONS

Complications in abortion can be classified into four major categories: error in the estimate of the length of gestation, failure to empty the uterus, failure to exercise sufficient caution in the avoidance of trauma, and functional problems.

The most common complications in first-trimester abortions cut across these categories. They include uterine hypotonia or postabortal hematometra, retained tissue, infection, perforation, and vasovagal reaction.[25] Of these, postabortal hematometra may be the most insidious and least recognized by beginning practitioners.[26,27] Major complications are rare in first-trimester abortion, but usually, they flow from one of the common complications that has progressed or is managed inappropriately. The same is true for abortion deaths studied by the Centers for Disease Control.[28]

MAJOR CAUSES OF COMPLICATIONS

Error in Estimate of Gestational Length

An orderly review of the major sources of complications and their management must begin with a discussion of preoperative evaluation and accurate estimation of gestational length. The first decision that must be made is whether the operator requires the patient to be pregnant. In most surgical procedures, at least a presumptive diagnosis is required. The same standard should apply to abortion. However, this caution regularly is abandoned in the mystical operation *menstrual extraction*.[29] This euphemism for early abortion, which pretends to "extract" the menses, shuns the concept of diagnosis of pregnancy, thereby justifying somehow the performance of abortion on nonpregnant women as well as women in whom pregnancy is too early to detect by routine hormonal assay. This deception serves both the patient and the physician badly for a variety of reasons.

First, it rarely is possible to justify the performance of a vacuum aspiration abortion procedure on a woman in whom the diagnosis of pregnancy is not at least presumptive. Second, very early pregnancy is likely to be missed during such a procedure. Third, tissue is more likely to be retained if the pregnancy is interrupted. Fourth, the small uterine cavity makes meaningful movement of instruments almost impossible. Fifth, the procedure hurts much more than a later abortion. The use of "menstrual extraction" to deny the emotional implications of pregnancy and the decision to have an abortion is a practice that must be deplored.

A variation is the use of increasingly sensitive pregnancy tests. Highly sensitive tests will yield a much larger proportion of false-positive results, which can lead to the type of problems just described as well as to unnecessary emotional distress. Even an accurate diagnosis of pregnancy in the third or fourth week should not automatically lead to an attempt at very early abortion for the reasons presented.

One way to establish a positive diagnosis of pregnancy before early abortion is to perform a routine ultrasound examination with a vaginal probe. This excellent procedure eliminates the guesswork and permits the exclusion or evaluation of more complicated diagnoses, such as hydatidiform mole and ectopic pregnancy.

If a procedure is performed with minimal or no tissue resulting, then an important component of the differential diagnosis is nonpregnancy with a false-positive pregnancy test result accompanied, we must assume, by a history of the classic symptoms and signs of pregnancy. The differential diagnosis also should include failure to interrupt an early pregnancy; ectopic pregnancy; perforation of the uterus; and failure to detect a uterine anomaly, such as didelphia, leading to evacuation of the nonpregnant horn, and leaving the pregnant side undisturbed.

Several procedures can be performed to exclude each of these possibilities. One is a careful tissue examination, with rinsing of the tissue followed by

gross examination supplemented by inspection with a magnifying glass or low-power dissecting microscope. The second follows the old adage: when in doubt, examine the patient. Bimanual examination may indicate a strong possibility of one or another. This examination may be followed by sonography to detect a gestational sac, retained tissue, or other problem.

Presence of a gestational sac in the uterus suggests a failure to interrupt an early pregnancy, perforation, or uterine anomaly. Careful instrumental reevaluation, either with or without direct real-time ultasound visualization, should assist in determining which of these situations is present. Failure to identify an intrauterine gestational sac on tissue examination suggests either nonpregnancy or ectopic pregnancy. Histopathologic examination of any tissue obtained that shows decidua only requires that ectopic pregnancy be excluded.

Each patient in whom the diagnosis of ectopic pregnancy is considered but cannot be excluded by ultrasonographic examination should be given written and verbal instructions to report symptoms of one-sided pelvic pain followed by generalized abdominal pain, shoulder pain, dizziness and, sometimes, syncope. The patient should be evaluated within 1 week for the presence of a tender adnexal mass.

A different problem occurs when the initiation of a procedure shows serious underestimation of the length of gestation. This problem may be prevented to some degree by routine ultrasound examination of patients whose pelvic examination shows a uterus that is large for dates or borderline between first and second trimester. The latter distinction is somewhat false because the operator encounters a spectrum of increasing difficulty from the 12th menstrual week on, and each week of gestation brings a different type of complexity. Familiarity with the techniques of early midtrimester D & E abortion will help the practitioner to manage these situations.

Routine preoperative sonographic evaluation for diagnosis of gestational length, at minimum, has become the standard of care in second-trimester abortion.[2]

Failure to Empty the Uterus

A continued pregnancy, hemorrhage, and infection are the principal signs of failure to empty the uterus, with the latter two being the most common. A continued pregnancy may result from the causes described in the previous section or from

an unsuspected uterine anomaly. Treatment consists of repeating the procedure.

The signs and symptoms of retained tissue are cramping, heavy bleeding, and infection signaled by fever. Problems resulting from an incomplete abortion usually will occur within 1 week, if not sooner, but unusually heavy bleeding several weeks after the abortion should be considered evidence of retained tissue until proved otherwise. The most reliable indication of retained tissue is bleeding, particularly when prophylactic antibiotics have been given to the patient. As a rule of thumb, bleeding that is significantly heavier than the normal menstrual flow indicates reaspiration. A history of sudden hemorrhage that then ceased is valuable. The intervening use of tampons may prevent the examiner from seeing the evidence of this bleeding, but the history alone suggests further study.

A high fever (102°F [39°C] or more) within 72 hours of abortion should be considered evidence of retained tissue with sepsis until proved otherwise. The patient should be treated by prompt reaspiration followed by intravenous administration of antibiotics in combinations designed for anaerobic and microaerophilic bacteria.

After initial blood cultures, cefoxitin 1 to 2 g intravenously every 6 to 8 hours may be used. Other alternatives are combinations of clindamycin, chloramphenicol, or one of the cephalosporins with ampicillin or a penicillinase-resistant penicillin.

Milder infections indicated by a fever of less than 102°F (39°C) and moderate uterine tenderness may be treated with oral antibiotics and reaspiration. An excellent first choice is doxycycline 100 mg twice a day for 10 days.

Patients who experience cramps and moderate bleeding within a few days after abortion but whose symptoms do not seem severe may be advised to massage the uterus firmly while sitting on the toilet at intervals of 1 to 2 hours. Frequently, this treatment results in passage of small clots and relief of symptoms. If this remedy is not effective, or if symptoms become worse, the patient should be seen for reaspiration. When in doubt, reaspiration is the treatment of choice.

The controversy concerning the use of prophylactic antibiotics in abortion continues.[30–32] Many recommend the use of doxycycline 100 mg twice a day for 5 days after abortion, as preemptive antibiotic therapy on the grounds that, by definition, abortion cannot be a sterile operation, and every uterus is contaminated, no matter how careful the operator. Most patients overcome this contamina-

tion with natural resistance, but some do not. Because most abortion patients are young and experiencing their first pregnancy, the benefits of protecting their reproductive capability outweigh the disadvantages of routine antibiotic administration.

Failure to Avoid Trauma

There are various approaches to the management of uterine perforation, with treatment depending on the severity of perforation. When perforation of the uterine fundus is recognized before a first-trimester abortion procedure has begun, it may be managed by observation, treatment with oral antibiotics, and delay of the abortion for 2 or 3 weeks. Perforation occurring before second-trimester abortion is far more serious and normally requires laparotomy and repair.

Recognition of the perforation, however, may occur with the report of generalized abdominal pain by the patient during vacuum aspiration, in the case of the first-trimester abortion, or during instrumental evacuation of the uterus, in the case of second-trimester abortion. This event may be accompanied by the discovery of mesenteric fat in the aspirate or the appearance of small bowel in the forceps or vacuum cannula. Such an event requires immediate laparotomy to repair damage to the bowel or other viscera and to complete the abortion under direct visualization of the uterus.

Discovery of perforation during first-trimester abortion without evidence of visceral injury may permit completion of the procedure under direct ultrasonic or laparoscopic visualization. All curettage and instrumentation should occur in a direction away from the perforation site, and suction must be avoided to prevent aspiration of bowel into the uterus.

If the perforation is thought to have occurred at the end of a first-trimester procedure during final curettage, for example, the patient may be examined by laparoscopy and observed for abdominal signs for several hours or overnight. It is advisable, however, to provide an intravenous infusion of oxytocin during this period to maintain maximum uterine contraction and to administer intravenous or oral antibiotics to reduce the risk of infection.

Perforation laterally into the uterine artery may be impossible to treat, except with hysterectomy or uterine artery ligation. There is no satisfactory way to staunch the bleeding or for the artery to contract. A catastrophic perforation of this type may not be evident for several hours after the abortion, when the patient, having left the recovery room in apparently good condition, goes into shock and dies.

Lacerations of the cervix at the level of the internal os may present the same set of problems seen with overly vigorous manual dilation. Immediate treatment may require digital pressure on the uterine arteries to control bleeding while intravenous oxytocin is administered and the patient is transported to the operating room for laparotomy and repair.

Cervical lacerations of the external os that result from tenaculum tears may be minimized by using *Laminaria*, but when they occur, they usually can be treated by closure with one or two sutures of 2-0 chromic material in a simple or figure-of-eight placement.

Other Iatrogenic Complications

Anesthesia deaths, however uncommon in comparison to other abortion-related deaths, continue to occur, and are common enough to cause concern. Although attention has been focused on deaths due to local anesthesia, complications and deaths from general anesthesia also have occurred. The common denominator in the deaths due to local anesthesia has been toxic or unknown dose levels resulting in convulsions and cardiorespiratory arrest. The importance of staying within the toxic dose levels and avoiding direct intravascular injection cannot be overemphasized.

For example, it rarely is necessary to use more than 20 ml of 1% lidocaine (200 mg) for a paracervical block, or the equivalent. The addition of epinephrine 1:200,000 reduces absorption of this agent and also may reduce the risk of vasovagal reaction. As already noted, the use of *Laminaria* for dilation further reduces the need for local anesthesia. Only 2 to 3 ml of 1% lidocaine is necessary for the tenaculum site, and a total of 10 to 12 ml is necessary for the entire block (2 ml each at 3:00, 5:00, 7:00, 9:00, and 12:00).

Management of anesthesia reactions caused by toxic doses consists principally of cardiopulmonary resuscitation and basic system support. Obvious allergic reactions may be managed by the administration of intravenous epinephrine, intramuscular diphenhydramine, and intravenous aminophylline, if necessary.

Functional Complications

To some degree, some complications of abortion seem to be independent of the operator's

competence or thoroughness in approach. Some complications may be preventable, but the plan for prevention is not clear. These complications include uterine atony, uterine anomalies, postabortal hematometra, vasovagal reaction, cardiopulmonary arrest not associated with anesthesia toxicity, amniotic fluid embolism with or without subsequent coagulopathy, postabortion amenorrhea, rhesus factor isoimmunization, postabortion depression, ectopic pregnancy, and hydatidiform mole.

Extremely heavy bleeding is, or should be, rare in first-trimester abortion, but it is not rare in later abortion. Fewer than 1% of first-trimester abortion patients experience blood loss of more than 25 ml. However, patients who are 11 to 12 weeks or more from the last menstrual period, in poor nutrition, multiparous, or recently delivered of a term infant, not to mention patients with fibroids or placenta previa, may experience uterine atony and bleed briskly.

In the event of this type of hemorrhage, even if a perforation is not suspected, the first step in treatment may be to remove the speculum and place digital pressure over the uterine arteries bilaterally. An assistant should start an intravenous line with Ringer's lactate and place at least 40 to 50 units of oxytocin in the bottle to run wide open through a minimum 18-gauge needle or the equivalent. Methylergonovine maleate may be given intramuscularly or directly into the cervix.

Once the situation appears to be under control, a ring or other smooth forceps should be placed gently into the uterine cavity to grasp placental tissue that may be remaining. Whether this approach succeeds or fails, it should be followed by insertion of the largest curette that the cervix will accept easily. Use of these two instruments should permit an evaluation of the situation as well as empty the uterus of remaining tissue. This maneuver will allow the uterus to continue to contract and further control bleeding. If a perforation has occurred, further damage is less likely to develop. As the uterus contracts, assuming that no perforation is present, suction may be applied to continue the process of evacuation.

Bleeding that persists after the uterine cavity appears to be empty may have one of three causes: atony, cervical trauma, or disseminated intravascular clotting (DIC) syndrome. A simple method for making the determination between the first two is to place a suction cannula tip well into the cavity to determine whether persistent bleeding occurs. If it does, the cause probably is atony. If no bleeding occurs until the suction cannula is

withdrawn to the level of the internal os or cervical canal, the answer is apparent. The treatment is the same: manual compression and massage of the uterus accompanied by the administration of oxytocin and methylergonovine maleate. The intramuscular administration of 15-methyl prostaglandin (Hemabate*) may be used as a last resort for the pharmacologic control of noncoagulopathic hemorrhage.

Continued heavy bleeding from either site (fundal or cervical) may indicate either perforation into the uterine artery, which requires operative intervention, or DIC syndrome.

The management of DIC syndrome first requires recognition. Coagulopathy should be anticipated or suspected whenever a second-trimester abortion patient experiences signs or symptoms of intraoperative amniotic fluid embolism (*e.g.*, coughing, dyspnea, chest pain, cyanosis, convulsions, cardiorespiratory arrest), or when profuse bleeding from the fundus is accompanied by bleeding from needle puncture sites and the whole blood does not clot in a plain glass tube. Baseline studies of the following parameters should be obtained: serum fibrinogen level, fibrin split (degradation) product value, prothrombin and partial thromboplastin times, platelet count, hematocrit value, and hemoglobin level. If the uterus is empty, the bleeding should not persist for longer than 10 or 15 minutes with the combination of oxytocin, manual compression, and administration of methylergonovine maleate and 15-methyl prostaglandin. If bleeding persists, fresh whole blood may be given. The blood can be supplemented or substituted with fresh frozen plasma and packed cells or cryoprecipitate. A rising platelet count, rising fibrinogen value, or declining level of fibrin split products indicates recovery. Results of fibrin split product and some other studies may remain abnormal for 12 to 24 hours.

Postabortal hematometra refers to uterine atony or hypotonia occurring shortly after an otherwise uncomplicated early abortion.[27] The patient typically reports uterine pain within an hour after the abortion, although this condition may take several hours to develop. On examination, the uterus is enlarged to 10 to 12 weeks' size, tender, and boggy. Signs of acute abdomen are absent. Reaspiration results in recovery of 50 to 200 ml of blood clots, no tissue, and immediate relief of symptoms. An excellent practice is intramuscular application of methylergonovine maleate as the

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* The UpJohn Co, Kalamazoo, MI

reaspiration is completed, followed by 3 days of oral medication.

Postabortal hematometra can be prevented in most cases by routine administration of methyl-ergonovine maleate 0.2 mg three times a day for 3 days.

Postabortion depression that is severe enough to require psychiatric treatment is rare, particularly if the abortion is conducted in a supportive atmosphere with preoperative counseling. Patients who experience this condition should be referred to a psychiatrist for extended treatment after evaluation by the abortion service personnel. Postabortion psychosis without a history of preabortion psychiatric illness has not been reported.

Hydatidiform moles occur once in a thousand or more pregnancies, and the diagnosis usually is apparent to the physician during the abortion procedure, particularly if a clear plastic cannula is used for aspiration. Although there are irregularities in the sensation of vacuum aspiration of an uncomplicated pregnancy, the presence of hydatidiform mole may be evident from the uniformity of the aspiration procedure. The tissue is obvious, even in early pregnancy, but routine histopathologic examination should be obtained.

Management consists primarily of serial β-subunit human chorionic gonadotropin titers until results are negative to exclude the existence of malignant trophoblastic material. Pregnancy should be prevented for the subsequent year, preferably through oral contraception because of its high level of effectiveness.

LONG-TERM RISKS

Abortion is the most common surgical procedure performed in the United States, and an estimated 1.6 million abortions are performed each year.[33] This number represents approximately one third of all pregnancies. The vast majority of women having abortions are young, in the teens or early twenties, and having their first pregnancy. Among those who have repeat abortions, only a few have had previous term deliveries.

In view of these facts, it is important to determine whether induced abortion impairs later reproductive performance or results in adverse long-term psychological consequences. The first of these questions has been studied extensively, with almost wholly inconclusive results. The second has had little study.

OUTCOME VARIABLES

When asking the question of whether induced abortion has long-term consequences, one also must ask the corollary question: compared with what? Are the effects of abortion to be compared with the effects of previous term pregnancies, nonpregnancy, contraceptive use, or previous abortions? The answer to the second question obviously will affect the answer to the first.

Some of the outcome variables to be considered in measuring the long-term effects of induced abortion are birth weight in subsequent term pregnancies, gestational length in subsequent pregnancies resulting in spontaneous abortion or delivery of a live infant, incidence of late fetal death, incidence of congenital anomalies, incidence of ectopic pregnancy, and incidence of neonatal death. Some of the psychological factors to be considered are prolonged depression or functional incapacity, functional sexual disorder, and incidence of postabortion psychosis. The negative consequences of denial of abortion have been studied by some authors.[34]

METHODOLOGIC PROBLEMS

An important methodologic problem arises from the general observation that adverse effects from induced abortion are increasingly difficult to find. Their elusiveness is witnessed by the difficulty investigators have had in documenting them with any degree of certainty.[35] Investigators are in the position, then, of trying to demonstrate negative results. In statistical terms, the null hypothesis is that there are no long-term effects of induced abortion, positive or negative. The certainty that scientific investigators usually require rests to a considerable extent on probability theory. For example, an investigator strives to reject the null hypothesis on the grounds that there is less than a 5% probability that the results could have occurred by chance. A much more acceptable result, in statistical terms, is the statement that the results could not have occurred by chance more than 1% of the time. A value greater than 5% ($p < 0.05$, as it usually is noted) is not very convincing. Epidemiologists and statisticians are trained to be conservative with conclusions.

This rigorous test produces conflict by increasing the chance of a type II error (*i.e.*, accepting the null hypothesis that abortion has no effect when in fact it is false). By contrast, a type I error is one in which the null hypothesis is rejected when it is in

fact true. Sources of bias, caused by false or incomplete information, can contribute to both types of error.

Suppose, for example, that a majority of women who had had abortion denied doing so in response to a survey. Women who had not had an abortion would be classified with women who had had an abortion but denied it. These women would form the control group. Suppose, then, that the women in the control group who had had an abortion experienced a significantly increased risk of spontaneous midtrimester abortion. This occurrence would raise the incidence of midtrimester spontaneous abortion for the entire control group to the point that the difference between the control group and the study group, made up of women with a reported history of induced abortion, was statistically insignificant. The investigator would conclude incorrectly that there was no increased incidence of spontaneous midtrimester abortion among women with previous induced abortion. This conclusion would be a type II error.

FACTORS AFFECTING RISK

Several general factors affecting both the immediate and long-term risks of abortion have changed profoundly since 1970, especially in the United States. These include state and national changes in the legal status of abortion, changes in abortion technology, changes in the general social acceptability of induced abortion, and important changes in the settings for the provision of abortion services.

Changes in the legal status of abortion resulted in women seeking abortion earlier in pregnancy, especially as services became available within easy transportation distance. These changes also permitted large numbers of physicians to become proficient in performing abortions, thereby increasing the general level of safety. They also increased the likelihood that minor complications of abortion could be treated promptly before a major complication resulted in death or long-term disability.

The increasing widespread use of vacuum aspiration as a principal component of first-trimester abortion technique had a significant effect on reducing the incidence of operative complications. Also, the advent of new dilator designs, such as the Pratt dilator, contributed to this decline in morbidity. The use of *Laminaria* for cervical dilation has had an uneven resurgence in the United States, although it is practiced extensively in Japan. *Laminaria* frequently is used for second-trimester as well as first-trimester abortion, but this change is recent, occurring since the late 1970s. Considerable evidence shows that the use of *Laminaria* may reduce significantly both the operative and long-term risks of abortion.

One of the most important innovations in modern health care has accompanied the provision of induced abortion as an outpatient health service. Approximately 85% of all abortions in the United States are performed on an outpatient basis in settings that range from a private physician's office to a large clinic that specializes in abortion services.[33] This change has decreased the formality of the setting in which a surgical procedure is performed and increased the opportunities for lay participation in health care activities. This increased lay participation has been particularly evident in the area of social support. The introduction of individual abortion counselors accompanying the abortion patient has had a dramatic effect on the way in which patients perceive themselves and their dilemma.

A woman who is supported and comforted by a sympathetic physician, nurse, and abortion counselor obviously will have a different psychological outcome from her abortion than the woman whose entry into a clandestine setting alone is accompanied by overwhelming feelings of fear, shame, guilt, and isolation. An important component of the counseling provided by most outpatient services is health education in the form of information about reproductive health and contraception. The knowledge and relationships that result from this type of contact significantly increase the probability of prompt contact if complications occur or the need for other services arises. The resulting prompt treatment of complications reduces the risk of long-term adverse effects.

PERFORMANCE VARIABLES

There are many differences in the way in which abortions are performed and the circumstances under which they occur. One of the most difficult to assess, yet one of the most critical, is the skill of the operating physician. The advent of operative techniques, such as D & E, has resulted in a greater emphasis on operator skill. Physicians differ in their application of any given technique, and the various techniques may be applied with greater or less vigor, and with varying results.

Given competent operators and consistent techniques of any type, the immediate and late complications of abortion may be affected by the length of gestation. Morbidity and mortality rates in first-trimester abortion have been consistently lower than in second-trimester abortion.

The manner of dilation of the cervix can vary considerably, depending on the length of gestation and the approach chosen by the operator. An obvious question for any investigator of the long-term effects of abortion is whether it is possible to determine, years after the event, the type of dilator used to perform a particular abortion and the skill with which the dilator was used.

Are prophylactic or preemptive antibiotics given at the time of abortion? The decision may affect infection rates and the subsequent incidence of sterility, which is an important long-term effect.

CONFOUNDING VARIABLES

Along with reviewing nearly 30 performance variables, the practitioner must note the age of the woman at the time of the abortion, her age at the time of the outcome variable observation, and any previous pregnancy experience. For the index abortion and outcome variable times, the following reproductive facts are important: the number of previous term births, the number of previous induced abortions, the pregnancy order of abortions, the gestational length in previous abortions and other pregnancies, and the procedure variables in previous abortions.

These and other items may be seen as *confounding variables*, meaning that each one may exert an independent effect and may make the effect of the variable in question difficult to measure.

In addition to accounting for these factors, the investigator must be aware of sources of bias that can lead to erroneous results. The types of bias that are of greatest concern are information bias and selection bias.

Information bias could include a lack of information about the types of performance and confounding variables that were described previously. For example, a study that does not describe anything about the length of gestation at the time of index abortion or the general method used cannot draw strong conclusions about the effects of abortion on the subsequent incidence of premature births.

In a study by Hogue[36] done in Skopje, Yugoslavia, most women with documented previous abortions denied or did not state a history of pre-vious abortion. This effect is called *selective recall*, and it can profoundly affect the results of a study that compares women with and without a history of induced abortion. This study was performed in a country where abortion is widely accepted and practiced, and has been for some time. Selective recall is a type of information bias.

Selection bias operates when some patients are more likely to seek care or are different in other respects from control subjects. For example, women who seek abortion may tend to be more fertile than women who do not have unplanned pregnancies, or at least more fertile than those who do not seek abortions. Are women who seek abortions different in other ways? For example, are they more likely to smoke? Some evidence shows that they are, and that fact could affect future reproductive performance. Because smoking is associated with low birth weight, a history of abortion could be a secondary noncausal association. On the other hand, smoking and previous abortion could interact, meaning that the combination is more effective than either one acting alone.

Various study designs (*e.g.*, prospective, retrospective, case-control) may enhance or minimize various types of bias that could distort the results of a study of the long-term effects of abortion.

LITERATURE CONCERNING LONG-TERM EFFECTS

A considerable amount of literature has been generated on the long-term effects of induced abortion. Only a few of the best and most recent studies are cited here.

In a 1975 historical prospective study, Hogue[36] found no significant difference between women delivering their first pregnancy at term or women aborting their first pregnancy and subsequent rates of conception, spontaneous abortion, or low-birth-weight deliveries. The author noted that 63% of the respondents with a documented history of abortion denied the abortion during the interview. Hogue raised questions about the results of retrospective studies that rely on patient recall of previous abortion.

Harlap and Davies[37] performed a 1975 prospective study of women presenting for delivery in Israel. They showed a significant increase in the frequency of low birth weight, a doubled risk of early neonatal death, and a threefold increase in late neonatal death among women with a history of induced abortion.[37] The authors cited selective recall bias as a possible problem affecting their results. In 1979, Harlap and colleagues[38] reported

a study comparing more than 2000 nulliparous women who had experienced an induced abortion with more than 12,000 control nulliparous women. The authors found a significantly increased risk of midtrimester spontaneous abortion among women with a previous induced abortion.[38] The increase was greater with more previous abortions, and it was not explained by social and demographic variables. The risk declined to a nonsignificant level among women whose abortions occurred after 1973, when the use of *Laminaria* for cervical dilation was introduced at the institution where the study was conducted. The authors concluded that the use of *Laminaria* reduces the risk of spontaneous abortion in subsequent pregnancies by reducing the trauma to the cervix. However, the authors also assumed that most abortions occurred at the study institution, which was not necessarily true, and there was no record linkage to relate *Laminaria* use in induced abortion to a subsequent reduction of risk of midtrimester spontaneous abortion.

A matched-pair cohort study conducted in Taiwan and reported by Daling and Emanuel[39] in 1975 controlled for relevant characteristics and found no relationship between induced abortion and the outcome of subsequent pregnancies. The authors noted that failure to control for possible confounding variables and the abortion technique may account for previous reports of the deleterious effects of abortion.

The same authors conducted a matched-pair analysis of hospital records in Seattle, Washington, and concluded that a history of induced abortion was not related to low birth weight, premature delivery, stillbirth, neonatal death, spontaneous abortion, or congenital malformation in subsequent pregnancies.[40] The authors suggested that the exposed group experienced a better pregnancy outcome than the control group because of the type of selective recall described by Hogue.[36] However, they also suggested that, for young women, abortion may have a less adverse effect than term delivery of the first pregnancy on reproductive performance in later pregnancies.

In an extensive review of the literature concerning the psychological effect of abortion, David and associates[41] noted three major deficiencies in the studies done to date: (1) overemphasis on case histories, (2) lack of psychological assessment before abortion, and (3) absence of standardized follow-up procedures and anchored psychiatric diagnoses.[41] More recently, Adler and associates[42] found no significant evidence of deleterious effects of properly performed abortions.

In a long-term continuing study of the effects of denying abortions to women seeking them, however, David and colleagues[34] found serious developmental problems among children of women who were denied abortions.

DISCUSSION

A real understanding of the long-term risks of induced abortion awaits us. Multiple abortions by certain techniques that have been abandoned or are now being abandoned may result in a higher risk of spontaneous midtrimester abortion in some women, but little evidence suggests any other effect. Current attention to atraumatic methods of cervical dilation, especially with the use of *Laminaria*, may reduce significantly whatever long-term effects can be measured. In fact, an atraumatic and uncomplicated early abortion may be the safest pregnancy outcome for the first pregnancy in an adolescent, both in terms of her immediate risk of death and complications and in terms of future pregnancy success.

There is no strong evidence concerning the adverse psychological effects of abortion compared with term delivery; healthy women probably can cope with either result successfully. The fact that most abortions currently occur in a strongly supportive setting makes it difficult to compare the psychological outcome with that in women who experienced abortion in a clandestine setting at a different time in history. The overall clinical impression among abortion specialists is that medically safe abortions provided in a supportive atmosphere in which counseling is provided can produce clear psychological benefits for women who obtain them. Although this impression may be true, it should be tested by objective investigators who are less likely to be biased in favor of that conclusion.

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