Complications of Gynecologic Procedures, Abortion, and Assisted Reproductive Technology

Christine Yang-Kauh

KEY POINTS

- Complications with the highest morbidity and mortality are severe hemorrhage, serious infection, damage to intraabdominal structures, and pulmonary embolism.
- Complications seen in the emergency department are usually delayed in presentation, and often difficult to diagnose due to insidious onset, resulting in increased morbidity and mortality and a higher risk for litigation (i.e., ureteral injuries). High suspicion must be maintained.
- Emergency department bedside ultrasonography can provide rapid, early imaging for the evaluation of postprocedural patients, particularly unstable ones.
- Abortion is one of the most common procedures in the United States and overall has very low serious complication rates.
- Ovarian hyperstimulation syndrome is a potentially fatal complication of assisted reproduction in a generally healthy young woman. With no cure, early recognition, aggressive intervention, and close monitoring are key.

This chapter is divided into three main sections—complications of gynecologic procedures, complications following medical and surgical abortion, and complications of assisted reproductive technology (ART).

Gynecologic procedures run the gamut from minor office procedures to major invasive surgery. They can be diagnostic or therapeutic and may initiate pregnancy or terminate it. They represent some of the most common surgical procedures performed in the United States today.

More than 146,000 cycles of ART were reported to the Centers for Disease Control and Prevention from 441 sites in the year 2009. In addition, approximately 600,000 hysterectomies are performed annually, which ranks it behind cesarean section as the most common major surgery in women of reproductive age.

Shortened hospital stays and minimally invasive or outpatient surgery have led to the delayed diagnosis of complications in the emergency department rather than during the postoperative hospitalization period.

COMPLICATIONS OF GYNECOLOGIC PROCEDURES

This section focuses on complications particular to gynecologic procedures that one might encounter in the ED setting and their evaluation and management (Fig. 125.1). Many complications of gynecologic procedures may go unrecognized before discharge, only to be seen later in the ED (Box 125.1). Box 125.2 lists the typical timing of these complications.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

During the evaluation of postoperative patients it is essential to avoid narrowing the differential diagnosis to postoperative complications alone. Other conditions, particularly preexisting ones that may have served as the original indication for surgery (e.g., malignancy, anemia) must be taken into consideration. Laboratory testing and imaging studies should be guided by the differential diagnoses under consideration (see the Priority Actions box).

For patients with complications after a gynecologic procedure, bedside ultrasonography (US) in the hands of a skillful operator can provide rapid recognition of intraabdominal and intrapelvic pathology. Possible ultrasonographic findings include free fluid heralding leakage from a perforated vessel, urinary tract, or viscus (Fig. 125.2); hydronephrosis as a result of ureteral obstruction; a full bladder secondary to urinary retention; fluid collections; and intrauterine contents. US can also be used to guide paracentesis for definitive fluid diagnosis or for the drainage of subcutaneous abscesses. It is important to remember that sensitivity and accuracy are very dependent on the user and interpreter and that anatomy, habitus, and elements such as bowel gas can greatly interfere with adequate imaging. US is a poor modality for evaluating the bowel or retroperitoneal space.
Fig. 125.1 Suggested algorithm for the evaluation and treatment of postoperative gynecologic patients. ABCs, Airway, breathing, and circulation; Gyn consult, gynecology consultation; OR, operating room; US, ultrasonography; UTI, urinary tract infection.
CHAPTER 125  COMPLICATIONS OF GYNECOLOGIC PROCEDURES, ABORTION, AND ART

<table>
<thead>
<tr>
<th>BOX 125.1 Most Threatening and Most Common Complications of Gynecologic Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most Threatening</strong></td>
</tr>
<tr>
<td>Vascular injury—consider both intraperitoneal and retroperitoneal</td>
</tr>
<tr>
<td>Bowel injury</td>
</tr>
<tr>
<td>Urinary tract injury—bladder more likely than ureteral</td>
</tr>
<tr>
<td>Sepsis, severe infection</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
</tr>
<tr>
<td><strong>Most Common</strong></td>
</tr>
<tr>
<td>Pain</td>
</tr>
<tr>
<td>Bleeding</td>
</tr>
<tr>
<td>Fever</td>
</tr>
<tr>
<td>Wound concerns</td>
</tr>
<tr>
<td>Nausea and vomiting</td>
</tr>
</tbody>
</table>

When a patient with postprocedural complications is seen in the ED, the physician who performed the procedure should be contacted; definitive management often requires gynecologic or other surgical intervention.

### URINARY TRACT INJURY

The incidence of urinary tract injury in gynecologic surgery is between 0.33% and 4.8%. The great majority (80%) of these injuries involve the bladder. Ureteral injuries occur in just 0.3% to 1.0% of cases, but unilateral injury is discovered postoperatively in the majority of cases. This delayed recognition leads to increased morbidity. As a result, ureteral injury has become the leading cause of legal action against gynecologic surgeons.

Typical symptoms are fever, flank pain, prolonged ileus, and prolonged abdominal distention. Unexplained hematuria or watery vaginal discharge may be present as well. The most common causes of these symptoms are cystitis and pyelonephritis secondary to perioperative bladder catheterization.

Inability to urinate may represent anuria or urinary retention, which are differentiated by postvoid urinary catheterization or US. No output at all indicates anuria as a result of bilateral compromise or renal failure. Urine residual volume greater than 500 mL suggests urinary retention instead. Bedside US can also detect intraabdominal fluid or hydronephrosis.

Laboratory testing includes a complete blood count and differential, electrolytes, kidney function tests, preoperative blood assays, urinalysis, and urine culture. If ascites or other fluid is obtained, fluid creatinine levels should be measured to determine whether it is urine in origin. Imaging to evaluate the urinary system is indicated, such as intravenous urography, abdominal/pelvic computed tomography with contrast enhancement, or renal US with retrograde uroteropyelography.

Complications of ureteral obstruction (secondary to ligation, stricture, or external compression by another structure) include hydronephrosis and progressive kidney damage, which ultimately leads to failure of the ipsilateral kidney if
Differential Diagnosis: Complications of Gynecologic Procedures

Abnormal Symptoms or Vital Signs?
Anemia, bleeding
- Hemorrhage may be internal or exsanguinating; emergency resuscitation and exploratory laparotomy are required if unstable. Bedside US for detection of free intraabdominal fluid. For emergency transfusion, use O-negative blood in women with childbearing potential; otherwise, use O positive blood.

Fever
- Consider septic shock, toxic shock syndrome, and necrotizing fasciitis; administer broad-spectrum antibiotics and search for the source of infection. Emergency surgical débridement is required for necrotizing fasciitis.

Abdominal distention
- Consider bowel obstruction or injury to the vasculature, bowel, or urinary tract; bedside US to evaluate for free fluid; upright chest and abdominal radiographs; antibiotics; abdominal/pelvic CT with contrast enhancement if stable; and early surgical evaluation.

Shortness of breath
- Consider pulmonary embolism, fluid overload, and aspiration pneumonia.
- If occurring after laparoscopy, also consider pneumothorax.

Vaginal Bleeding—Is It Cervical or Uterine in Origin?
Cervical or vaginal lacerations: Controlled by simple measures in the ED?
- If yes, discharge with close follow-up with gynecology.
- If not or if after conization, pack and gynecology consultation for management in the operating suite.

Uterine bleeding: Is retained tissue or hemometra noted on ultrasound imaging?
- If yes, gynecology consultation for definitive care.
- If not, consider uterine perforation, and if uterine perforation is present, maintain high suspicion for a perforated viscus and obtain abdominal/pelvic CT. Consider other specific evaluation of nearby structures (i.e., cystoscopy).

Abdominal Pain with Distention?
Ileus or small bowel obstruction on radiography? Nasogastric tube if excessive vomiting; surgical consultation required. If not, consider intestinal, urinary, or vascular injury. Abdominal/pelvic CT imaging.

Unable to Urinate?
Postvoid catheterization or bedside US:
- >500 mL of urine noted? Maintain the urinary catheter and check for a UTI. Substitute a leg bag and treat the UTI if present; discharge to follow-up with urology.
- <200 mL, consider renal failure from medications or bilateral ureteral obstruction. Renal function tests, US to evaluate for hydronephrosis or free fluid. Admit for further evaluation.

Dysuria?
Hematuria and abdominal pain? Persistent or recurrent UTI? Suspect urinary tract injury; obtain imaging to evaluate for ureteral or bladder compromise.
If not, treat the UTI with antibiotics, urine culture, and close follow-up.

Wound Redness and Drainage?
Localized? If so, check the fascia; if it is intact, treat as a superficial wound infection with packing and close follow-up. If the fascia is not intact, consider a subfascial abscess, early necrotizing fasciitis, or hernia or evisceration; make sure that it is not an incarcerated hernia; gynecology consultation and possible surgical evaluation are required.

Widespread? Consider cellulitis or fasciitis; administer antibiotics and hospitalize the patient. If only mild cellulitis is present, oral antibiotics, very close follow-up, and explicit return instructions are required (consider priming with first dose of intravenous antibiotics).

CT, Computed tomography; ED, emergency department; US, ultrasound; UTI, urinary tract infection.

Treatment is delayed. Bilateral injury (or unilateral injury to a solitary functioning kidney) may simply manifest as anuria and subsequent total renal failure. Urinary leakage from ureteral disruption can cause urinary ascites or an enclosed urinoma.

Months to years after the procedure, watery drainage from the vagina heralds an ureterovaginal or vesicovaginal fistula, whereas watery wound drainage suggests a ureterocutaneous or vesicocutaneous fistula (Table 125.1).

**VAGINAL BLEEDING**

Bleeding from the vagina must be evaluated in the context of the procedure performed. A careful history and speculum examination are key to determining the source, quantity, and persistence of the bleeding.

Blood flowing from the cervical os implies a uterine cause. It may be a result of hemometra (intrauterine hematoma), retained tissue, retained foreign bodies, infection, or uterine...
injury. Bimanual examination helps ascertain the size and tenderness of the uterus. A pelvic US scan must be performed to assess the uterine contents. It can be done at the bedside if the patient is unstable. An acute abdominal radiographic series (flat and upright abdominal views with an upright chest radiograph) to look for signs of perforation may be obtained, but it must be kept in mind that residual pneumoperitoneum from laparotomy or laparoscopy often persists for at least 24 hours and may be present for up to 72 hours.

Uterine perforation is manifested as pelvic cramping and vaginal bleeding. It is of serious concern because of risk for associated injury to adjacent bowel, pelvic vessels, bladder, or other structures. Rapid bedside US by the emergency physician (EP) can be useful to assess for free pelvic fluid suggesting hemorrhage or bladder leakage.

Symptoms of acute hemometra include severe, progressive, cramping pelvic pain. Vaginal bleeding may be minimal if the os is obstructed by the enlarging hematoma. The total blood loss is usually insufficient to cause hypotension or anemia. An extremely distended and tender uterus on bimanual pelvic examination is diagnostic, and bedside US can be used to further support the diagnosis.

In rare cases of persistent bleeding without explanation, an unrecognized bleeding diathesis must be considered. von Willebrand disease is the most common bleeding disorder in women of childbearing age.

TREATMENT

Minor vaginal or cervical lacerations can be managed in the ED with direct pressure followed by the application of Monsel solution or silver nitrate. Persistent bleeding despite these measures may require sutures or electrocautery. Bleeding following cold knife conization is often profuse and frequently requires surgical management.

Minor cases of uterine perforation in which the damage was inflicted by a small blunt instrument (e.g., dilator) may be managed conservatively with close observation and consideration of antibiotics if the bleeding is minimal and the patient is otherwise stable. All cases of perforation with a sharp instrument—or significant damage with a blunt instrument—require definitive management with laparoscopy or laparotomy to evaluate the extent of the damage and to stop the bleeding. Cystoscopy may also be necessary if the bladder lies in the path of the perforation. Broad-spectrum antibiotic coverage is indicated.

Definitive treatment of an intrauterine hematoma is suction evacuation of the uterus. This provides prompt relief and can typically be performed without anesthesia or cervical dilation. Afterward, methylergonovine maleate (0.2 mg intramuscularly [IM]) should be administered to induce uterine contraction unless contraindicated by hypertension, in which case a 1000-mcg rectal suppository of misoprostol can be given instead.

<table>
<thead>
<tr>
<th>TYPE OF FISTULA</th>
<th>FINDINGS</th>
<th>BEDSIDE DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ureterovaginal</td>
<td>Copious, watery vaginal discharge; multiple urinary tract infections</td>
<td>To confirm and differentiate these fistulas:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Place a tampon in the vagina.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Administer phenazopyridine, 200 mg orally.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Instill normal saline tinted with methylene blue into the bladder.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Results:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Orange tampon = a ureterovaginal fistula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blue tampon = a vesicovaginal fistula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note that both types may be present concurrently and that blue may overpower orange.</td>
</tr>
<tr>
<td>Vesicovaginal</td>
<td>Copious, watery vaginal discharge; multiple urinary tract infections</td>
<td>Acidity can be tested with litmus paper or the pH portion of a urine dipstick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place a tampon in the vagina and administer oral activated charcoal. A stained tampon is diagnostic.</td>
</tr>
<tr>
<td>Enterovaginal</td>
<td>Vaginal discharge may contain intestinal contents; severe vaginovulvar irritation may be present because of the pH</td>
<td>Place a tampon in the vagina and instill normal saline tinted with methylene blue into the bladder. A blue-stained tampon is diagnostic of a rectovaginal fistula. Higher colonic lesions may be diagnosed by oral administration of activated charcoal.</td>
</tr>
<tr>
<td>Colovaginal</td>
<td>Brown, feculent vaginal discharge</td>
<td>Place a tampon in the vagina and instill normal saline tinted with methylene blue into the rectum. A stained tampon is diagnostic of a rectovaginal fistula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acidity can be tested with litmus paper or the pH portion of a urine dipstick.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Place a tampon in the vagina and administer oral activated charcoal. A stained tampon is diagnostic.</td>
</tr>
<tr>
<td>Vescicocutaneous</td>
<td>Copious watery suprapubic wound discharge</td>
<td>Place a clean dressing and administer saline tinted with methylene blue into the bladder. A blue-stained dressing is diagnostic. To differentiate from ureterocutaneous fistulas, insert a urinary catheter, instill methylene blue via the catheter and clamp it off, wait ½ hour, and then drain the bladder until clear and perform the test described below.</td>
</tr>
<tr>
<td>Ureterocutaneous</td>
<td>Copious, watery wound drainage</td>
<td>Place a clean dressing and then administer methylene blue intravenously. A blue-stained dressing is diagnostic.</td>
</tr>
</tbody>
</table>

Note that blue-stained tampon may be present concurrently and that blue may overpower orange.
ENDOMETRITIS

Patients with endometritis are typically initially seen 3 to 7 days after instrumentation with fever and pelvic or lower abdominal pain and tenderness. Vaginal bleeding is frequently present. Potential pathogens are those of pelvic inflammatory disease, in addition to organisms that may have been introduced during the procedure. Risk factors include retained tissue, as well as pelvic inflammatory disease and insufficiently aseptic operating conditions.

Evaluation consists of pelvic US to assess for retained products and laboratory tests, including a complete blood count and assay for the β subunit of human chorionic gonadotropin (β-hCG).

TREATMENT

Mild endometritis without retained products can be managed on an outpatient basis. Many antibiotic regimens can be used, including a single shot of ceftriaxone, 250 mg IM, plus doxycycline, 100 mg orally twice per day for 14 days, or amoxicillin-clavulanate, 875 mg twice daily, along with the doxycycline. Anaerobic coverage such as metronidazole, 500 mg every 8 hours, may be required as well.

For severe endometritis, inpatient admission is necessary for intravenous (IV) administration of clindamycin, 900 mg every 8 hours, and gentamicin, 1.5 mg/kg every 8 hours. Alternatives are triple IV therapy consisting of ampicillin, 2 g every 6 hours, plus gentamicin, 1.5 mg/kg every 8 hours, and metronidazole, 500 mg every 6 hours, or IV ampicillin-sulbactam, 3.0 g every 8 hours as monotherapy. Doxycycline, 100 mg twice per day for 14 days, should be added if Chlamydia is a possible pathogen.

WOUND AND ABDOMINAL WALL INFECTIONS

Superficial wound infections occur in up to 10% of patients who have undergone gynecologic surgery without perioperative antibiotics. The most common causes are Staphylococcus aureus and vaginal or enteric flora. The great majority of these infections are minor, although systemic toxicity or extensive infection may occur if the initial infection is neglected or in patients who are immunosuppressed, have diabetes, or are obese.

Thorough evaluation requires opening the wound for drainage and examination for deep fascial or muscular involvement. Superficial wound infections can be managed without antibiotics by meticulous wound care, irrigation with diluted hydrogen peroxide or Dakin solution four times per day, and dry gauze packing. Delayed wound closure can be performed if necessary. Table 125.2 details the clinical findings, evaluation, and treatment of wound infections, dehiscence, and necrotizing fasciitis.

VAGINAL EVISCERATION

Vaginal evisceration (bowel and organs protruding from the vagina) is rare, yet dramatic and has a mortality of up to 10% because of associated intestinal necrosis, peritonitis, or other underlying or global illness. It occurs as a result of increased intraperitoneal pressure in the setting of a ruptured vaginal enterocele or unrecognized uterine perforation. The diagnosis is based on findings on physical examination.

TREATMENT

A moist covering must be placed immediately to protect the viscera. Bed rest in the supine or Trendelenburg position is recommended to prevent further outward pressure. Broad-spectrum antibiotics should be administered, and gynecology consultation should be obtained immediately for surgical repair.

COMPLICATIONS SPECIFIC TO LAPAROSCOPY

Laparoscopic procedures are characterized by more rapid recovery and lower complication rates than seen with open surgical procedures. However, unique complications are associated with needle or trocar insertion, induced pneumoperitoneum, and extensive use of electrocautery (Box 125.3). Most catastrophic complications are recognized intraoperatively. Management in the ED in the first month postoperatively is usually for wound complaints or symptoms caused by injury to the bowel, bladder, or ureters. Remote complications include hernias.

BLEEDING

Abdominal wall hematomas may occur as a result of damage to superficial vessels at laparoscopic sites. If the injury is extensive or if the size cannot be estimated because of habitus, a complete blood count can be obtained to estimate and track the blood loss, although the blood lost is not usually sufficient to require transfusion.

Injury to the inferior epigastric vessels can cause intraperitoneal and retroperitoneal bleeding. Patients with slow retroperitoneal bleeding may possibly be seen in the ED if the postoperative observation time was short. Bedside US is of limited utility for evaluating the retroperitoneal space. Worsening flank or back pain soon after the procedure must raise concern for retroperitoneal bleeding. Work-up includes laboratory tests to evaluate for anemia and computed tomography with intravenous contrast enhancement to identify the bleeding.
### Table 125.2 Wound and Abdominal Wall Infections

<table>
<thead>
<tr>
<th>FINDINGS</th>
<th>EVALUATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial wound infections</td>
<td></td>
<td>Wound care—irrigate with diluted hydrogen peroxide or Dakin solution four times a day, dry gauze wound packing, no antibiotics if no surrounding cellulitis, delayed wound closure if desired</td>
</tr>
<tr>
<td><strong>Incidence:</strong> ≈10% in surgeries without antibiotic prophylaxis</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Risk factors:</strong> diabetes, obesity, immunosuppression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low mortality and morbidity if recognized and treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus, vaginal or enteric flora—presents 5-7 days postoperatively with serosanguineous or seropurulent drainage, with or without fever and leukocytosis</td>
<td>Open incision to drain and rule out deep fascial or muscular involvement, cultures not helpful</td>
<td></td>
</tr>
<tr>
<td>Group A β-hemolytic streptococci—presents 1-2 days postoperatively with rapidly advancing erythema, lymphangitis, lymphadenopathy, and scant, watery drainage</td>
<td>External examination, if little drainage, leave wound intact, cultures not helpful</td>
<td>Wound care as above, amoxicillin-clavulanate, 875 mg orally q12h for 7-10 days, or a first-generation cephalosporin, initial IV dose of nafcillin or oxacillin, 2 g for more severe cases, if suspected, add coverage for community-acquired MRSA</td>
</tr>
</tbody>
</table>

| Wound dehiscence (complete fascial disruption)      |                                                                             |                                                                                                                                          |
| **Incidence:** 0.5% of gynecologic surgical cases  |                                                                             |                                                                                                                                          |
| **Mortality:** 10-35%                               |                                                                             |                                                                                                                                          |
| **Risk factors:** obesity, poor nutrition, cancer, previous radiation exposure, previous incision, infection, distended abdomen, bronchopulmonary disease, corticosteroid use, absorbable sutures, layered closure | Diagnosis based on interruption of fascia, skin may still be closed, if open, gently probe with a sterile gloved finger or sterile cotton swab to evaluate the integrity of the fascial layer, ultrasound may be useful if skin is intact to reveal subcutaneous herniated bowel loops, laboratory tests, wound cultures CT scan if deeper infection suspected | Cover exposed viscera with a wet sterile dressing, decompress the stomach and bladder with a nasogastric tube and Foley catheter, IV antibiotics, resuscitation and repletion of fluid, electrolyte, and nutritional deficits, once stabilized, operative management with removal of old suture material, abscess drainage, wound débridement, and peritoneal cavity lavage before closure of abdominal wall, skin closure often by secondary intention |
| Lump, bloody drainage, pain, or wound opening after a sudden movement or abrupt increase in intraperitoneal pressure, such as a violent cough, evisceration (herniation of abdominal contents through the wall) in extreme cases, complications include sepsis, death, hemias, and poor cosmetic outcome | Diagnoasis based on interruption of fascia, skin may still be closed, if open, gently probe with a sterile gloved finger or sterile cotton swab to evaluate the integrity of the fascial layer, ultrasound may be useful if skin is intact to reveal subcutaneous herniated bowel loops, laboratory tests, wound cultures CT scan if deeper infection suspected | Cover exposed viscera with a wet sterile dressing, decompress the stomach and bladder with a nasogastric tube and Foley catheter, IV antibiotics, resuscitation and repletion of fluid, electrolyte, and nutritional deficits, once stabilized, operative management with removal of old suture material, abscess drainage, wound débridement, and peritoneal cavity lavage before closure of abdominal wall, skin closure often by secondary intention |
|其他 |                                                                             |                                                                                                                                          |

*Continued*
Necrotizing fasciitis

Necrosis of superficial fascia and connective tissue, undermining skin but sparing muscle

Incidence: about 50% of these cases associated with surgical incisions

High morbidity and mortality (70-80%)

Risk factors: immunosuppression, diabetes, elderly, peripheral vascular disease, poor nutrition, obesity, hypertension, malignancy, radiation exposure, renal insufficiency

Mixed aerobic-anaerobic, group A streptococci, Clostridium perfringens, community-acquired MRSA, Vibrio vulnificus

Early findings nonspecific—pain, edema, and firm induration with erythema

Duskeness of skin, anesthesia of the area, or pain out of proportion to findings on examination may be the keys to early recognition

Fever and leukocytosis

Superficial bullae and altered mental status may develop

May present already in septic shock

Progression over hours to a few days

Complications: limb loss, organ failure, death

Lack of fascial resistance to probing in the wound of a toxic-appearing patient is highly suspicious

Laboratory testing includes a complete blood count with differential, electrolytes, renal and liver function tests, lactate, preoperative tests and cultures of the wound and blood

Chest radiograph and urine cultures to rule out other sources of infection

If stable, CT may help assess extent of involvement (should not delay surgical evaluation)

ABGs and lactate if septic shock

Immediate IV antibiotics—assume polymicrobial infection from recent hospitalization: ampicillin-sulbactam, 3.0 g q6-8h, or piperacillin-tazobactam, 3.375 g q6-8h

Plus clindamycin, 600-900 mg q8h

Plus ciprofloxacin, 400 mg q12h

Or imipenem-cilastin, 1 g q6h, or meropenem, 1 g q8h

Community-acquired infection: assume group A streptococci (penicillin G, 18 million units daily in 3-4 divided doses; clindamycin, 900 mg q8h for streptococcal or clostridial infection; with or without vancomycin, 30 mg/kg/day divided q12h for Staphylococcus infection)

Aggressive IV repletion of fluids, colloids, and calcium

Immediate surgical consultation for emergent wide surgical débridement

Central venous monitoring and admission to intensive care unit

Hyperbaric therapy can be considered postoperatively

If toxic shock, IV immunoglobulin, 1 g/kg on day 1 followed by 0.5 g/kg for 2 more days, decreases sepsis-related organ failure

---

**Table 125.2 Wound and Abdominal Wall Infections—cont’d**

<table>
<thead>
<tr>
<th>FINDINGS</th>
<th>EVALUATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necrotizing fasciitis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**COMPLICATIONS OF UTERINE FIBROID EMBOLIZATION**

Uterine fibroid embolization is typically performed by an interventional radiologist to treat bleeding fibroids in patients who are poor candidates for major surgery, are not interested in reproduction, or wish to preserve their menses for personal or for ethnic or religious reasons. The procedure consists of the injection of a mass of microspheres (tris-acryl gelatin) or polyvinyl alcohol directly into the uterine artery to occlude it. The goal is to cut off the blood supply to the fibroids so that they will shrink and degenerate.

A relatively new procedure, uterine fibroid embolization has been rapidly gaining in popularity in the United States, from 50 cases performed in 1996 to now more than 100,000 worldwide. Early results show a success rate of about 90% and a complication rate of about 5% by American College of Gynecology criteria. Patients have a shorter hospitalization and return to activities sooner but have a higher rate of treatment failure and delayed rehospitalization than patients undergoing surgery.

Postembolization syndrome (low-grade fever, malaise, pelvic pain, nausea, and vomiting) affects most of these patients to some degree. Only symptomatic treatment is warranted as long as other causes have been ruled out.

These patients are at risk for angiographic complications such as femoral hematoma, site infection, pseudoaneurysm, arteriovenous fistula, thromboembolism, and contrast agent–induced nephropathy.

**TREATMENT**

Treatment depends on the site and degree of bleeding. The EP should be prepared for blood transfusion and involve the gynecologic surgeon early.

**BOWEL INJURY**

The incidence of bowel injury from laparoscopic surgery is estimated to be 0.06% to 0.5%, with higher rates for therapeutic procedures than for diagnostic ones, and about 50% to 70% of the time it is diagnosed postoperatively.

Most of these bowel injuries are caused by the initial needle insertion or thermal injury with electrocautery. Major injuries are typically discovered intraoperatively because of excessive bleeding or spillage of intestinal contents, but some are less obvious.

Thermal bowel injuries are serious and typically manifested days or even weeks after laparoscopy. Symptoms include abdominal distention, severe lower abdominal pain and tenderness, and fever, often accompanied by nausea, vomiting, and peritoneal signs. Blood tests reveal leukocytosis. Abdominal radiographs may show free air or ileus. Although residual induced pneumoperitoneum may persist for up to 72 hours, in a symptomatic patient the EP should not assume that the free air is benign if it persists longer than 24 hours after laparoscopy.

**TREATMENT**

Early gynecology consultation should be obtained if thermal injury is suspected. The EP should also consider early empiric antibiotics effective against gastrointestinal pathogens if perforation is suspected or confirmed.

**BLEEDING AFTER CERVICAL PROCEDURES**

Cervical cancer used to be the top cancer killer of women in the United States. Even though numbers have declined over the past few decades because of the emphasis on regular Papanicolaou tests, in 2007 cervical cancer was diagnosed in 12,280 women, and 4021 died of the disease.

Cervical procedures such as cervical conization (laser conization, cold knife conization, loop electrosurgical excision), colposcopy, and cryotherapy are used for the diagnosis and treatment of early cervical neoplasia.

Cold knife conization (surgical excision with a scalpel) is always performed in the operating room, usually with general or spinal anesthesia. Because intraoperative and postprocedural bleeding can be profuse, cerclage is often performed prophylactically before the procedure as a tourniquet. Postconization bleeding is usually manifested 1 to 2 weeks after the procedure.

Laser conization has only slightly lower rates of bleeding. Cervical cryotherapy and loop electrosurgical excision cause just minor bleeding and thus are performed in the outpatient setting.

**TREATMENT**

Vaginal packing may be attempted, but the patient often needs to return to the operating room for control of hemorrhage.

**BOX 125.4 Most Threatening and Most Common Complications of Uterine Fibroid Embolization**

<table>
<thead>
<tr>
<th>Most Threatening</th>
<th>Most Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>Postembolization syndrome</td>
</tr>
<tr>
<td>Nontarget embolization</td>
<td>Severe pain</td>
</tr>
<tr>
<td>Uterine ischemia, rupture</td>
<td>Vaginal bleeding</td>
</tr>
<tr>
<td>Endometritis, pyometrium</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td>Contrast agent–induced renal failure</td>
<td>Groin hematoma</td>
</tr>
<tr>
<td>Thromboembolic disease</td>
<td>Retained tissue</td>
</tr>
<tr>
<td>Iatrogenic menopause*</td>
<td>Embolization failure</td>
</tr>
</tbody>
</table>

*The incidence is 1% to 5% in all women but up to 43% in women older than 45 years.
Documentation

Patients with Complications of Gynecologic Procedures

History
Gravida, para, aborta, current pregnancy status
Last normal menstrual period or onset of menopause
Procedure performed, including any previous associated complications
Time lapsed since the procedure
If bleeding, quantify the rate and whether symptoms of anemia are present

Physical Examination
Are the vital signs stable?
Does the patient look ill? pale? febrile? uncomfortable?
Abdominal examination—Distention, soft, tender, peritoneal signs
Speculum examination—Vaginal discharge, bleeding, color, quantity
Bimanual examination—Uterine and ovarian size and texture, tenderness
Wound evaluation—Is there discharge? Erythema? Tenderness? Is it intact at all layers?

Diagnostic Studies
Bedside ultrasound imaging results, if performed, to evaluate for free fluid, bladder fullness, hydronephrosis, or uterine contents
Other imaging or blood and urine laboratory study results

Medical Decision Making
Time and person contacted for gynecology consultation

Patient Instructions
Documentation of discussion with the patient regarding diagnosis, anticipated course, recognition of warning signs, what to do if they occur, follow-up, and reasons to return to the emergency department

PATIENT TEACHING TIPS

After a Gynecologic Procedure

Explain the normal postoperative course to the patient.
If the patient is not being admitted, schedule follow-up with the patient’s physician in the next 1 to 3 days.
If antibiotics are prescribed, instruct the patient to complete the entire course of therapy as indicated.
Tell the patient to call her physician or return to the emergency department if she has:
- Worsening abdominal or pelvic pain or abdominal distention
- Intractable vomiting
- Any evidence of wound infection or discharge
- Vaginal bleeding soaking more than 1 maxi-pad an hour for at least 4 hours (instruct her that there may be an initial gush in the morning or on standing after lying down)
- Foul-smelling, milky, green, or other abnormal vaginal discharge
- Fever with a temperature higher than 100.3° F
- Any other concerning symptoms

SECTION XII  WOMEN’S HEALTH AND GYNECOLOGIC DISEASES

POSTABORTION COMPLICATIONS

Epidemiology

Since becoming legalized nationwide in 1973, termination of pregnancy has become one of the most frequently performed operative procedures in the United States, with more than 1 million performed yearly. A total of 1.2 million cases were reported in 2008. An estimated half of all pregnancies are unplanned, and 40% of unintended pregnancies are terminated. In fact, each year approximately 3% of all women of childbearing age have abortions, thus accounting for almost one fourth of all pregnancies. Most abortions are performed during the first trimester—62% within the first 8 weeks and 95% within the first 16 weeks. Overall complication rates are low, ranging from 1% to 5% of cases, and associated maternal mortality is extremely rare. Death is infrequent, with seven occurring after the almost 1 million legal abortions reported in the United States in 2005. In fact, for every gestational age, mortality is lower with abortion than with pregnancy and childbirth.

Medical abortion has a success rate of 80% to 97% (higher for gestations <50 days); 2% to 5% of patients with failed abortions require subsequent surgical abortion, with a 5% to 10% rate of incomplete evacuation of products of conception.

Pathophysiology

Medical Abortion

The three most commonly used abortion medications are mifepristone (an antiprogestin), misoprostol (a prostaglandin), both of which trigger uterine contraction, and methotrexate, an antimetabolite that interrupts embryonic development. Methotrexate and misoprostol are also teratogenic. Thus once used, termination must be completed, even if surgical means are ultimately necessary.

Medical abortion of both live and deceased fetuses between 13 and 28 weeks of gestation is uncommon but can be achieved with prostaglandin E2 suppositories, carboprost tromethamine, misoprostol, or high-dose oxytocin (80% to 90% effective).

Surgical Abortion

Dilation plus curettage is the most frequently used abortion method in the United States (>90% of abortions). The cervix is dilated and the uterine contents scraped out with a curette or aspirated via vacuum extraction. In the first trimester the overall risk profile is very low (0.1% to 0.3%) and even lower with regional anesthesia. However, the complication rate does increase with increasing gestational age.

Dilation plus evacuation is performed to terminate pregnancies more than 16 weeks of gestation. Dilation is achieved via osmotic dilators (i.e., laminaria) or vaginally administered prostaglandins, as opposed to instrumentation, and the uterine contents are removed with forceps or vacuum. This technique is also used for the management of spontaneous abortion, retained products of conception, intrauterine fetal demise, and gestational trophoblastic neoplasia. Its application
depends on uterine volume, age of gestation, and operator experience.13

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Abortion is a commonly performed procedure and, when performed under medical supervision, rarely has severe complications. The vast majority of terminations are procedural (including vacuum aspiration, sharp curettage, and dilation and evacuation). Medical abortion can be used earlier in the pregnancy and avoids the risks and stigma of procedural termination, but it has a higher incidence of incomplete abortion and failed termination and can be accompanied by severe side effects of the medication and physical discomfort.

General complications of abortion include retained pregnancy, hemorrhage, infection, and incomplete evacuation (Table 125.3); the most threatening and most common complications of abortion are listed in Box 125.5.

In the long term there is a risk for decreased fertility and amenorrhea. Postabortion infection seems to be the only predictor of decreased fertility. For instance, the risk for ectopic pregnancy increases only in cases of postabortion infection. Because ovulation can resume as early as 2 weeks after abortion, contraception should be initiated soon after abortion.

<table>
<thead>
<tr>
<th>ABORTION METHOD</th>
<th>GESTATIONAL AGE</th>
<th>IMMEDIATE (&lt;24 HR)</th>
<th>EARLY (1 DAY-4 WK)</th>
<th>DELAYED</th>
<th>LATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td></td>
<td>Nausea</td>
<td>Bleeding</td>
<td>Psychologic trauma</td>
<td>Psychologic trauma</td>
</tr>
<tr>
<td>Mifepristone (single 200-mg dose)</td>
<td>&lt;8 wk</td>
<td>Bleeding</td>
<td>Retained products</td>
<td>Rh isoimmunization</td>
<td>Rh isoimmunization</td>
</tr>
<tr>
<td>Methotrexate with or without misoprostol</td>
<td></td>
<td>Pain, cramping</td>
<td>Rh isoimmunization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misoprostol, vaginal or buccal prostaglandins</td>
<td>Up to 23 wk</td>
<td>Pain</td>
<td>Rh isoimmunization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical</td>
<td></td>
<td>Pain</td>
<td>Bleeding</td>
<td>Postabortive amenorrhea</td>
<td>Postabortive amenorrhea</td>
</tr>
<tr>
<td>Curettage (suction or sharp): without dilation</td>
<td>&lt;7 wk</td>
<td>Bleeding</td>
<td>Retained products</td>
<td>Rh isoimmunization</td>
<td></td>
</tr>
<tr>
<td>Curettage (suction or sharp): with dilation</td>
<td>7-13 wk</td>
<td>Cervical laceration</td>
<td>Rh isoimmunization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dilation and evacuation</td>
<td>&gt;13 wk</td>
<td>Uterine perforation</td>
<td>Disseminated intravascular coagulation (rare)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COMPLICATIONS OF MEDICAL ABORTION

The most feared complication is uterine rupture with intraabdominal expulsion of the fetus, especially in women with a scarred uterus (e.g., from a previous cesarean delivery), grand multiparity, and nulliparity with an insufficiently ripened cervix. Common side effects include nausea, vomiting, diarrhea, headache, dizziness, back pain, and fatigue, but it is the severe cramping and heavy bleeding that occur with medical induction that are most likely to bring patients to the ED. Treatment is symptomatic, and regardless of whether the

BOX 125.5 Most Threatening and Most Common Complications of Induced Abortion

<table>
<thead>
<tr>
<th>Most Threatening</th>
<th>Most Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular injury</td>
<td>Bleeding</td>
</tr>
<tr>
<td>Bowel injury</td>
<td>Pain, cramping</td>
</tr>
<tr>
<td>Urinary tract injury</td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td></td>
</tr>
<tr>
<td>Uterine perforation or rupture</td>
<td></td>
</tr>
</tbody>
</table>

| Medication intolerance (medical abortion) | Retained products of conception |
| Cervical laceration (surgical abortion) | Retained pregnancy |
| Infection, endometritis | |
bleeding is heavy, transfusions are rarely required. It is important to distinguish the natural course of medical termination from incomplete abortion or uterine rupture.

**COMPLICATIONS OF SURGICAL ABDUCTION**

Surgical abortion carries the risks associated with anesthesia, in addition to those related to the procedure. Complications categorized as immediate, delayed, and long term are listed in **Box 125.6**.

Complications include uterine perforation, cervical laceration, hemorrhage, incomplete removal of the fetus and placenta, and infection. Very rarely, curettage performed in advanced pregnancy results in a severe, fatal consumptive coagulopathy.

The most common postprocedural complaints are bleeding and pain. Uterine bleeding may be due to retained products of conception, uterine atony, infection, uterine arteriovenous malformation, placenta accreta, coagulopathy (secondary to high levels of tissue thromboplastin released during the procedure), or uterine perforation.

**HEMORRHAGE**

Posttermination vaginal bleeding in the natural course of abortion must be differentiated from pathologic causes. Determination of the abortion method, rate of bleeding, and accompanying symptoms such as fever, abdominal pain, and symptoms of acute anemia is essential.

Diagnostic testing includes a complete blood count, coagulation studies, basic metabolic profile, type and screen (or crossmatch if the bleeding is brisk and uncontrolled), and US to evaluate for intruterine contents. Bedside US revealing free fluid or an upright chest radiograph revealing free air is sufficient evidence of perforation and the need for emergency exploratory laparotomy. Heavy bleeding or a nonfundal perforation requires evaluation of the adjacent intraabdominal organs for collateral damage. In a stable patient, US is required to evaluate the pelvic structures, followed by a computed tomography scan if the US image is equivocal. Incomplete abortion is one of the most common causes of ongoing bleeding, and US is extremely useful for making the diagnosis.

Uterine atony is a diagnosis of exclusion and can be treated medically after the findings on US and hemoglobin levels are within normal limits.

Uterine perforation carries a high risk for concomitant damage to the intraperitoneal structures and severe hemorrhage. Delayed manifestation is not uncommon because fundal perforations (accounting for two thirds of all perforations) have scant bleeding. Lateral perforations may have heavy bleeding hidden in the broad ligament, and a lacerated uterine artery may initially spasm. The signs and symptoms depend on the site of perforation (Table 125.4). Uterine perforation related to surgical abortion or uterine rupture from medical abortion must be considered in patients with vaginal bleeding and abdominal pain.

**TREATMENT**

The EP must first establish that the patient is stable, resuscitate if necessary, and then determine whether the source of bleeding is vaginal, cervical, or uterine. Resuscitation of unstable patients is paramount. Management includes rapid diagnosis, large-bore IV access, fluid resuscitation or transfusion (or both), and gynecologic consultation.

Uterine perforation related to surgical abortion and uterine rupture from medical abortion are surgical emergencies, so gynecology must be involved early. Laparotomy or laparoscopy to examine the abdominal contents is usually indicated, although small perforations may be managed expectantly with consideration of antibiotic treatment. In the presence of rapid bleeding, insertion of a Foley catheter into the uterus and inflation of the balloon with 60 mL of saline can serve as a temporizing tamponade (Table 125.5).

Definitive treatment of incomplete abortion with retained products of conception is dilation and curettage. Gynecology should be consulted and antibiotics should be considered because retained products place patients at risk for infection.
CHAPTER 125
COMPLICATIONS OF GYNECOLOGIC PROCEDURES, ABORTION, AND ART

Lacerations of the vagina or cervix are treated with direct pressure, followed by the application of Monsel solution or silver nitrate if needed.

Treatment options for uterine atony are methylergonovine maleate (Methergine), 0.2 mg IM, carprofen tromethamine (Hemabate), 250 mcg IM every 15 to 90 minutes (maximum total dose, 2 mg), misoprostol, 1000-mcg suppository per rectum, oxytocin (Pitocin), 40 units in 1 L of 5% dextrose in NS by IV drip, with the rate titrated to bleeding control.

Retained products of conception
Dilation and curettage
Antibiotics if endometritis is suspected

Placenta accreta
Uterine artery embolization

Severe continued bleeding
Temporizing measure: intraventricular tamponade via uterine packing or transcervical placement of a Foley catheter and inflation of the balloon with 30 mL of sterile NS (or 100 mL of NS for a 30-mL balloon)

Postabortion infection is infrequent, but when it does occur, it is usually a result of retained products of conception or unrecognized preexisting infection.

Patients with endometritis usually have fever, prolonged vaginal bleeding, and pelvic pain. A midline boggy mass may be noted on examination. Laboratory tests include a complete blood count with differential, electrolytes, kidney and liver function, coagulation profile, lactate studies, β-hCG, a blood bank sample, urinalysis, and cervical and urine cultures.

TREATMENT
Postabortion infections require antibiotics, as well as suction curettage. The antibiotic regimens recommended are usually based on guidelines of the Centers for Disease Control and Prevention for treating pelvic inflammatory disease and include IV clindamycin, 900 mg every 8 hours, plus gentamicin, 1.5 mg/kg every 8 hours; triple coverage with ampicillin, gentamicin, and metronidazole is indicated for sicker patients; and ampicillin-sulbactam is used as monotherapy in less severe cases. Treatment of sepsis begins with rapid stabilization and aggressive IV fluid resuscitation. Broad-spectrum intravenous antimicrobials and gynecology consultation for definitive evacuation of the products of conception should not be delayed.

PATIENT TEACHING TIPS

Postabortion Instructions
Instruct the patient about the natural course of recovery, in particular how much bleeding and pain can be anticipated and when to be concerned.

If antibiotics are prescribed, the patient should complete the entire course as indicated.

Inquire whether the patient wishes to use contraception.

Also clarify that only barrier contraception protects against sexually transmitted diseases as well.

Tell the patient to call her physician or return to the emergency department if she has
- Vaginal bleeding soaking more than 1 maxi-pad per hour for at least 4 hours
- Foul-smelling, milky, or green vaginal discharge
- Increasing abdominal or pelvic pain
- Fever with a temperature higher than 38°C
- Any other concerning symptoms

COMPLICATIONS OF ASSISTED REPRODUCTIVE TECHNOLOGY

EPIDEMIOLOGY

On July 25, 1978, Louise Brown, the original “test tube baby,” was born in England. Conceived by in vitro fertilization, her birth was a landmark in the history of ART. Four years later, the first child conceived by ART in the United States was born. In 2009, 146,244 ART procedures were reported by 441 sites in the United States, resulting in more than 60,000 babies, and it is estimated that more than 1% of children conceived worldwide can be attributed to ART each year.
Despite the growing frequency of ART, however, published data on complications are limited. What does exist focuses primarily on outcomes of the pregnancy (multiple-birth gestations, low-birth-weight babies, cesarean sections, and preterm delivery), as well as long-term effects on women and the resultant children. These complications are dealt with only indirectly in the ED.

**PATHOPHYSIOLOGY**

The subfertility of a couple can be attributed to male factor, female factor, or incompatibility issues. Male factor infertility includes dysfunctional sperm, inadequate sperm concentration, and obstruction. Female factor infertility can be due to ovulatory dysfunction, poor egg quality, anatomic abnormalities, or hormonal imbalance. Compatibility factors include a hostile environment.

Many techniques are used in the course of assisted reproduction, and rapid advances have been made over the last 2 decades. ART incorporates techniques of controlled ovarian hyperstimulation, egg or sperm retrieval, insemination, and embryo transfer. Selection of the ART methods used depends on the specific fertility issues identified. During the course of evaluation and preparation, each party may undergo diagnostic and corrective procedures before the initiation of assisted reproduction.

The five basic stages of ART for women are ovulation (natural or induced), egg harvesting, implantation of the egg and sperm or fertilized zygote, pregnancy, and delivery. Each stage has its own risks. For men, the risks are limited mostly to procedures for the acquisition of sperm.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

When dealing with these patients, the EP must keep in mind that infertility specialists are typically very involved in the management of their patients and would prefer to have close communications regarding the patient’s status while being able to provide close monitoring and follow-up.

Major complications of ART likely to be encountered in the ED include ovarian hyperstimulation syndrome (OHSS), ectopic or heterotopic pregnancy, miscarriage, ovarian torsion, ovarian rupture, thromboembolism, and postprocedural complications (Table 125.6 and Box 125.7).

### Table 125.6 Complications of Assisted Reproductive Technology

<table>
<thead>
<tr>
<th>PHASE OF ART</th>
<th>IMMEDIATE</th>
<th>EARLY</th>
<th>DELAYED</th>
<th>LATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled ovarian hyperstimulation: clomiphene citrate, gonadotropins (FSH/LH, GnRH, hMG)</td>
<td>Medication side effects</td>
<td>OHSS,* ovarian torsion, ovarian cyst, cyst rupture</td>
<td>Multifetal pregnancy, thromboembolic disease*</td>
<td>Ovarian cancer is not supported by trials</td>
</tr>
<tr>
<td>Oocyte retrieval</td>
<td>Risks of anesthesia, bleeding from the vaginal puncture site, intraperitoneal bleeding</td>
<td>Bleeding from the vaginal puncture site, intraperitoneal bleeding, ovarian torsion, infection</td>
<td>Bowel endometriosis</td>
<td></td>
</tr>
<tr>
<td>Embryo transfer</td>
<td>Contractions expelling the embryos</td>
<td>Infection, OHSS*</td>
<td>Multifetal pregnancy</td>
<td></td>
</tr>
<tr>
<td>Pregnancy</td>
<td>Early pregnancy, bleeding, placenta previa</td>
<td>OHSS,* ectopic or heterotopic pregnancy,* spontaneous abortion, thromboembolic disease*</td>
<td>Multifetal pregnancy, preeclampsia or eclampsia,* thromboembolic disease,* placental abruption</td>
<td>Multifetal pregnancy, preeclampsia or eclampsia,* thromboembolic disease*</td>
</tr>
<tr>
<td>Delivery</td>
<td>Preterm labor or PROM, preeclampsia or eclampsia,* primary inadequate contractions, secondary uterine inertia; increased risk for cesarean section, multifetal delivery; EVLBW, VLBW, LBW infants</td>
<td>Thromboembolic complications,* retained placenta, bleeding associated with vaginal delivery, preeclampsia or eclampsia*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Major complication.

ART, Assisted reproductive technology; EVLBW, extremely very low birth weight; FSH/LH, follicle-stimulating hormone/luteinizing hormone; GnRH, gonadotropin-releasing hormone; hMG, human menopausal gonadotropin; LBW, low birth weight; OHSS, ovarian hyperstimulation syndrome; PROM, premature rupture of membrane; VLBW, very low birth weight.
COMPLICATIONS OF GYNECOLOGIC PROCEDURES, ABORTION, AND ART

AMBULATORY PROCEDURE INVOLVING INTRAVENOUS ANALGESIA AND TRANSVAGINAL US–GUIDED OOCYTE ASPIRATION

Transvaginal US–guided oocyte aspiration is typically an ambulatory procedure involving intravenous analgesia and sedation. Risks include vascular injury with bleeding from the vaginal puncture site, hemoperitoneum, rupture of ovarian cysts, bowel perforation, injury to pelvic organs, and infection.

Bleeding from the vaginal mucosa because of the harvesting punctures typically resolves spontaneously by the end of the procedure or with direct pressure. Topical hemostatic agents may be used if compression fails. Persistent or significant bleeding despite these measures requires suturing.

Intraabdominal bleeding should be suspected in patients with postprocedural symptoms of anemia even before peritoneal signs become evident.

If vital signs remain stable and the patient is minimally symptomatic, conservative management is possible; however, hemodynamic instability unresponsive to basic fluid resuscitation or a falling hemoglobin level in a symptomatic patient requires emergency exploratory laparotomy for definitive diagnosis and correction. Typed and crossmatched blood should be used for transfusion if the patient is sufficiently stable. Uncrossmatched O-negative blood can be used for immediate transfusion if necessary.

ELEVELS OF HORMONES. A HIGH INDEX OF SUSPICION MUST BE MAINTAINED, BUT EVALUATION SHOULD TAKE INTO ACCOUNT THE ONGOING ATTEMPTS AT PREGNANCY.

BEFORE ANY TYPE OF IMAGING IS PERFORMED, PREGNANCY STATUS SHOULD BE ESTABLISHED. CHEST COMPUTED TOMOGRAPHY WITH INTRAVENOUS CONTRAST ENHANCEMENT TO EVALUATE FOR PULMONARY EMBOLISM CAN BE PERFORMED WITH SHIELDING. THE PATIENT SHOULD FIRST BE INFORMED OF THE RISKS AND BENEFITS OF THE PROCEDURE AND PROVIDE WRITTEN CONSENT. ECHOCARDIOGRAPHY CAN BE USED TO EVALUATE FOR SIGNS OF CRITICAL PULMONARY EMBOLISM SUCH AS RIGHT HEART STRAIN WHEN THE PATIENT REFUSES A RADIOACTIVE STUDY, ALTHOUGH THIS IS NOT THE PREFERRED METHOD OF EVALUATION.

LOWER EXTREMITY VASCULAR STUDIES CAN BE PERFORMED, BUT THEIR SENSITIVITY IS LOW IF NO LEG SYMPTOMS ARE PRESENT. NEVERTHLESS, CONFIRMED DEEP VEIN THROMBOSIS MUST BE TREATED AND MAY SAVE THE PATIENT AND HER EARLY PREGNANCY FROM FURTHER EXPOSURE TO RADIATION.

BEDSIDE US BY AN EP TRAINED IN ECHOCARDIOGRAPHY AND LOWER EXTREMITY DOPPLER STUDIES CAN SPEED THE DIAGNOSIS OF THROMBOEMBOLIC DISEASE.

OOCYTE HARVESTING

Transvaginal US–guided oocyte aspiration is typically an ambulatory procedure involving intravenous analgesia and sedation. Risks include vascular injury with bleeding from the vaginal puncture site, hemoperitoneum, rupture of ovarian cysts, bowel perforation, injury to pelvic organs, and infection.

Bleeding from the vaginal mucosa because of the harvesting punctures typically resolves spontaneously by the end of the procedure or with direct pressure. Topical hemostatic agents may be used if compression fails. Persistent or significant bleeding despite these measures requires suturing.

Intraabdominal bleeding should be suspected in patients with postprocedural symptoms of anemia even before peritoneal signs become evident.

If vital signs remain stable and the patient is minimally symptomatic, conservative management is possible; however, hemodynamic instability unresponsive to basic fluid resuscitation or a falling hemoglobin level in a symptomatic patient requires emergency exploratory laparotomy for definitive diagnosis and correction. Typed and crossmatched blood should be used for transfusion if the patient is sufficiently stable. Uncrossmatched O-negative blood can be used for immediate transfusion if necessary.

EMBRYO TRANSFER

Pelvic infection, ectopic or heterotopic pregnancy, spontaneous expulsion of the embryo, and multiple-gestation pregnancy may complicate embryo transfer.

ECTOPIC AND HETEROTOPIC PREGNANCIES

Despite careful placement of embryos in the uterus, approximately 4% of in vitro fertilization pregnancies are ectopic. This incidence is slightly reduced with US guidance of embryo placement; however, migration of the embryo may occur occasionally. Ectopic pregnancies as a result of ART are usually diagnosed very early because of close monitoring by the fertility specialist.

Heterotopic pregnancies (multigestational pregnancies with at least one ectopic and one intrauterine pregnancy) are very rare with spontaneous conception (1 in 30,000) but occur in up to 1% of assisted conception cycles. This number is expected to decrease as technology continues to improve and the use of single-embryo transfer increases. In patients with symptoms consistent with a possible ectopic pregnancy, the presence of an intrauterine pregnancy does not rule out a heterotopic ectopic pregnancy, and a full work-up should be performed.

Management of patients who have undergone the psychological, physical, and financial burden of using ART and have a heterotopic pregnancy should be focused on maintaining the intrauterine pregnancy while eliminating the ectopic pregnancy and avoiding excessive risk to the mother.

MULTIPLE-GESTATION PREGNANCIES

In 2009, 31% of infants born as a result of ART were multiple-gestation births, in contrast to approximately 3% of births in the general population. 13

Multiple embryos are often placed in the uterus because of the low implantation rate per embryo (10% to 25%). Although this can be welcome news to the expectant parents, these multifetal pregnancies are associated with an increased risk for mortality and morbidity in both the mother and fetuses.

OVARIAN TORSION

Ovarian enlargement predisposes to torsion. ART patients are at particular risk because they are actively seeking to attain hyperovulation and pregnancy. In addition, patients with elevated risk because of preexisting conditions such as polycystic ovarian syndrome are overrepresented in the ART population.

Severe unilateral adnexal or pelvic pain may initially be intermittent as the ovary twists and untwists; the pain then becomes sustained when the torsion persists and the ovary becomes ischemic. Immediate pelvic Doppler US of the ovarian vessels is the key to diagnosis and differentiation from benign causes of pelvic pain. Emergency surgical intervention is indicated to avoid permanent damage to the ovary.

THROMBOEMBOLIC DISEASE

ART patients are at increased risk for thromboembolism because of the elevated levels of hormones. A high index of suspicion must be maintained, but evaluation should take into consideration the ongoing attempts at pregnancy.

Before any type of imaging is performed, pregnancy status should be established. Chest computed tomography with intravenous contrast enhancement to evaluate for pulmonary embolism can be performed with shielding. The patient should first be informed of the risks and benefits of the procedure and provide written consent. Echocardiography can be used to evaluate for signs of critical pulmonary embolism such as right heart strain when the patient refuses a radioactive study, although this is not the preferred method of evaluation.

Lower extremity vascular studies can be performed, but their sensitivity is low if no leg symptoms are present. Nevertheless, confirmed deep vein thrombosis must be treated and may save the patient and her early pregnancy from further exposure to radiation.

Bedside US by an EP trained in echocardiography and lower extremity Doppler studies can speed the diagnosis of thromboembolic disease.

BOX 125.7 Most Threatening and Most Common Complications of Assisted Reproductive Technology

<table>
<thead>
<tr>
<th>Most Threatening</th>
<th>Most Common</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovarian hyperstimulation syndrome</td>
<td>Medication side effects</td>
</tr>
<tr>
<td>Ectopic or heterotopic pregnancy</td>
<td>Multiple-gestation pregnancies</td>
</tr>
<tr>
<td>Ovarian torsion</td>
<td>Preterm labor</td>
</tr>
<tr>
<td>Pulmonary embolism, deep vein thrombosis</td>
<td>Bleeding</td>
</tr>
<tr>
<td></td>
<td>Infection</td>
</tr>
<tr>
<td></td>
<td>Miscarriage</td>
</tr>
<tr>
<td></td>
<td>Pain</td>
</tr>
</tbody>
</table>

Most Common Complications of Assisted Reproductive Technology

- Ovarian hyperstimulation syndrome
- Ectopic or heterotopic pregnancy
- Ovarian torsion
- Pulmonary embolism, deep vein thrombosis

Pain

Common Complications of Assisted Reproductive Technology

- Miscarriage
- Preterm labor
- Multiple-gestation pregnancies
- Infection
- Mediation side effects
- Bleeding
- Ectopic or heterotopic pregnancy
- Ovarian hyperstimulation syndrome
- Pregnancy
- Medication side effects
Maternal complications include preterm labor, placental abruption and placenta previa, cesarean section, postpartum hemorrhage, gestational diabetes, and preeclampsia. Fetuses are at risk for the secondary effects of maternal complications, as well as premature birth, low birth weight, intrauterine demise, and congenital conditions such as cerebral palsy. As new technologic developments increase the success of implantation, however, protocols are changing to dictate the transfer of only one or two embryos.

**OVARIAN HYPERSTIMULATION SYNDROME**

**Epidemiology**

OHSS is the most feared complication of ovulatory stimulation. Severe OHSS is life-threatening and occurs in an estimated 0.5% to 5% of ART cycles. It also occurs occasionally in spontaneous pregnancy. The estimated mortality rate is 1 in 400,000 to 500,000 patients.\(^{15}\)

**Pathophysiology**

OHSS is characterized by increased capillary permeability with third spacing of protein-rich fluid. This results in hemoconcentration with severe intravascular hypovolemia manifested as edema, ascites, and pleural and pericardial effusions. Multisystem organ failure, renal failure, immunosuppression, pulmonary failure, thromboembolism, and death may result.

Through an unclear mechanism, hCG appears to be a trigger for OHSS. The syndrome is usually manifested within a week of exogenous hCG administration and oocyte retrieval and has a second peak of incidence after implantation as a result of the rise in endogenous hCG.

Risk factors include young age, low body mass index, use of gonadotropin-releasing hormone analogues and exogenous hCG, elevated estradiol levels, increased number of stimulated follicles during controlled ovarian hyperstimulation (“necklace sign” or “string of pearls” appearance on US images), polycystic ovarian disease, and previous OHSS (Box 125.8).

**Presenting Signs and Symptoms**

Patients have abdominal pain and distention, nausea, and vomiting and may complain of constipation or diarrhea. Chest discomfort, dyspnea, concentrated oliguria, rapid weight gain, and peripheral edema are symptoms of more severe cases.

Physical examination reveals abdominal distention with tenderness in the bilateral lower quadrants and tender, enlarged ovaries. Increasing evidence of third spacing such as peripheral edema, ascites, dull lung fields consistent with pleural effusion, and distant heart sounds are evident in patients with severe disease.

**Differential Diagnosis and Medical Decision Making**

Laboratory testing reveals serum estradiol levels elevated to higher than 3000 pg/mL, hemoconcentration with hyponatremia and hyperkalemia, and decreased renal function. Pelvic US with Doppler is essential to evaluate for the presence of ascites (Fig. 125.3) and the extent of follicular recruitment (Fig. 125.4) while ruling out alternative diagnoses such as ovarian torsion.

**Treatment**

No specific cure is available for OHSS; treatment is empiric and focused on supportive care until spontaneous resolution occurs (Table 125.7). The syndrome is usually self-limited.

Early detection and prevention are key. Individuals at risk should receive only low-dose gonadotropins and be monitored closely by the fertility specialist. The development of symptoms, elevated estradiol levels (>3000 pg/mL), or excessive follicular recruitment (>20) calls for the initiation of preventive treatment strategies such as decreasing hormone dosages, freezing the embryos rather than waiting for fresh embryo transfer, administering albumin during oocyte harvesting, and

---

**BOX 125.8 Risk Factors for Ovarian Hyperstimulation Syndrome**

- Younger than 35 years
- Low body mass index
- Use of gonadotropin-releasing hormone analogues and gonadotropins
- Elevated estradiol levels
- Increased number of stimulated follicles during controlled ovarian hyperstimulation
- Polycystic ovarian disease
- Previous episode of ovarian hyperstimulation syndrome

---

![Fig. 125.3 Ascites and pleural effusion in a patient with ovarian hyperstimulation syndrome.](image1.png)

![Fig. 125.4 Polycystic ovarian syndrome affecting both ovaries in a patient with ovarian hyperstimulation syndrome.](image2.png)
“coasting” (withholding further gonadotropin administration until estradiol levels decrease, which allows fresh embryo retrieval and transfer). In extreme circumstances, the stimulation protocol should be terminated.

MILD CASES Mild cases can be managed on an outpatient basis with very close follow-up and daily monitoring of weight, abdominal girth, and urine output. Conservative management focuses on treating pain and maintaining hydration, although some treatment strategies include high-protein diets and high-sodium drinks (e.g., exercise rehydration drinks). Progressive symptoms or weight gain of more than 2 lb should prompt hospital admission. In the absence of pregnancy, the symptoms are expected to resolve about 2 weeks after hCG was administered.

MODERATE CASES Patients with moderate disease require a complete work-up, including laboratory tests and US, and hospitalization is recommended for close observation and serial examinations, as well as for symptomatic care if the patient has disabling nausea, intractable abdominal pain, tense ascites, abnormal laboratory values, or other indications of a downward trajectory. Pelvic examination is not recommended in moderate or severe cases because of the risk for cyst rupture with hemorrhage.16 There should be a low threshold for admission to the hospital for monitoring, but typically these patients are being very closely followed by their fertility specialist; if the symptoms are controlled adequately, the patient can be discharged to follow-up in the next 1 to 3 days. She should be instructed to maintain a record of fluid balance and avoid physical activity.

SEVERE CASES Severe OHSS requires inpatient care in the intensive care unit.17 Strict monitoring of fluid balance and hemodynamics is critical. Large-bore IV access must be established for fluid resuscitation, and a subclavian line for central venous pressure is advised. Aggressive repletion of the intravascular space starts with at least 2 to 3 L of normal saline. If urine output remains inadequate (<50 mL/hr), salt-poor IV albumin (or hydroxyethyl starch) is the next step. Lactated Ringer solution should be avoided because of elevated potassium levels.

Ongoing oliguria and renal failure in the face of aggressive volume repletion may be due to abdominal compartment syndrome with elevated intraperitoneal pressure compressing the renal vasculature. This can be relieved with therapeutic paracentesis. Bedside US guidance is recommended to avoid puncturing the enlarged ovaries.

Diuretics are not suggested as first-line care because they may deplete the intravascular space and increase the risk for

<table>
<thead>
<tr>
<th>SEVERITY</th>
<th>SIGNS AND SYMPTOMS</th>
<th>MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Abdominal discomfort, distention, pain</td>
<td>Outpatient management</td>
</tr>
<tr>
<td></td>
<td>Enlarged ovaries (up to 5 cm)</td>
<td>Analgesia</td>
</tr>
<tr>
<td></td>
<td>Minimal ascites</td>
<td>Increased oral fluid intake (high-salt solutions)</td>
</tr>
<tr>
<td></td>
<td>Weight gain of &lt;10 lb</td>
<td>Close follow-up with regular visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report if symptoms worsen</td>
</tr>
<tr>
<td>Moderate</td>
<td>AS ABOVE, PLUS:</td>
<td>Admit to the hospital</td>
</tr>
<tr>
<td></td>
<td>Enlarged ovaries (5-12 cm)</td>
<td>Daily assessment</td>
</tr>
<tr>
<td></td>
<td>Nausea, vomiting, diarrhea</td>
<td>Thromboembolic prophylaxis</td>
</tr>
<tr>
<td></td>
<td>Ultrasonographic evidence of ascites</td>
<td>Monitor laboratory tests—CBC, electrolytes, blood urea</td>
</tr>
<tr>
<td></td>
<td>Hemoconcentration (Hct &lt; 45%)</td>
<td>nitrogen, creatinine, liver function tests, coagulation profile</td>
</tr>
<tr>
<td>Severe</td>
<td>AS ABOVE, PLUS:</td>
<td>Admit to the intensive care unit</td>
</tr>
<tr>
<td></td>
<td>Clinical evidence of ascites</td>
<td>Strict fluid balance with input of 3 L or more</td>
</tr>
<tr>
<td></td>
<td>Palpable ovaries</td>
<td>2 large-bore IV catheters (18 gauge or larger)</td>
</tr>
<tr>
<td></td>
<td>Hepatic dysfunction</td>
<td>Consider central venous pressure line</td>
</tr>
<tr>
<td></td>
<td>Hydrothorax, dyspnea</td>
<td>Consider IV albumin</td>
</tr>
<tr>
<td></td>
<td>Peripheral edema, anasarca</td>
<td>Thoracentesis or paracentesis as needed</td>
</tr>
<tr>
<td></td>
<td>Oliguria</td>
<td>Thromboembolic prophylaxis</td>
</tr>
<tr>
<td></td>
<td>Hemoconcentration (Hct &gt; 45%, Hg &gt; 15 g)</td>
<td>Terminate the ART cycle</td>
</tr>
<tr>
<td>Critical</td>
<td>AS ABOVE, PLUS:</td>
<td>Admit to the intensive care unit</td>
</tr>
<tr>
<td></td>
<td>Severely contracted blood volume (Hct &gt; 55%, WBC count &gt; 25,000)</td>
<td>Strict fluid balance with input of 3 L or more</td>
</tr>
<tr>
<td></td>
<td>Renal failure (Cr &gt; 1.6 mg/dL)</td>
<td>2 large-bore IV catheters, central venous pressure line</td>
</tr>
<tr>
<td></td>
<td>Thromboembolism</td>
<td>IV albumin</td>
</tr>
<tr>
<td></td>
<td>Acute respiratory distress syndrome</td>
<td>Intubation and ventilation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thoracentesis or paracentesis as needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hemodialysis as needed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anticoagulation or IVC filter as required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terminate the ART cycle</td>
</tr>
</tbody>
</table>

ART, Assisted reproductive technology; CBC, complete blood count; Cr, creatinine; Hct, hematocrit; Hg, hemoglobin; IV, intravenous; IVC, inferior vena cava; WBC, white blood cell.
thromboembolism; however, once hemodilution has been achieved, following each 100 mg of albumin with 10 to 20 mg of furosemide may be of benefit in patients with recalcitrant prerenal azotemia. Prophylaxis for deep vein thrombosis is essential given the high risk for thromboembolic disease. Syndrome-associated hypoglobulinemia results in a relative immunosuppression. Antibiotic choice should target specific suspected infectious causes.

**Complications of Assisted Reproductive Technologies**

**Induction Phase**
Abdominal pain, distention or ascites? Initiate a work-up and symptomatic treatment of OHSS. Obtain a US scan and estradiol levels.

Difficulty breathing and unstable? If signs of third spacing are present, suspect severe OHSS; start aggressive symptomatic and supportive treatment. Admit to the ICU.

Dyspnea with only leg edema or without any evidence of third spacing? Consider PE; obtain a chest radiograph. Anticoagulation and lower extremity vascular Doppler US are required to evaluate for DVT. If still equivocal, obtain a helical CT scan of the chest with IV contrast enhancement.

Pelvic pain? Consider early OHSS.

**Any Time During ART**
Pelvic pain? Perform Doppler US to evaluate for ovarian torsion versus ovarian cyst rupture.

**After Oocyte Harvesting**
Fever? Consider infection; administer antibiotics and evaluate whether stable for discharge.

Vaginal bleeding from a puncture site? Place pressure. If the bleeding does not stop, consider Monsel solution or silver nitrate.

Abdominal pain or peritoneal signs? Consider intraperitoneal hemorrhage; cardiovascular stabilization and definitive exploratory laparotomy are required.

**After Implantation or Embryo Transfer**
Pelvic pain or vaginal bleeding? Perform or obtain a pelvic US and check quantitative β-hCG to evaluate for ectopic or heterotopic pregnancy or threatened spontaneous miscarriage.

**PATIENT TEACHING TIPS**

**Ovarian Hyperstimulation Syndrome**
Clarify the details of the anticipated therapeutic course. Schedule follow-up with the patient’s physician in 1 to 3 days.

Instruct her to call her physician or return to the emergency department immediately if progressive symptoms of ovarian hyperstimulation syndrome develop, including:
- Chest discomfort
- Difficulty breathing
- Abdominal pain
- Bloating and swelling, rapid weight gain
- Decreased urination
- Severe or persistent vomiting

Warn the patient that there can be a second peak in symptoms after implantation triggered by her own hormonal surge.

**RED FLAGS**

**Complications of Assisted Reproductive Technology**
Increased abdominal girth, abdominal pain, edema, and dyspnea during induction of ovulation or early after implantation are suspicious for ovarian hyperstimulation syndrome.

Unilateral pelvic pain is suspicious for ectopic pregnancy or ovarian torsion.

Severe pain, fever, brisk bleeding, and peritoneal signs are suspicious for perforation.

Shortness of breath, possibly with pleuritic chest pain, should prompt evaluation for pulmonary embolism, although pleural effusions as a result of ovarian hyperstimulation syndrome are also possible.

Selection of medication must take into careful consideration the possible presence of early pregnancy.

**CRITICAL CASES** Critical cases with complications such as renal failure, thromboembolism, or acute respiratory distress syndrome require all of the previously described measures and termination of the pregnancy.

**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
REFERENCES