Incisional hernias of the abdominal wall occur in up to 11% of all other postoperative patients and in as many as 23% of patients with postoperative wound infections. Trocar site hernias after laparoscopic surgery are reported in up to 6% of patients. Parastomal hernia formation occurs in 28% of ileostomies and 48% of colostomies. Morbidity depends on the location and contents of the hernia, as well as the development of incarceration or strangulation.

PATHOPHYSIOLOGY

Hernias are congenital or acquired defects in the abdominal wall that allow protrusion of intraabdominal contents through the pathologic opening. The characteristic finding consists of pain and swelling at the hernia site. Intraabdominal hernias, which can occur spontaneously or after surgery or trauma, are caused by defects in the diaphragm, mesentery, or ligamentous structures.

Incarcerated hernias are those in which abdominal contents have become trapped in the opening (i.e., nonreducible). Bowel incarceration can be manifested as pain, vomiting, or frank obstruction.

Strangulated hernias involve a compromise of the blood supply to the hernia contents. Strangulation can be manifested as fever, ischemia, or necrosis of the hernia contents and, occasionally, erythema or necrosis of the skin overlying the hernia. Smaller defects in the abdominal wall are more likely to be manifested as incarceration or strangulation.

Incisional hernias of the abdominal wall occur in up to 11% of all other postoperative patients and in as many as 23% of patients with postoperative wound infections. Trocar site hernias after laparoscopic surgery are reported in up to 6% of patients. Parastomal hernia formation occurs in 28% of ileostomies and 48% of colostomies. Morbidity depends on the location and contents of the hernia, as well as the development of incarceration or strangulation.

NOMENCLATURE

Table 38.1 and Box 38.1 summarize the nomenclature of hernias, and Figures 38.1 to 38.13 illustrate some of the hernia types.
### Table 38.1 Nomenclature of Hernias

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Groin Hernias</strong></td>
<td></td>
</tr>
<tr>
<td>Inguinal hernia (Fig. 38.1)</td>
<td>Physical examination cannot accurately distinguish between indirect and direct inguinal hernias. Occurs through the inguinal canal. Inguinal canal contents include the ilioinguinal nerve, genital branch of the genitofemoral nerve, spermatic cord in men (vas deferens, testicular artery, and vein), and round ligament in women. 65% of inguinal hernias are indirect. Weakness of the aponeurosis of the transversus abdominis and transversalis fascia in the Hesselbach triangle (the medial border of which is the lateral aspect of the rectus abdominis, the superior border is the epigastric artery, and the inferior border is the inguinal ligament).</td>
</tr>
<tr>
<td>Femoral hernia</td>
<td>Occurs through the femoral canal, inferior to the inguinal ligament, medial to the femoral vein. More common in elderly, parous women.</td>
</tr>
<tr>
<td>Sportsman’s hernia</td>
<td>Syndrome of persistent groin pain in athletes; probably caused by recurrent or persistent groin strain, osteitis pubis, or a nonpalpable hernia. More common in kicking sports.</td>
</tr>
<tr>
<td><strong>Abdominal Wall Hernias</strong></td>
<td></td>
</tr>
<tr>
<td>Anterior (Fig. 38.2)</td>
<td></td>
</tr>
<tr>
<td>Epigastric hernia</td>
<td>Occurs through the linea alba, the midline between the xiphoid line and umbilicus. Caused by an abnormally large or weak umbilical ring. Umbilical hernia usually closes spontaneously in infancy but does not heal in adulthood. Rarely incarcerates in children. Worsened by pregnancy, obesity, or cirrhosis with ascites.</td>
</tr>
<tr>
<td>Umbilical hernia</td>
<td></td>
</tr>
<tr>
<td>Spigelian hernia (Figs. 38.3 and 38.4)</td>
<td>Lateral ventral hernia through the spigelian zone: transversalis fascia between the lateral margin of the rectus abdominis muscle, medial margins of the external and internal obliques, and the transversus abdominis muscles. Accounts for 1-2% of all hernias.</td>
</tr>
<tr>
<td>Ventr al or incisional hernia (Fig. 38.5)</td>
<td>Trocar sites: Difficult to recognize on physical examination. Dangerous cause of early postoperative small bowel obstruction. Can be the Richter type (incarceration of one intestinal wall). Iliac crest bone graft sites. Parastomal hernias.</td>
</tr>
<tr>
<td>Traumatic</td>
<td>Caused by blunt or penetrating trauma. “Handlebar” hernia: Can occur in any location on the abdominal wall from a fall on a bicycle handlebar with tear of the abdominal wall muscles. Has also been reported in the thorax from a tear of the intercostal muscles (similar hernias have been reported as a result of severe coughing).</td>
</tr>
<tr>
<td>Congenital abdominal wall defects</td>
<td>Surgical emergencies in neonates: Immediate management: cover the abdominal contents with warm moist saline-soaked gauze, insert a nasogastric tube, administer intravenous fluids and antibiotics, obtain surgical consultation. Types: Gastrochisis: intact umbilical cord, eversion of the bowel through a defect usually to the right of the cord; no membrane covering. Omphalocele: herniation of the bowel, liver, and other organs into the intact umbilical cord; membrane present unless ruptured.</td>
</tr>
<tr>
<td>Posterior (lumbar) hernias (Fig. 38.6)</td>
<td>Bounded superiorly by the 12th rib, inferiorly by the iliac crest, posteriorly by the erector spinae muscles, and anteriorly by the posterior border of the external oblique muscle. Types: Inferior or Petit: just superior to iliac crest (point up). Superior or Grynfeltt: just below the 12th rib, inverted triangle (point down).</td>
</tr>
<tr>
<td><strong>Diaphragmatic Hernias</strong></td>
<td></td>
</tr>
<tr>
<td>Congenital hernia (Fig. 38.7)</td>
<td>Eventration: thin diaphragm with normal but widely spaced muscle fibers. Posterosilateral: through the foramen of Bochdalek. Anterior, retrosternal, or parasagittal: through the foramen of Morgagni (Figs. 38.8 and 38.9). Peritoneopericardial.</td>
</tr>
<tr>
<td>Acquired hernia</td>
<td>Hiatal: sliding or fixed. Paraesophageal. Acquired eventration: caused by phrenic nerve injury and paralysis. Traumatic (Fig. 38.10).</td>
</tr>
</tbody>
</table>
**Table 38.1 Nomenclature of Hernias—cont’d**

<table>
<thead>
<tr>
<th>Pelvic Wall and Floor Hernias</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sciatic hernia (Fig. 38.11)</td>
<td>Protrusion of the peritoneal sac and contents through the greater or lesser sciatic foramen</td>
</tr>
<tr>
<td>Obturator hernia (Fig. 38.12)</td>
<td>Protrusion of preperitoneal fat or intestine through the obturator foramen</td>
</tr>
<tr>
<td>Perineal hernia</td>
<td>Protrusion of a viscus through the pelvic floor (rare)</td>
</tr>
<tr>
<td>Prolapse</td>
<td>Weakness of the pelvic floor muscles can cause a cystocele, rectocele, and uterine or rectal prolapse</td>
</tr>
</tbody>
</table>

**Intraabdominal Hernias**

**Spontaneous**

| Transmesenteric hernia                                           | Through the sigmoid mesocolon, broad ligament, or falciform ligament |
| Transomental hernia                                               | Hernia beneath a mesenteric or peritoneal fold (no disruption of the peritoneum) |
| **Locations:**                                                    |                                                                 |
| Epiploic foramen of Winslow (Fig. 38.13)                         |                                                                 |
| Paraduodenal                                                      |                                                                 |
| Superior ileocecal fossa                                          |                                                                 |
| Internal supravesicular                                           |                                                                 |

**Postoperative**

Transmesenteric and transomental hernias are most common, especially after Roux-en-Y procedures. May occur through the falciform ligament from a trocar puncture during laparoscopic cholecystectomy. Retroanastomotic—may occur behind the anastomosis

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**BOX 38.1 Eponyms Associated with Hernias**

- **Richter hernia** (partial enterocele): Herniation of only the anterior surface of the intestinal wall through the hernia defect; accounts for 10% of strangulated hernias.
- **Amyand hernia**: Acute appendicitis in the sac of an inguinal hernia.
- **Garengiot hernia**: Acute appendicitis in the sac of a femoral hernia.
- **Littre hernia**: Strangulated Meckel diverticulum in a hernia sac.
- **Maydl hernia**: Internal hernia with double-loop strangulation.
- **Chilaiditi syndrome**: Symptomatic interposition of the intraabdominal contents between the liver and diaphragm; can become incarcerated.
- **Canal of Nuck**: The portion of the processus vaginalis that accompanies the round ligament through the inguinal canal in women; may contain hernia contents or, rarely, hydrocele in women.
- **Romberg-Howship sign**: Lancinating pain along the inner side of the thigh to the knee or down the leg to the foot caused by compression of the obturator nerve in cases of incarcerated obturator hernia.

*Fig. 38.1 Infarcted inguinal hernia.*
ABDOMINAL WALL HERNIAS

Fig. 38.2 Anterior abdominal wall hernia.

- Rectus abdominis
- Epigastric hernia • Between rectus abdominis • Xiphoid to umbilicus
- Umbilical hernia • Through umbilical
- Inguinal canal
- Inguinal ligament
- Femoral hernia • Through femoral • Below inguinal

Spigelian hernia
• Weakness of muscular layers
• Medial border is lateral edge of rectus abdominis

Direct inguinal hernia
• Weakness of all muscular layers

Hesselbach triangle

Obturator hernia
• Through obturator canal

Indirect inguinal hernia
• Through inguinal canal

Fig. 38.3 Spigelian hernia.

Fig. 38.4 Computed tomography scan of a spigelian hernia in an adult woman with right lower quadrant pain. (From Mull AC, Hurtado TR. Right lower quadrant pain in an adult woman. Am J Emerg Med 2011;29:132.e1-2.)
**PATHOPHYSIOLOGY**

In comparison with controls, patients in whom incisional or recurrent hernias develop may exhibit abnormal synthesis of type I and type III collagen. A higher incidence of incisional hernia formation is seen in patients with wound infection, obesity, and multiple comorbid conditions. The use of synthetic mesh and “tension-free” repair techniques has reduced rates of hernia recurrence.

**PRESENTING SIGNS AND SYMPTOMS**

The classic manifestation of an abdominal wall hernia is pain and swelling at the hernia site. Symptoms are more pronounced with increased intraabdominal pressure, such as occurs with standing, coughing, and straining. Occasionally, patients report an acute onset of symptoms after heavy lifting or during sports. Many patients observe that the swelling (“lump” or “knot”) resolves when they are supine or pressure is applied over the area.

Inguinal hernias can be manifested as scrotal pain, a groin mass, or swelling. Incarcerated hernias typically feature a painful lump or knot on the abdominal wall or in the scrotum. The hernia is very tender to palpation and is not reduced by gentle pressure. If small bowel is incarcerated in the hernia sac, the patient may exhibit nausea and vomiting. Incarcerated omentum or preperitoneal fat may give rise to only a localized painful mass.

**RED FLAGS**

Symptoms that suggest hernia complications (obstruction, incarceration, or strangulation) are as follows:
- Diffuse rather than localized pain and tenderness with guarding or rebound
- Nausea or vomiting
- Markedly tender, nonreducible hernia
- Fever
- Erythema or necrosis of the skin overlying the hernia

**LUMBAR HERNIAS**

**Fig. 38.5** Ventral hernia with small bowel obstruction.

**Fig. 38.6** Locations of lumbar hernias.
Fig. 38.8 Morgagni-type diaphragmatic hernia manifested as an abnormal cardiac silhouette. (From Daneshvar S, Shriki J, Sohn H, et al. Morgagni-type diaphragmatic hernia presenting as an abnormal cardiac silhouette. Am J Med 2010;123:e11-2.)

Fig. 38.9 Morgagni-type diaphragmatic hernia manifested as an abnormal cardiac silhouette (arrow). (From Daneshvar S, Shriki J, Sohn H, et al. Morgagni-type diaphragmatic hernia presenting as an abnormal cardiac silhouette. Am J Med 2010;123:e11-2.)

Fig. 38.10 Computed tomographic scan of a diaphragmatic hernia. (From Yang YM, Yang HB, Park JS, et al. Spontaneous diaphragmatic rupture complicated with perforation of the stomach during Pilates. Am J Emerg Med. 2010;28:259.e1-3.)
As the incarceration persists over time, swelling of the hernia contents eventually compromises the blood supply and strangulation ensues. The signs and symptoms vary with the contents of the hernia. Patients with incarcerated intestine leading to intestinal ischemia or necrosis may have fever and peritonitis. Prolonged incarceration with necrosis of the hernia contents may cause erythema or necrosis of the skin overlying the hernia.

Long-standing hernias may feature very large defects in the abdominal wall. In general, larger defects are less likely to be manifested as strangulation. A large hernia may be chronically incarcerated or nonreducible. With time, fibrous adhesions develop and prevent spontaneous reduction when the patient is supine.

Less typical findings include ill-defined abdominal pain, nausea, and vomiting but without an obvious mass on the abdominal wall. This manifestation is more likely to occur with intraabdominal hernias, in obese patients, or in patients who are unable to give an adequate history.

The incidence of postoperative internal hernias is rising because of the increase in bariatric operations in the United States, particularly Roux-en-Y gastric bypass. Postoperative complications of hernia repair include wound infection, seroma or hematoma, ileus or small bowel obstruction, recurrence of the hernia, and in rare cases, erosion of preperitoneal mesh into intraabdominal organs with associated fistula formation. Complications of inguinal hernia repair are chronic pain as a result of nerve disruption or entrapment and, rarely, testicular ischemia.

Traumatic diaphragmatic disruption from penetrating trauma should be suspected when the trajectory of a gunshot wound or the location of a stab wound potentially crosses the diaphragm. Though rare, diaphragmatic disruption can occur after significant blunt trauma and is more common on the left side. Traumatic diaphragmatic disruption is difficult to diagnose in the acute stage because of nonspecific signs, but it should be suspected when the patient has a proximate injury and pain out of proportion to the physical findings. Standard imaging techniques, including chest and abdominal computed tomography (CT), may miss small diaphragmatic injuries, and laparoscopy, thoracoscopy, or surgical exploration may be required.

Diaphragmatic disruption has also been described after forceful coughing or vomiting. Delayed manifestations of diaphragmatic hernias consist of chest pain, dyspnea, or abnormal findings on chest radiography or CT (with or without abdominal symptoms). The use of multidetector CT scanning has improved the detection of diaphragmatic hernias.
The differential diagnosis of abdominal wall hernias includes other masses involving the abdominal wall, such as lipomas and rectus sheath hematomas. Abdominal wall or intraabdominal hernias should be considered a potential cause in patients with signs and symptoms of small bowel obstruction. In patients who have previously undergone abdominal surgery, either open or laparoscopic, careful examination of the incisions, trocar sites, and parastomal areas should be performed to detect masses or abdominal wall defects. To facilitate detection of the hernia, the examiner should hold the tips of the fingers over the incision while the patient coughs or strains.

Inguinal hernias should be considered in the evaluation of patients with scrotal pain or swelling. Detection of inguinal hernias is improved by examination of the patient in a standing position and insertion of the examiner’s finger into the inguinal canal through the loose skin of the scrotum. This technique allows direct palpation of the inguinal ring. Having the patient cough or strain allows the examiner to palpate the hernia bulging against the examining finger. Other causes of scrotal pain, masses, or swelling can be confused with an umbilical hernia.

Obturator or other rare pelvic floor hernias should be considered in the differential diagnosis of patients with chronic atypical pelvic pain; CT should be performed.

In the majority of cases, physical examination alone enables the identification of abdominal wall or inguinal hernias. When physical examination is not sufficient, ultrasonography, CT, and occasionally magnetic resonance imaging can assist in the identification of hernias and serve to further delineate their contents.

Ultrasonography is the imaging modality of choice in the evaluation of scrotal swelling or masses because it allows differentiation of the testicles, spermatic cord, hydrocele, or varicocele separately from the hernia contents. This modality can assist in the diagnosis of abdominal wall hernias through identification of bowel loops within the hernia sac. Color flow Doppler imaging can detect the presence or absence of blood flow in some cases, thereby aiding in the diagnosis of strangulation.

CT can be used to identify intraabdominal and abdominal wall hernias (as well as delineate the contents of the hernia sac) and signs of ischemia, perforation, or abscess formation. Plain abdominal films have limited utility in the diagnosis and evaluation of hernias. Laparoscopy may be necessary to assist in the diagnosis of difficult cases when the findings of other modalities are unrevealing.

Omphalocele occurs in 2 to 3 per 10,000 births. Historically, gastroschisis occurred less frequently than omphalocele, but recent trends show an increase in the incidence of gastroschisis worldwide (and in the United States). Gastroschisis occurs more commonly with younger maternal age and is associated with fewer congenital anomalies than omphalocele is. Ultrasonography has led to more frequent prenatal diagnosis, but cesarean delivery has not been shown to improve outcomes over vaginal delivery in infants with abdominal wall defects.

Congenital diaphragmatic hernias occur in 1 in 2500 births. The mortality rate is high because of pulmonary hypoplasia and the development of pulmonary hypertension. Ultrasonography allows prenatal diagnosis and identification of infants with the potential for a poor prognosis. The prognosis worsens when the liver is located intrathoracically and total lung volume is less than total head volume. In utero repair of diaphragmatic hernias has been performed, although better outcomes than those with conventional treatment have not been observed.

Percutaneous placement of a fetal endoluminal tracheal occlusion balloon may improve survival by preventing egress of the pulmonary fluid needed to stimulate lung growth. This treatment is still controversial because of a higher incidence of preterm labor. Stabilization of infants with congenital diaphragmatic hernia consists of intravenous fluid resuscitation, insertion of a nasogastric tube, intubation with gentle ventilation or permissive hypercapnia (to avoid barotrauma), and surgical consultation. The use of nitric oxide and surfactant has not been demonstrated to improve outcomes in infants with congenital diaphragmatic hernias.

Late manifestations of congenital diaphragmatic hernia have been described in children and adults. Cases typically involve respiratory difficulty, and tension gastrothorax has also been reported. Unrecognized diaphragmatic hernias can be exacerbated by pregnancy and be manifested as incarceration and bowel obstruction, in addition to respiratory distress.

Indirect inguinal and umbilical hernias are extremely common in children—parents may bring an infant or child to the emergency department when the lump or bulge is first noted. Incarceration or strangulation is uncommon but can occur. The clinical findings in children are similar to those in adults. Physical examination of the scrotum and groin is mandatory in the evaluation of crying or vomiting infants. Ultrasonography is used more often than CT for the evaluation of hernias in children.

HOSPITAL

Reduction of the hernia is attempted by applying slow gentle pressure over the hernia contents and directing the contents.
toward the defect in the abdominal wall. Reduction can be facilitated by placing the patient in a supine or Trendelenburg position and administering analgesia, which may decrease intraabdominal pressure and relax the abdominal musculature. Some authorities advocate placing a cool pack of ice over the area to decrease swelling and provide slow continuous pressure. Procedural sedation should be used when the patient exhibits significant tenderness and anxiety.

Postoperative complications of hernia repair include bowel injury, hemorrhage, wound infection, and recurrence. The use of prosthetic mesh has decreased hernia recurrence, although mesh is problematic when wound infection occurs. Late complications of the use of prosthetic mesh for hernia repair consist of fibrosis and erosion into adjacent structures, including bowel and bladder, and occasionally fistula formation. Other complications of inguinal hernia repair are entrapment of the genitofemoral or ilioinguinal nerves, persistent pain syndromes, and in male patients, injury to the vas deferens and testicles with resultant alterations in fertility. Repair of abdominal wall hernias can injure cutaneous nerves and give rise to persistent abdominal wall pain syndromes.

To reduce a hernia through a small defect, it may be wise to pull on the hernia instead of pushing. Imagine a balloon trying to pass through a small hole—direct pressure on the balloon flattens the mass rather than pushing it through the hole. Instead, pressure applied at the defect in the abdominal wall (the base of the hernia) with accompanying traction on the herniated contents can narrow the sac and facilitate passage. The emergency physician should apply horizontal pressure with the tips of the fingers to narrow the base of the herniated contents while gently pulling the herniated mass. Pulling on the hernia from the base may be more successful than pushing.

Complications of persistent hernia incarceration include small bowel obstruction, bowel ischemia, or necrosis of the hernia contents. Surgical consultation should be obtained for possible operative intervention in cases of persistent incarceration, small bowel obstruction, bowel ischemia or necrosis.

Hernias with signs or symptoms suggestive of bowel obstruction or ischemia are true surgical emergencies that require immediate consultation.

Emergency repair of incarcerated or strangulated hernias is associated with higher morbidity and mortality than is the case with elective repair, especially in elderly patients or those with multiple medical comorbid conditions. Complications include a higher incidence of bowel ischemia and necrosis, wound infection and dehiscence, intraabdominal compartment syndrome, sepsis and respiratory compromise, and hernia recurrence.

Patients with easily reducible hernias may be discharged for surgical follow-up and elective hernia repair. Repair is generally recommended for symptomatic hernias in otherwise healthy patients. Patients who have multiple medical problems and for whom surgery poses a high risk may not be suitable candidates for elective hernia repair, especially when the fascial defect is large and less likely to become incarcerated. The decision about the timing of hernia repair should be made by the patient in conjunction with the primary care physician and the surgeon. Elective repair of symptomatic hernias in elderly patients should be considered.

Unrepaired hernias may gradually enlarge over time, and some become incarcerated. Patients with incarcerated hernias that cannot be reduced should be admitted for urgent surgical reduction and repair because some hernias progress to ischemia of the hernia contents.
PATIENT TEACHING TIPS

A hernia is a defect in the abdominal wall that allows the intestines or abdominal fat to bulge through the opening. Hernias do not typically heal spontaneously and may enlarge over time. They may be repaired by surgery.

Sometimes the contents of the hernia may become trapped or incarcerated, which is potentially dangerous because the blood supply to the contents of the hernia may be cut off. You should return to the emergency department if your hernia suddenly becomes larger or more painful or if fever, nausea, vomiting, or redness over your hernia develops; if any of those things happen, your hernia would need to be treated right away.

REFERENCES

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

SUGGESTED READINGS


REFERENCES