Chapter 1
Acute Pelvic Pain

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Definitions

Peritoneal Signs Evidence of peritonitis (irritation of the peritoneum, which lines the abdomen) on physical exam includes rebound (pain on the abrupt release of abdominal palpation), involuntary guarding of the abdomen, or tenderness with gentle shaking of the patient's abdomen or the bed. Peritonitis is often a response to intra-abdominal infection or inflammation or intra-abdominal hemorrhage [1]. A patient with ovarian torsion may also present with an acute abdomen, due to ovarian inflammation and necrosis.

Hemodynamic Instability Definitions vary but include a heart rate over 100 beats per min and a systolic blood pressure (SBP) below 90 millimeters of mercury (mmHg) or 20 % or more below a patient's baseline [2, 3]. In severely decompensated patients, the presence of a carotid pulse, reflecting an SBP of at least 60 mmHg, and a femoral pulse (SBP of

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60–70 mmHg), can be used as a quick estimate of blood pressure [4]. Other signs include tachypnea (over 20 breaths per minute) [5]. Tachycardia and any degree of hypotension in young healthy women, in particular, require immediate attention and aggressive resuscitation, as these can mark the onset of decompensated shock. Diagnostic criteria of hemorrhage shock and severe sepsis are shown in Tables 1.1 and 1.2.

Table 1.1 Stages of hemorrhagic shock

Class I: blood volume lost <15 %	**Class II**: blood volume lost 15–30 %
Heart rate <100 beats per minute	Heart rate >100 beats per minute
Blood pressure normal	Blood pressure normal
Respiratory rate 14–20 breaths per minute	Respiratory rate 20–30 breaths per minute
Urine output >30 mL/h	Urine output 20–30 mL/h
Mental status normal	Mental status mildly anxious
Class III: blood volume lost 30–40 %	**Class IV**: blood volume lost >40 %
Heart rate >120 beats per minute	Heart rate >140 beats per minute
Blood pressure decreased	Blood pressure decreased
Respiratory rate 30–40 breaths per minute	Respiratory rate >35 breaths per minute
Urine output 5–15 mL/h	Urine output negligible
Mental status anxious/ confused	Mental status confused/ lethargic
Often marks the onset of decompensated hypovolemic shock	

Committee on Trauma [5]

Table 1.2 Clinical criteria of sepsis and severe sepsis

Sepsis	Severe sepsis
Suspected source plus two or more: 1. Temperature >38.3 °C (101 °F) or <36 °C (96.8 °F) 2. Heart rate >90 beats per minute 3. Tachypnea (>20 breaths/minute) 4. WBC >12,000 μ/L or <4000 μ/L or normal with >10 % immature (band) forms	Sepsis plus one or more: 1. Systolic blood pressure <90 mmHg or decrease from baseline by 40 mmHg 2. Elevated lactate (>1 mmol/L; >4 particularly concerning, sign of organ hypoperfusion) 3. Acute lung injury: PaO_2/FiO_2 <250 (in the absence of pneumonia) or <200 (with pneumonia) 4. Acute oliguria: <0.5 mL/kg/h despite fluid resuscitation 5. Creatinine >2 mg/dL 6. INR >1.5 7. Platelets <100,000/uL 8. Bilirubin >2 mg/dL

Adapted from Fischerova [6] and Dellinger et al. [7]

Differential Diagnosis

Please refer to Chap. 2, Vaginal Hemorrhage, for the diagnosis and management of patients with vaginal bleeding as their primary complaint.

The most dangerous conditions are those resulting in hemodynamic compromise, including:

1. Sepsis due to tubo-ovarian abscess or other pelvic abscess, septic abortion, or post-procedural complication leading to infection, including visceral injury.
2. Intra-abdominal hemorrhage due to ruptured ectopic pregnancy or ruptured ovarian cyst.

Postoperative Complications

Please refer to Chaps. 16, Complications of Minimally Invasive Gynecologic Surgery, and 18, Gynecologic Oncology, for more information on the following conditions:

- *Postoperative infection*, including infection of abdominal or vaginal incisions, the vaginal cuff, or pelvic abscess.
- *Endomyometritis*: Polymicrobial infection of the endometrial cavity, which can occur after any uterine instrumentation.
- *Necrotizing fasciitis*: A rare and rapidly advancing wound complication, known colloquially as "flesh-eating bacteria."
- *Toxic shock syndrome*: A rare, life-threatening syndrome caused by bacterial enterotoxins, initially recognized in menstruating women and attributed to tampon use; TSS is now diagnosed most commonly in nonmenstruating women, often in the days following a procedure or in the postpartum period [8–10].
- *Genitourinary tract injury.*
- *Urinary retention.*
- *Bowel injury* or *obstruction*.
- *Anastomotic* or *stoma complications*.
- *Bowel herniation* through an incision or port site.
- *Dehiscence* of vaginal cuff or abdominal wound.
- *Uterine perforation.*
- *Nerve injury* or *entrapment*.
- *Septic pelvic thrombophlebitis* (SPT): Inflammation of the pelvic vessels may occur in the postpartum or postoperative setting, with thrombus and bacterial infection [11].
- *Ovarian vein thrombosis.*

Infections

Relatively common and potentially highly morbid etiologies of patient presentations for acute pain. Please see Chap. 6, Pelvic Inflammatory Disease and Tubo-ovarian Abscesses, for more information.

Pelvic Inflammatory Disease (PID) Infection and inflammation of the upper genital tract in women, including inflammation of the endometrium (endometritis), fallopian tube(s) (salpingitis), pelvic peritoneum, and adnexa [12]. Risk factors include multiple sexual partners, non-use of barrier contraception, smoking, illicit drug use, infection with *Neisseria gonorrhoeae* and *Chlamydia trachomatis*, and prior episodes of PID [13, 14]. In addition to pelvic pain, patients may present with chills, abnormal vaginal bleeding or discharge, and/or dyspareunia [15].

Tubo-Ovarian Abscess (TOA) Abscess(es) involving the adnexa, including the fallopian tube and/or ovary. Risk factors for TOA are similar risk to factors for PID, and abscesses are usually polymicrobial [16]. Patients may present similarly to those with PID, though patients may also have high fever and sepsis.

Associated with Pelvic Masses or IUD

Adnexal Torsion Rotation of the ovary, fallopian tube, and the associated infundibulopelvic ligament, most often occurring with adnexal masses in adults, resulting in significant pain and eventual necrosis [17]. Please see Chap. 5, Adnexal Torsion, for diagnosis and management of adnexal torsion.

Ovarian Cyst The differential diagnosis of an ovarian mass detected by physical examination or imaging includes simple (follicular) cyst, paraovarian or paratubal cyst, corpus luteum, hemorrhagic cyst, ectopic pregnancy, endometrioma, benign cystic teratoma, cystadenoma, theca lutein cyst, hydrosalpinx (fluid filled fallopian tube) or pyosalpinx, tubo-ovarian abscess or other pelvic abscess, polycystic ovaries, ovarian hyperstimulation syndrome, uterine anomaly, broad ligament or pedunculated fibroid, peritoneal inclusion cyst, ovarian malignancy (germ cell, sex cord or stromal, or epithelial), metastatic implants on the ovary, and nongynecologic causes such as diverticular abscess, appendicitis, nerve sheath tumor,

or urologic pathology (pelvic kidney, ureteral or bladder diverticulum) [18]. Please see Chap. 4, Adnexal Masses and Ovarian Cyst Rupture, for more information on the diagnosis and management of adnexal masses.

Ruptured Ovarian Cyst Please see Chap. 4, Adnexal Masses and Ovarian Cyst Rupture, for more information on the diagnosis and management of ovarian cyst rupture.

Degenerating Fibroid The most common neoplasm in reproductive age women, fibroids are smooth muscle tumors that produce symptoms of pelvic pain, menorrhagia, and/or infertility in 25 % of women [19]. Acute pain can occur when a fibroid outgrows its blood supply and degenerates, causing necrosis and inflammation [20]. Rarely, torsion of a pedunculated fibroid can also occur [19]. Fibroids may also prolapse through the cervical os, into the vagina, causing pain and irregular bleeding; patients with prolapsing fibroids are frequently anemic [21, 22].

Fibroids are optimally visualized by ultrasound or MRI [23]. By ultrasound, a degenerating fibroid may have cystic spaces and peripheral color Doppler flow, while a necrotic fibroid may have diminished Doppler flow. Cystic spaces may also be seen within degenerating fibroids visualized by MRI, and fibroids in the later stages of degeneration may appear calcified (Fig. 1.1) [25]. By MRI, degenerating or torsing fibroids may not enhance with gadolinium, due to compromised blood supply [24]. In hemodynamically stable patients without signs of infection or acutely declining hemoglobin, treatment is supportive. Prolapsing fibroids are usually removed, often vaginally, for diagnostic purposes, though in stable patients without severe anemia, surgery can be planned as an outpatient [21].

Malpositioned IUD Patients with malpositioned IUDs may present with symptoms of pelvic pain, cramping, or irregular vaginal bleeding, though many malpositioned IUDs are detected incidentally [26]. On pelvic examination, the IUD strings should be visible protruding from the cervical os; when the strings are not visible, a Cytobrush used for pap

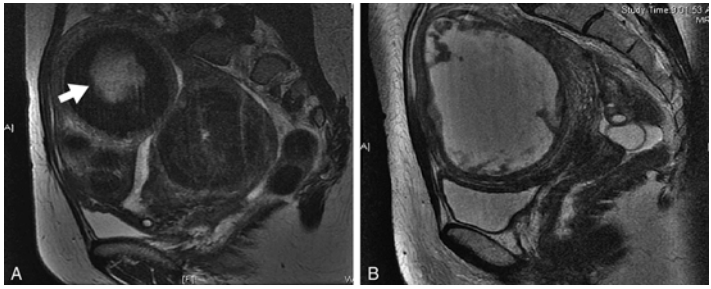

Fig. 1.1 Degenerating leiomyomas seen by T2-weighted magnetic resonance imaging (MRI; **a**; *arrow*) and by T1-weighted MRI (**b**) with gadolinium contrast (From Laughlin and Stewart [24], with permission of the American College of Obstetricians and Gynecologists)

smears can be used to try to sweep the strings out of the cervical canal [27]. While absent strings are concerning for IUD malpositioning, pelvic ultrasounds are necessary to confirm IUD location (Fig. 1.2). Patients should have a beta-human chorionic gonadotropin (hCG) checked to ensure unintended pregnancy has not occurred.

Regardless of presentation, malpositioned copper IUDs should be removed as the risk of pregnancy is increased; malpositioned levonorgestrel IUDs likely still provide adequate contraception but should be removed if the patient's pain is attributed to IUD malpositioning [26, 29]. A patient's pain should improve following removal of a malpositioned IUD; always consider the possibility of concomitant infection, including pelvic inflammatory disease, particularly in patients with persistent pelvic pain and/or fever. Please refer to Chap. 6, Pelvic Inflammatory Disease and Tubo-ovarian Abscess, for more information. If the IUD is not visualized on ultrasound, an abdominal radiograph can be obtained to assess for IUD perforation; if the IUD is not visualized in the abdominal cavity, it is assumed to have been expelled [26, 27]. Consider the possibility of visceral injury if an IUD is located in the pelvis or abdomen, outside of the uterus.

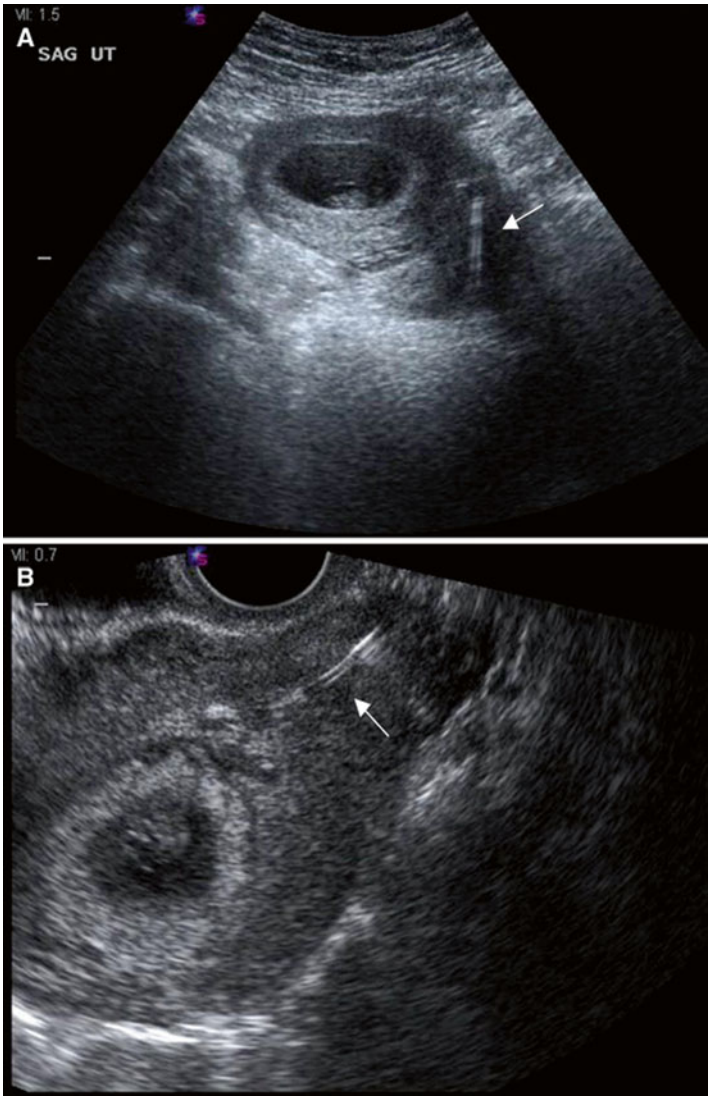

FIG. 1.2 Malpositioned IUD. (**a**) This sagittal transabdominal image shows an IUP above the malpositioned IUD (*arrow*) in the cervix. (**b**) Sagittal transvaginal image of the same patient, showing the malpositioned IUD (*arrow*) in the endocervical canal. *IUD* intrauterine device, *IUP* intrauterine pregnancy (Reprinted from Moschos and Twickler [28], with permission from Elsevier)

In patients presenting with pain and an IUD in place with a positive hCG, the pelvic ultrasound should be used to assess not only IUD location but also pregnancy location. If no pregnancy is identified, the patient should be followed for a pregnancy of unknown location (see Chap. 3, Pregnancy of Unknown Location and Ectopic Pregnancy, for more information). A patient with an intrauterine pregnancy with an IUD in place is at increased risk of first and second trimester spontaneous abortion, septic abortion, and preterm delivery [28, 30]. The IUD should be removed if the strings are visible at the cervix, though removal in itself carries a small risk of spontaneous abortion [30]. If the IUD strings are not visible at the cervix, and the IUD cannot be removed easily with ultrasound guidance, it should be left in place in patients wanting to continue their pregnancies. Patients with ongoing pregnancy with an IUD in place should be carefully counseled to present for pain, abnormal bleeding, fevers, or any other signs of infection.

Functional

Many functional causes of pelvic pain can be managed with hormonal medications, as detailed below. Contraindications to estrogen therapy include, but are not limited to, migraines with aura; smoking (in women over 35 years of age); prior deep vein thrombosis or pulmonary embolism; known thrombophilia; cerebrovascular disease; ischemic cardiac disease; severe hypertension; complicated vascular disease; peripartum cardiomyopathy within the last 6 months or with impaired cardiac function; severe cirrhosis; liver malignancy; active breast cancer; and lupus with positive antiphospholipid antibodies [31]. Contraindications to progesterone therapy include but are not limited to current breast cancer and severe liver dysfunction. Please refer to the Centers for Disease Control and Prevention U.S. Medical Eligibility for Contraception Use for further details.

Dysmenorrhea Pelvic pain during menses. Primary dysmenorrhea is defined as menstrual pain in the absence of identifiable pathology, while secondary dysmenorrhea is attributable to an underlying cause, such as endometriosis, adenomyosis, or fibroids [32]. Episodes of dysmenorrhea begin around the onset of menses and usually last 2–3 days [33]. Patients describe repetitive cramping, sometimes characterized as labor pain, potentially severe enough to necessitate absence from school or work. Patients may have accompanying backache, nausea, vomiting, and diarrhea [33]. On physical examination, patients may have mild uterine tenderness, but usually no other significant findings; laboratory assessment and pelvic ultrasound will usually be similarly unrevealing [33]. Nonsteroidal anti-inflammatory drugs and combined oral contraceptive pills have been shown to be effective in the treatment of dysmenorrhea [34, 35].

Mittelschmerz Pelvic pain preceding the rupture of the ovarian follicle (ovulation), likely occurring in 50 % of women in their lifetimes [36]. Ovulation usually occurs 2 weeks before menses begin; in patients with approximately monthly cycles, the pain will occur midcycle. Pain is usually sudden in onset; on ultrasound, patients may have a small amount of simple or complex free fluid [37]. This pain may last up to 48 h. Management is supportive, though ovulation suppression with combined oral contraceptive pills or injected or implantable progestins can be considered for patients with recurrent episodes of Mittelschmerz.

Endometriosis The presence of endometrial glands and stroma outside of the uterus, which causes inflammation and scarring [38]. Endometriosis is estimated to be present in 6–10 % of reproductive age women [39]. Patients may experience painful menses, though some also report chronic pain throughout the menstrual cycle; bladder, bowel, and/or musculoskeletal dysfunction may also contribute to endometriosis-related pain [39, 40]. Endometriosis may be suspected by transvaginal ultrasound or MRI. A pelvic ultrasound may reveal endometriomas, and by MRI, endometriosis implants

may appear as thickening of the uterine ligaments, peritoneal nodules, obliteration of the anterior or posterior cul-de-sacs, or ovarian endometriomas [41]. Please see Chap. 4, Adnexal Masses and Ovarian Cyst Rupture, for more information on the diagnosis of endometriomas. The gold standard method of diagnosis is detection of endometriosis lesions by laparoscopy.

Maintenance therapy for endometriosis chiefly involves hormonal medications, including but not limited to combined oral contraceptive pills, progesterone-only pills, injections, implant or intrauterine device, or gonadotropin-releasing hormone agonists, and some patients require surgical resections of their endometriotic implants [40]. Patients with severe chronic pain may be managed by pain specialists.

Patients with endometriosis may present with acute exacerbations of their pelvic pain, often in the context of disruption of their hormonal medications. It can be helpful to ask patients whether the quality and distribution of their current pelvic pain is consistent with their baseline endometriosis-related pain. Physical examination may reveal thick or nodular uterosacral ligaments, a nonmobile uterus, or tender adnexa. A pelvic ultrasound can be obtained if a patient does not have recent pelvic imaging, and may reveal endometriomas. In patients whose acute pain is attributed to endometriosis, treatment is supportive; nonsteroidal anti-inflammatory drugs and application of heating pads can be helpful.

Adenomyosis The presence of endometrial glands and stroma within the myometrium. Less commonly, adenomyosis may also present as a focal mass, called an adenomyoma [38]. Adenomyosis can be associated with menorrhagia, irregular bleeding, dysmenorrhea, or chronic pelvic pain. On examination, patients may have an enlarged or globular uterus [42]. Adenomyosis may be diagnosed using transvaginal ultrasound, though the reported sensitivity and specificity varies and is operator dependent (Fig. 1.3); MRI has higher sensitivity for the diagnosis of adenomyosis [44–46]. By ultrasound, adenomyosis may appear as heterogeneity in the uterine myometrium; small myometrial cysts may also be noted [43].

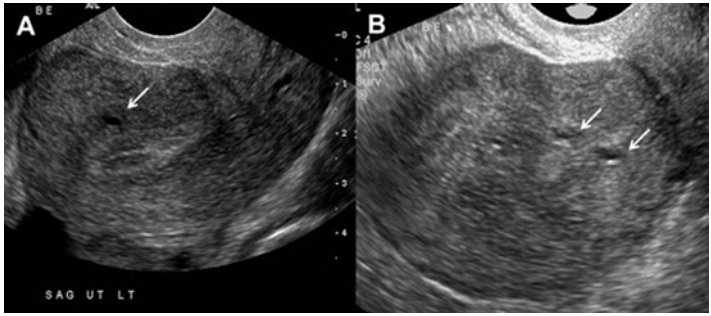

FIG. 1.3 Adenomyosis. (**a**) Transvaginal sagittal image of the uterus demonstrates a subendometrial myometrial cyst (*arrow*). (**b**) Additional cysts (*arrows*) were seen in a parasagittal plane, in the region of the junctional zone (Reprinted from Amirbekian and Hooley [43], with permission from Elsevier)

Acute interventions are not required for adenomyosis; symptoms of adenomyosis are generally treated with similar hormonal treatment regimens as endometriosis, namely, oral contraceptive pills, progesterone-only methods including levonorgestrel IUDs, and gonadotropin-releasing hormone agonists, with variable success [47, 48]. The only definitive management is hysterectomy.

Pregnancy Related

Septic Abortion An ascending polymicrobial infection of the upper genital tract following spontaneous, medical, or surgical abortions and commonly presenting with fever, bleeding, and/or pain. These infections may quickly evolve into fulminant sepsis [49]. Please see Chap. 8, Spontaneous Abortion, for more information.

Spontaneous Abortion Also known as a miscarriage, occurring in pregnancies less than 20 weeks of gestational age, and usually presenting with pain and bleeding. Please see Chap. 8, Spontaneous Abortion, for more information.

Ectopic Pregnancy A pregnancy implanted outside of the uterine cavity. Rupture of tubal ectopic pregnancies can result in acute pain and intra-abdominal hemorrhage. Please see Chap. 3, Pregnancy of Unknown Location and Ectopic Pregnancy, for more information.

Other obstetrical issues, including labor, placental abruption, uterine rupture, and chorioamnionitis, are discussed in Chap. 12, Obstetrics in the Emergency Room.

Other

Sexual Trauma or Domestic Violence Please see Chap. 9, Sexual Assault, for more information.

Ovarian Hyperstimulation Syndrome (OHSS) An iatrogenic condition resulting from ovarian stimulation, resulting in pain (usually due to ovarian enlargement), nausea, electrolyte abnormalities, ascites, oliguria, pleural effusions, and thromboembolism [50]. Please see Chap. 20, Reproductive Endocrinology and Infertility, for more information.

Pediatrics

For assessment and management of acute pelvic pain specifically in pediatric patients, please see Chap. 10, Acute Pelvic Pain in Pediatric and Adolescent Patients.

Nongynecologic Etiologies

- Cardiovascular: dissecting aortic aneurysm or other ruptured aneurysm (including splenic artery aneurysm, particularly in pregnancy)
- Urologic: urinary tract infection (cystitis or pyelonephritis), nephrolithiasis, and acute urinary retention
- Musculoskeletal: myofascial pain, pelvic floor or abdominal muscular pain
- Neurologic/pain: chronic pain syndromes
- Endocrine: diabetic ketoacidosis

- Gastrointestinal: constipation, gastroenteritis, appendicitis, colitis, diverticulitis, bowel obstruction, mesenteric ischemia, and inflammatory bowel disease
- Hematologic: porphyria and sickle cell crisis
- Psychiatric: somatization, conversion disorder, factitious disorder, and malingering

When You Get the Call Ask for the most recent full set of vital signs to assess for hemodynamic stability. Of note, tachycardia is often a first sign of sepsis or hemorrhagic shock; hypotension, even a brief episode, requires emergent assessment. Ask whether a pregnancy test has been performed and, if not, request one; a urine pregnancy test provides a more rapid result than a serum test, which is particularly important in a patient with severe pain or hemodynamic changes.

If the patient is postoperative, review the operative report, including whether any intraoperative complications occurred. Note whether extensive lysis of adhesions was performed, which may potentially increase the risk of visceral injury or other postoperative complications.

When You Arrive Review all available vital signs to determine hemodynamic stability. Assess whether the patient is in distress, including whether she is alert, visibly uncomfortable, pale, and diaphoretic. Ask whether the patient has received any pain medications, which may affect the patient's physical exam findings.

History

The history provided by the patient may be abbreviated in the setting of clinical instability, namely, abnormal vital signs or altered mental status.

In a stable patient, review her full medical, surgical, obstetrical, and gynecologic history, including prior ovarian cysts, pelvic infections, or ectopic pregnancy. Record the date of her last menstrual period and inquire whether she is currently pregnant, using reliable contraception or undergoing fertility treatment. Review whether the patient recently had surgery.

Ask the patient about the onset of her pain, whether it occurred acutely or developed over days or longer. Review the location and quality of her pain, including aching, sharp, continuous, or episodic. Ask whether it was incited by an event such as intercourse, exercise, heavy lifting, or abdominal trauma, which may indicate (depending on the patient's history) vaginal cuff or wound dehiscence, rupture of ovarian cyst or ectopic pregnancy, ovarian torsion, or musculoskeletal injury. Identify associated symptoms, including fever, nausea, vomiting, diarrhea, or new or different vaginal bleeding or discharge. Review whether she has ever had this pain before or suffers from chronic pain.

Physical Examination

Observe the patient's degree of discomfort with her pain, as evidenced by posture or inability to settle into a comfortable position. Note whether the patient is pale or diaphoretic, and whether she is alert and oriented. Check for capillary refill by pressing on the fingernails; delayed reperfusion of the fingernail beds is evidence of decreased perfusion, associated with sepsis or anemia [7]. Examine the patient's abdomen for distention, rebound (pain with quickly withdrawing pressure from the abdomen), or involuntary guarding. An abdominal exam may also reveal a mass. Assess for right-sided abdominal pain suggestive of appendicitis or right-sided adnexal pathology, flank pain suggestive of nephrolithiasis, or suprapubic pain suggestive of cystitis.

If the patient is having vaginal bleeding or complains of purulent vaginal discharge, perform a speculum exam to quantify any bleeding and collect a cervical swab for nucleic acid amplification testing (NAAT) for *Neisseria gonorrhoeae* and *Chlamydia trachomatis*. A wet prep (a slide of vaginal discharge prepared with potassium hydroxide and saline, separately) or gram stain of the vaginal discharge to check for white blood cells may be helpful in diagnosing pelvic inflammatory disease or acute cervicitis. Perform a bimanual exam to assess for cervical motion tenderness, and adnexal

enlargement or tenderness. In a patient who is suspected of having an ectopic pregnancy—with a positive hCG and pelvic pain—a bimanual exam is not strictly necessary and may risk rupture of the ectopic pregnancy.

Diagnosis

A temperature of 100.4 °F (38 °C) on two occasions more than 4 h apart or a single temperature of 101 °F (38.3 °C) constitutes a fever in non-neutropenic patients. Take note of tachycardia and hypotension (even transient), which can herald impending septic or hemorrhagic shock. In patients with hemodynamic instability or altered mental status, begin resuscitation in parallel with the diagnostic workup. Hemodynamic and laboratory findings in patients with hemorrhagic or septic shock are shown in Tables 1.1 and 1.2, respectively.

All reproductive aged women—from menarche to menopause—should have an hCG checked, either by serum or by urine. Bladder catheterization can be performed to obtain this sample if necessary. Urine pregnancy tests have a lower limit of hCG detection of 20–50 milli-international units per milliliter (mIU/mL) [51].

A complete blood count with differential should be obtained in all patients with acute pelvic pain, which may reveal anemia and/or leukocytosis. Of note, hemoglobin may underestimate acute anemia due to an ongoing hemorrhage. A blood type and antibody screen should be obtained for any pregnant patient or any patient who is suspected to have sepsis or significant bleeding. Obtain coagulation studies (prothrombin time (PT), activated partial thromboplastin time (aPTT), and fibrinogen) in patients with known bleeding diathesis, taking anticoagulant medications, or those with hemorrhage or sepsis (to assess for disseminated intravascular coagulation). In patients with possible sepsis, also obtain a lactate, liver function tests, electrolytes, and creatinine. Blood, urine, sputum, wound, and/or drain cultures (as applicable)

should be obtained in any patient with a temperature above 38.3 °C (101 °F) and/or concern for sepsis. Consider sending stool studies for *Clostridium difficile* in patients with diarrhea, recent antibiotic exposure and/or prior *C. difficile* infection. In well-appearing patients with just mild pelvic discomfort, a urinalysis and nucleic acid amplification testing (NAAT) of a cervical swab for *N. gonorrhoeae* and *C. trachomatis* are often good starting points.

In patients with peritoneal signs, mental status changes, and/or hemodynamic instability, waiting for a formal ultrasound may not be prudent; a focused assessment with sonography for trauma (FAST) scan should be performed for the rapid assessment of hemoperitoneum, potentially due to ruptured ovarian cyst or ectopic pregnancy. The FAST scan is a bedside ultrasound assessing for free fluid in the perihepatic, perisplenic, and pelvic space (Fig. 1.4); the full trauma assessment includes the pericardial space [52]. Of note, a FAST scan will not reliably reveal retroperitoneal hemorrhage, which is

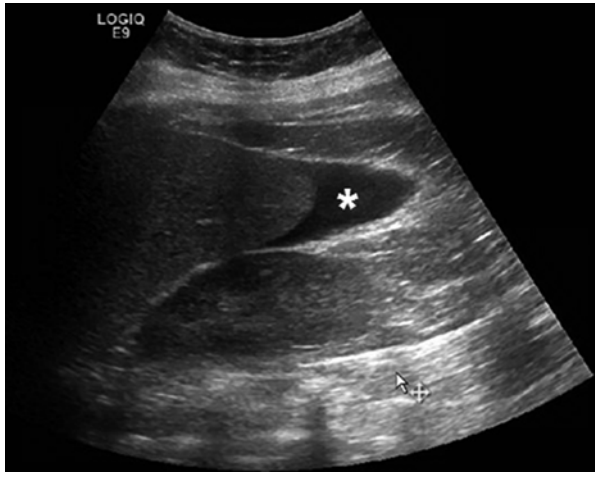

Fig. 1.4 Hemoperitoneum by abdominal ultrasound. Abdominal ultrasound revealed hemoperitoneum, indicated with an asterisk (*), extending from the pelvis to the liver edge

generally best visualized by CT scan. Most patients are sufficiently stable for formal imaging, and a transvaginal ultrasound is preferable as a first step in women with acute pelvic pain.

In patients with signs of sepsis, imaging should be obtained to identify the source. A pelvic ultrasound may suggest a tubo-ovarian abscess, while a CT scan may be useful in better characterizing a pelvic abscess while also allowing visualization of the gastrointestinal and urinary tracts, and such pathology as diverticulitis, appendicitis, bowel obstruction, nephrolithiasis, and postoperative surgical complications. A patient who is hemodynamically unstable, however, may need to move straight to surgical exploration without obtaining a CT scan, unless she responds immediately to resuscitative measures.

Management

Please see Fig. 1.5 for a diagnostic and management algorithm for patients with pelvic pain, focusing on emergent or life-threatening causes of pelvic pain. An important branch point in the assessment and management of acutely ill patients with pelvic pain is to determine whether an infection is present.

Noninfectious

In hemodynamically unstable patients with pain and without evidence of sepsis, hemorrhage is a frequent cause. In patients who are not hemorrhaging vaginally (Chap. 2), intra-abdominal hemorrhage should be suspected; intraperitoneal (but not retroperitoneal) hemorrhage can be confirmed with a FAST scan. Hemodynamic changes in patients with hemorrhagic shock are shown in Table 1.1.

The more common gynecologic etiologies of hemoperitoneum include a ruptured ectopic pregnancy and a ruptured

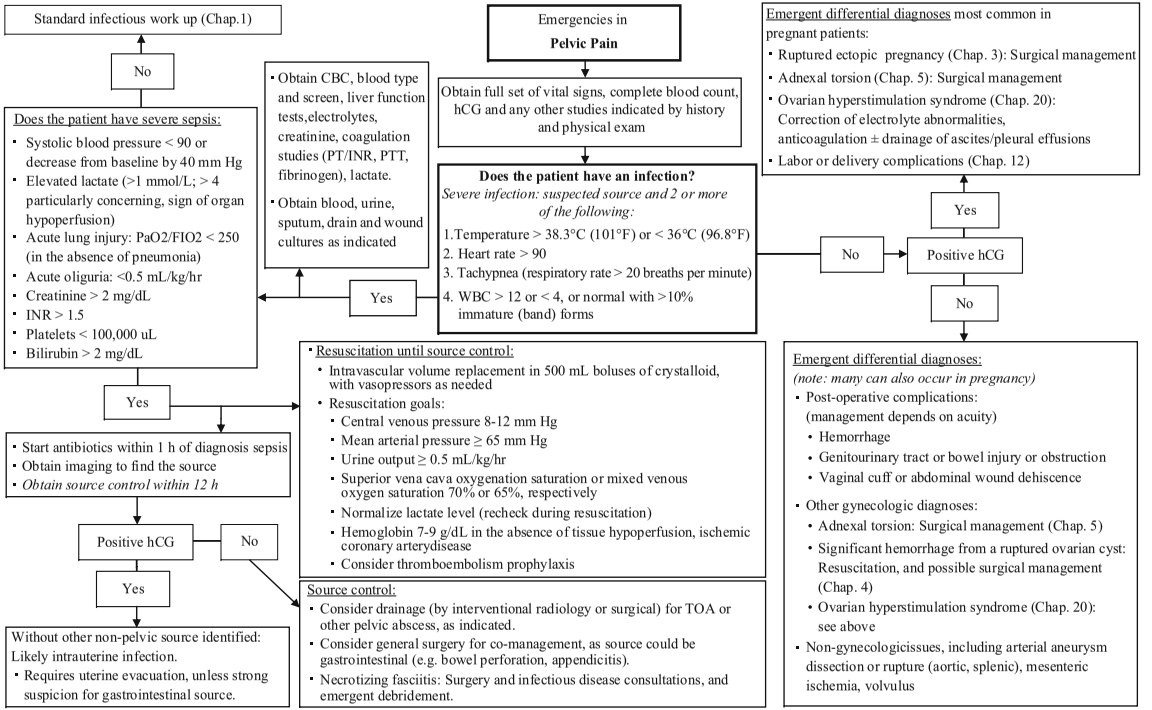

FIG. 1.5 Diagnostic and management algorithm for acute pelvic pain

ovarian cyst. In patients with a positive hCG (without intrauterine pregnancy), pain, and hemodynamic compromise, immediate operative management is indicated with the presumed diagnosis of ruptured ectopic pregnancy. A caveat is in patients who have recently undergone in vitro fertilization. Patients may rarely have significant hemoperitoneum following oocyte retrieval (particularly in the first 24 h), with residual positive serum hCG due to their treatment medications. Additionally, patients with severe OHSS (who may also be pregnant) may have large ascites by FAST exam, as well as tachycardia, oliguria, and hypotension. Please refer to Chap. 20, Reproductive Endocrinology and Infertility, for more information on the diagnosis and management of these complications. Please see Chap. 3, Pregnancy of Unknown Location and Ectopic Pregnancy, for the diagnosis and management of ectopic pregnancy. Please see Chap. 4, Adnexal Masses and Ovarian Cyst Rupture, for diagnosis and management of ruptured ovarian cysts.

While resources are being mobilized for a patient with suspected intra-abdominal hemorrhage, resuscitation should be started for patients with estimated blood loss of 500 cc or more and/or hemodynamic changes. In acutely unstable patients, uncrossed O-negative blood can be ordered. Resuscitation goals include a heart rate below 100 beats per min, hemoglobin of at least 7 g per deciliter (dL), platelets above 50,000 per microliter (uL), fibrinogen above 100 mg/dL, and an INR less than 1.5 [53, 54]. These laboratory values should be rechecked frequently during resuscitation and transfusion, in addition to blood pH and electrolytes (particularly calcium and potassium). Hypothermia should be avoided.

Please see Chap. 13, Preparing for Urgent or Emergent Surgery, for more information on resuscitation and transfusion. Patients with acute intra-abdominal or vaginal hemorrhage, particularly those requiring surgery, may require reversal of anticoagulant medications, also discussed in Chap. 13. Management of patients with disseminated intravascular coagulation and von Willebrand disease is discussed in Chap. 2, Vaginal Hemorrhage.

Non-hemorrhagic causes of acute pelvic pain without infection include ovarian torsion, which is a surgical emergency and is discussed in further detail in Chap. 5, Adnexal Torsion. Pregnancy-related issues (including labor, placental abruption, and uterine rupture) are discussed in Chap. 12, Obstetrics in the Emergency Room. OHSS can also cause significant pelvic pain and distention, in addition to metabolic and hematologic perturbations; OHSS is discussed in Chap. 20, Reproductive Endocrinology and Infertility. Non-gynecologic causes of acute pelvic pain include, but are not limited to, abdominal arterial aneurysm dissection or rupture, mesenteric ischemia, bowel obstruction or volvulus, and nephrolithiasis. Bowel obstruction is discussed in Chaps. 16 and 18.

Infectious

This chapter will focus on emergent infectious causes of pelvic pain, namely, conditions leading to sepsis (Table 1.2). Infections without sepsis are addressed in Chap. 6, Pelvic Inflammatory Disease and Tubo-ovarian Abscesses, and Chap. 16, Complications of Minimally Invasive Gynecologic Surgery, and neutropenic fever is discussed in Chap. 18, Gynecologic Oncology. Furthermore, potentially morbid noninfectious sources of fever specific to gynecologic patients include ovarian torsion, ovarian cyst rupture, venous thrombosis, medication reactions, alcohol withdrawal, tumor fever, and some blood transfusion reactions (though sepsis from a blood transfusion is also possible).

The patient's vital signs and laboratory results can be used to diagnose sepsis; the clinical criteria for the diagnosis of sepsis are shown in Table 1.2 [6, 7]. The suspected source of infection is usually suggested by the patient's history, including recent surgical procedure, physical examination, and/or imaging.

For acutely unstable patients, including those with hypotension and mental status changes, additional support personnel should be called to assist. Initial management of severe sepsis/shock includes the placement of two large-bore IVs, IV

crystalloid for blood pressure support, and supplemental oxygen by high-flow facemask as needed [7]. As resuscitation continues using intravenous fluid, oxygen, and vasopressors as needed, goals include a central venous pressure of 8–12 mmHg; a mean arterial pressure >65 mmHg; urine output of at least 0.5 mL/kg/h; superior vena cava oxygenation saturation or mixed venous oxygen saturation 70 % or 65 %, respectively; a normalized lactate level; and a hemoglobin level of 7–9 g/dL in patients without tissue hypoperfusion or ischemic coronary artery disease [7]. Thromboembolism prophylaxis should be considered.

If not obtained earlier, a complete blood count, blood type and antibody screen, liver function tests, coagulation studies (PT, aPTT, and fibrinogen), and lactate should be obtained. A complete blood count, electrolytes, lactate, and coagulation studies (as indicated) should be rechecked frequently during resuscitation to assess progress. An arterial blood gas should be obtained if the patient is in distress. Blood, urine, sputum, and/or wound cultures should be collected as indicated; 1,3 [beta]-D-glucan, mannan, and anti-mannan antibody assays can be obtained in immunocompromised or chronically ill patients at risk for disseminated candidiasis. Antibiotics should be started within 1 h of diagnosis of sepsis [7].

Antibiotic selection is dictated by the suspected source and recent antibiotic exposure. Please refer to Chap. 16, Complications of Minimally Invasive Gynecologic Surgery, for antibiotic recommendations for specific sources. In patients with sepsis from an unknown source, a broad-spectrum regimen can include vancomycin (15 mg/kg IV every 12 h, in patients with normal renal function) and piperacillin-tazobactam (3.375–4.5 g IV every 6 h); cefepime (2 g IV every 8 h) and ceftazidime (2 g every 8 h) are alternatives to piperacillin-tazobactam [55]. Antibiotic regimens for neutropenic fever are discussed in Chap. 18, Gynecologic Oncology.

The source of infection must be identified and addressed quickly. Infectious collections must be addressed as soon as possible, through uterine evacuation, abscess drainage (by

interventional radiology, laparotomy or laparoscopy, as indicated), or repair of visceral injury or vaginal cuff dehiscence. If a patient has an intrauterine pregnancy and no other source can be identified, a septic abortion is diagnosed and uterine evacuation must be performed. Patients with suspected necrotizing fasciitis (postpartum or postoperatively) based on fever, laboratory parameters, imaging and exquisite pain require urgent, aggressive surgical debridement. For management of septic abortion, please see Chap. 8, Spontaneous Abortion. For management of tubo-ovarian abscess, please see Chap. 6, Pelvic Inflammatory Disease and Tubo-ovarian Abscess. For the management of postoperative complications including bowel and urinary tract injuries, necrotizing fasciitis, pelvic abscesses, and vaginal cuff cellulitis, please see Chap. 16, Complications of Minimally Invasive Gynecologic Surgery. For management of bowel anastomotic leaks, abdominal wound dehiscence, and neutropenic fever, please see Chap. 18, Gynecologic Oncology.

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