Abdominal Wall Hernias

Michael M. Pavletic, DVM, DACVS
Director of Surgical Services
Angell Animal Medical Center
Boston, Massachusetts

By definition, a hernia is the protrusion or projection of an organ through the wall of the cavity that contains it. Hernias can be congenital, such as the common umbilical hernia, acquired as a result of trauma, or the result of the “breakdown” or dehiscence of a surgical closure (incisional hernia). Organ displacement through a ring of tissue that is confined within a compartment of the abdominal cavity is considered an internal abdominal hernia (e.g., a diaphragmatic hernia). External abdominal hernias involve defects of the abdominal wall.

“True” abdominal hernias are defined as wall defects associated with anatomically defined hernia rings. Most congenital hernias are true hernias, in which the displaced organ(s) are confined to a peritoneal sac. Umbilical hernias are the most common true hernias noted in small animal surgery. Therefore, the composition of a true hernia includes:

• The opening or “ring”
• A sac or pouch comprised of the peritoneum
• The contents of the hernia, which may include anything within the abdomen

In contrast, traumatic hernias lack a peritoneal sac, and the hernial contents are displaced directly through a rent or tear in the abdominal wall. As a result, traumatic and incisional hernias, by definition, are considered “false” hernias. This article covers the management of traumatic and incisional hernias involving the abdominal wall.

Most traumatic hernias are the result of blunt trauma to the abdomen, including vehicular trauma, falls, or violent kicks. Traumatic hernias also result from sharp or penetrating trauma, including bite wounds, knife wounds, impalement injuries, and gunshot wounds. In the case of bite wounds, smaller patients may be crushed, lifted, and shaken violently. As a result, internal injuries can be the result of direct or indirect trauma. Internal organ injury can be extensive and may be more serious than the more obvious abdominal hernia.

Hernias with large abdominal wall defects may be less of a threat to patients compared with those with smaller defects that are more likely to entrap variable portions of a visceral organ. Incarceration or entrapment of the hernia contents may cause tissue strangulation. Strangulation may be the result of progressive scar tissue contraction compromising circulation to the tissue, circulatory compromise to the entrapped tissue by the shifting or twisting of the contents, or progressive swelling causing a progressive circulatory loss to the entrapped tissue. This loss of circulation can result in tissue necrosis, a particularly serious condition when an intestinal segment is involved. Clinical signs of intestinal necrosis and infection include fever, vomiting, localized swelling, sepsis, and secondary peritonitis.

The size and location of a traumatic hernia varies according to patient size and individual anatomic characteristics, the amount of force exerted on the patient, and how the force is absorbed (local or focal impact versus broader contact and dispersion). In the case of blunt vehicular trauma, large intraabdominal pressures may be generated on impact. Depending on body position and variations in muscle thickness and contraction at impact, comparatively weak areas may tear first. Muscle attachments
may stretch or tear (avulse) from bone attachments. Prepubic and femoral hernias, alone or in combination, are examples of avulsion injuries secondary to blunt trauma. In other cases, herniation can occur through major fracture gaps, especially those involving the pelvis.

The most common locations for traumatic abdominal hernias (listed in order of frequency) are in front of the pubis, around the ribs, lateral abdomen, dorsal abdominal wall attachment to the transverse processes of the lumbar vertebrae, and the femoral triangle area. Blunt trauma also can result in dilation or tearing at the inguinal canal, alone or in combination with a prepubic hernia. The ventral midline is the most common location for incisional hernias, since the midline incision is the approach most often used in abdominal cavity surgery.

Of particular concern with incisional hernias is abdominal herniation with dehiscence of the overlying skin incision. Evisceration can result in serious trauma to exposed intestine; patients often lick, chew, or eat the exposed tissue. Peritonitis also becomes a significant risk, especially when surgical intervention has been delayed.

There are several causes of incisional hernias (see box at right). When incisional hernias are surgically corrected, close examination of the suture material and tissue sutured is invaluable in assessing the cause(s) of hernia formation. From my experience in correcting incisional hernias, suture pullout is more common than suture breakage.

**DIAGNOSTIC CRITERIA**

**Historical Information**

**Gender, Age, and Breed Predispositions**

None.

**Owner Observations**

- Owners may recognize swelling or a protrusion at the general location of the hernia. At times, a contusion and local edema are associated with the site of trauma, especially in areas where hair growth is relatively sparse.
- Incisional hernias most commonly occur within the first 3 to 5 days after surgery. Owners may note a bulge or swelling. In some cases, the veterinarian recognizes local swelling at the time of suture removal. With complete incisional dehiscence, viscera (intestine, omentum) may protrude through the abdominal wall defect and skin.

**Other Historical Considerations/Predispositions**

- There may be no history of trauma when patients are allowed to roam freely without supervision. Most commonly, the affected dog or cat was struck by a vehicle or was involved in a fight with another animal. In some cases, the dog or cat may have fallen from a substantial height. Traumatic hernias are not necessarily accompanied by an obvious bite wound or laceration of the overlying skin.
- Blunt abdominal trauma from kicks or blows from humans or large animals is relatively uncommon. In most cases, there are no witnesses to these events. Farm dogs and cats are more prone to injuries from horses or cattle.
- Gunshot and knife wounds are uncommon causes of abdominal hernias.
- Hernias may not be visible initially; later, abdominal contents can shift and enter the abdominal tear.

**Physical Examination Findings**

- A complete physical examination should be performed and a detailed history obtained.
- Swelling or bulging beneath the skin is the most prominent finding in cats and dogs with an external abdominal wall hernia. Loss of abdominal symmetry may be visualized or palpated.
• As noted, swelling or bulging may not be evident initially after trauma; abdominal contents may protrude later, as the visceral organs (especially the omentum and intestinal tract) slip through the abdominal defect.
• Swelling may not be obvious until a patient changes body position. Arching or bending the torso can widen the abdominal tear, thereby allowing the visceral organs to protrude.
• Coughing and barking increase intraabdominal pressure. Along with abdominal muscle contraction, hernia bulging may abruptly appear with each cough or vocalization.
• The largest area of bulging may not directly overlie the hernia. Visceral contents can gravitate below the hernia site; this is especially evident in lateral abdominal wall hernias.
• Progressive enlargement may be the result of increasing accumulation of visceral tissues and omentum. Abdominal fluid accumulation and edema may enhance the bulge. Obstruction of a hollow viscus may cause gas and fluid dilation.
• A complete physical examination is necessary to locate more discrete traumatic hernias. Manual examination of the abdomen often can determine the borders or “ring” of the abdominal tear.
• Because of their ventral location, hernias in the prepubic and femoral triangle area are easily overlooked on initial examination; veterinarians should examine these areas carefully.
• Palpation of the hernia contents may reveal distinct loops of bowel, omentum, or other displaced organs, especially the spleen. If the contents can be manipulated back into the abdominal cavity, the hernia is considered reducible. Most large defects are reducible hernias; smaller defects make reduction difficult or impossible (irreducible hernias). In more long-standing hernias, scarring and adhesions may prevent reduction of hernia contents without surgical intervention.
• Pain may be focal or generalized, depending on the severity of trauma.

Laboratory Findings
• A baseline complete blood count, serum chemistry profile, and urinalysis should be obtained. The need for subsequent serial tests varies based on the individual patient. $
• Blood gas analysis, pulse oximetry, and electrocardiography can be considered to assess unstable patients with respiratory trauma or distress. $

Other Diagnostic Findings
• Thoracic radiography should always be considered to rule out lung contusions, pneumothorax, hemothorax, and diaphragmatic hernia in traumatized patients. $
• Abdominal radiographs are routinely obtained to determine integrity, asymmetry, or discontinuity of the abdominal wall and assess the abdominal viscera. Hernia contents can be assessed based on their density and other characteristics. Gas-filled organs (stomach, small intestine, colon) are readily discernible on plain radiographs. $
• Additional radiographs are taken to assess skeletal abnormalities. $
• Ultrasonography can be useful in assessing hernia contents, adjacent visceral organs, integrity (or discontinuity) of the abdominal wall, and soft-tissue density. $
• Abdominocentesis can help assess fluid accumulation, septic abdomen secondary to abdominal trauma, or the possible strangulation of tissue incarcerated in the hernia ring. $
• Aspiration of questionable swellings can help differentiate seromas and soft-tissue tumors from abdominal wall hernias. Incisional seromas occasionally prevent closer digital assessment of the underlying abdominal wall; aspiration of the fluid bubble facilitates subsequent attempts to determine the presence of a defect. Evacuation of seromas can facilitate palpation of incisional hernias. $
• Contrast studies (excretory urography, peritoneography, upper gastrointestinal series) may occasionally be useful to further define the nature of the hernia, hernia contents, and extent of organ involvement. $

Summary of Diagnostic Criteria
• A baseline complete blood count, serum chemistry profile, and urinalysis are useful in the overall assessment of traumatized patients.
• Additional diagnostic tests (blood gas analysis, pulse oximetry, abdominocentesis, diagnostic aspirations) are used to assess specific problems noted in individual patients.
• Thoracic and abdominal radiography are useful in assessing traumatized patients.
• A complete physical examination is used to determine the severity of trauma and the presence of abdominal hernias.
• Ultrasonography helps differentiate hernias from soft-tissue tumors and seromas secondary to trauma. Ultrasonography can help determine the contents of the hernia. Defects in the abdominal wall can show up as discontinuity with the normal muscle layers comprising the abdominal wall.

Diagnostic Differentials
• Seroma.
• Hematoma.
• Scar tissue; healed partial tears (“pseudoesthesia”).
• Soft-tissue tumor.
• Soft-tissue edema and/or inflammation.

TREATMENT RECOMMENDATIONS

Initial Treatment
• Initial treatment varies with the severity of the trauma.
• Emergency support measures may be indicated before definitive hernia repair is performed. In some cases, emergency surgery is indicated when a patient’s status fails to stabilize or deteriorates despite aggressive medical support. $$$$–$$$$$
• Prophylactic, broad-spectrum antibiotics should be considered in patients with extensive trauma.

**Surgical Approach and Closure Options $$$$$**

• Hair should be liberally clipped from the abdominal area; if exploratory laparotomy is anticipated or a possibility, the patient should also be prepped for a midline abdominal approach.
• Tissue with questionable blood supply or necrotic muscle or fascia should be debrided before a traumatic hernia is closed.
• Torn or shredded linea tissue secondary to suture pullout can be trimmed with a scalpel blade to facilitate suture placement into healthier fascial tissue.
• Depending on the location and extent of the hernia, definable muscle layers may be sutured separately, such as in the case of paracostal and lateral abdominal wall hernias.
• Dorsolateral and prepubic hernias are normally closed in a single layer, with the sutures engaging all three abdominal layers and muscle fascia simultaneously.
• Suture bites may be 10 mm or more from the muscle edge to help prevent suture pullout; when possible, including the strong external fascial layer of the abdominal wall is advisable.
• In patients with large areas of dead space in conjunction with compromised tissue, vacuum or closed suction drain systems are preferable to passive drain systems (e.g., Penrose drains).
• Suture patterns vary: simple interrupted, far-near-near-far, or a combination of these patterns is commonly used to repair abdominal wall hernias.
• Paracostal and lateral abdominal hernias should be approached with a linear incision over the area.
• A lateral approach is commonly used for lateral abdominal wall hernias: A centrally located (dorsoventral direction) incision allows for skin retraction to gain access to the length of the hernia.
• If there is clinical and radiographic evidence of potentially serious internal abdominal trauma, paracostal, lateral abdominal, and dorsolateral hernias can be repaired via a ventral midline laparotomy. Because of the large defect associated with dorsolateral abdominal wall avulsion, a laparotomy also can be conducted from a lateral abdominal approach described above.
• Lateral abdominal wall defects are often dorsal to the swelling: Hernia contents normally gravitate ventral to the abdominal wall tear. The initial incision can be made just above the bulge and expanded as needed to reduce the hernia and repair the abdominal defect.
• The entire dorsolateral abdominal wall musculature may be avulsed from the transverse processes of the lumbar vertebrae. A lateral abdominal approach or intraabdominal approach can be used to repair this extensive hernia. Care must be taken if suturing the abdominal wall to the psoas major and minor muscle groups because the femoral nerve courses through the caudal portions of these two muscle masses.

### Checkpoint

As noted, some surgeons will consider delaying the repair of a hernia for 3 to 5 days following the injury. In most cases, prompt repair of the hernia can be performed safely and effectively, provided that the patient is stable. Bite wounds and other open traumatic wounds should be addressed as early as possible to avoid the potential for infection. When possible, placement of surgical access incisions through traumatized skin should be avoided; an incision adjacent to the area, with modest skin retraction, usually provides reasonable exposure of the hernia and tissue required to close the defect.

• A prepubic hernia is normally approached with a ventral midline incision; skin is retracted to expose the pubic bone and area of the femoral triangles.
• The avulsed abdominal wall can be secured to the pubic bone by predrilling holes along its border. Occasionally, sutures can be secured to the head of small screws or wire loops placed in the pubic bone. Alternatively, sutures can be placed around intact pubic bones through the cranial aspect of the obturator foramina.
• Care must be taken when closing femoral and inguinal hernias because of the presence of vasculature through the canals.
• To avoid further circulatory compromise, it is preferable to make a skin incision adjacent to, rather than through, badly contused skin. The skin is sufficiently elastic to obtain exposure (retractors) with incisions lateral to the ventral midline.
• I prefer to use monofilament nylon or polypropylene sutures to close all abdominal hernias; 3-0 suture material is adequate for cats and dogs weighing less than 5 kg, and 2-0 is adequate for most medium to large dogs.
• Most incisional hernias can be repaired with a series of simple interrupted sutures, which may be preferable to a continuous pattern.
• Vacuum drain systems may be used to control large areas of dead space postoperatively.

**Alternative/Optional Treatments/Therapy $$$$$**

• Some surgeons prefer to delay the repair of traumatic hernias, if possible, for up to 5 days. This is based on the premise that edema and inflammation will decrease during this time, thereby reducing the potential risks of tissue necrosis and infection secondary to surgical trauma. Compromised tissue may declare its viability by this time, thereby facilitating areas that may require debridement. I do not believe a delay is necessary in most cases. (See Checkpoint, above.)
• Open traumatic wounds and those cases in which internal injuries may pose a risk to the patient are best managed once the animal is stable.
• Long-standing hernias (weeks, months) can be problematic, and surgical closure can be difficult depending on the size...
and location of the wound. Muscle contraction and fibrosis of the abdominal wall are particularly troublesome when closing prepubic hernias. Caudal abdominal wall advancement and suture apposition to the pubis may be difficult or impossible to perform without the use of a supplemental muscle flap or synthetic mesh.

- Muscle flaps, when possible, are preferable to synthetic mesh materials. Implantation of mesh in contaminated areas can cause an infection that may not be resolved until the implant is removed. Muscle and omental flap techniques currently used for problematic abdominal hernia repair include:
  - Cranial sartorius muscle flap for prepubic hernia repair (single or paired).
  - Pectineal muscle flap to assist in the closure of problematic femoral hernias.
  - External abdominal oblique muscle flap for large abdominal wall defects, especially for problematic ventral abdominal wall hernias. This muscle easily dissects free of the internal abdominal oblique muscle; tethered or supported by the cranial abdominal artery, the muscle can be pivoted or advanced into hernia defects. In problematic abdominal incision hernias, both muscle layers can be dissected, advanced, and sutured together.
  - Omentum can be folded and sutured into small hernias to facilitate the closure of problematic defects in which insufficient muscle and fascia are available to close selective areas. Omentum also can be incorporated into a closure, thereby creating a “backup” or “default wall” in the event that portions of a muscle closure separate.

To reduce tension during closure of a ventral midline incisional hernia, a tension-relief or release incision can be made in the external abdominal oblique muscle fascia, 3 to 5 cm on each side of the hernia. (I have used this on a few occasions, and it is also noted in the older surgery literature.)

**Supportive Treatment**

- Minimal postoperative supportive care is necessary for stable patients undergoing minor hernia repair.
- Traumatized patients require appropriate intravenous catheters and supportive care based on individual needs.
- Analgesics are indicated for most patients.
- Abdominal bandages may be used to support the closure of a problematic lateral or incisional hernia for 7 to 14 days after repair (such bandages partially restrict excessive flexion and motion).
- As a general rule, patient activity should be minimized for 1 month after surgery. Cage confinement may be advisable.
- Many surgeons administer prophylactic antibiotics at the time of hernia repair.
- Infected wounds should be cultured and an appropriate antibiotic selected.
- Patients should be fed a balanced, nutritious diet. Inappetent patients may require supplemental nutritional support.

**Patient Monitoring**

- Minimal postoperative monitoring may be all that is needed for minor abdominal wall hernias.
- Intensive care monitoring (blood pressure, pulse oximetry, and the like) is indicated for more severely traumatized patients.
- Fluid collected in vacuum drain reservoirs should be assessed for both quantity and content.
- Unless bandaged, surgical site(s) should be examined daily. Bandages can be opened or changed every 2 to 4 days to evaluate the patient for local swelling, discharge, and condition of the tissue.

**Home Management**

- Activity must be minimized. Enforced cage rest may be advisable.
- Bandages must be kept clean and dry.
- Unless bandaged, incision(s) should be examined on a daily basis for discharge, swelling, and the integrity of the skin closure.
- An Elizabethan collar may be required to prevent licking or chewing at the surgical site.
- Owners can be trained on the use of vacuum drain systems and to record the fluid amounts removed on a daily basis. Quantifying the amount of fluid removed can serve as a general guideline as to when to remove the drain.

**Milestones/Recovery Time Frames**

- The development and use of muscle flaps have been beneficial in the closure of many of the more challenging traumatic hernias encountered in small animal surgery. Muscle flaps reduce the need to use more expensive synthetic mesh materials and thus avoid the complications associated with these materials in closing traumatic hernias.

**Treatment Contraindications**

- Synthetic mesh materials in traumatic hernia closure are best avoided when possible, particularly in cases in which contamination or the presence of infection precludes their use.
- Unless a hernia is possibly contributing to the deterioration of a patient’s health status, surgical correction of the hernia may necessarily be delayed until other health issues are addressed. Once the patient is stable, repair of the defect can be scheduled.

**PROGNOSIS**

**Favorable Criteria**

- Complete healing at the surgical site.
- Viability of the skin and underlying tissue used for wound closure.
- Correction and resolution of collateral trauma associated with traumatic hernia formation.
Unfavorable Criteria

• Dehiscence of the skin.
• Dehiscence of the hernia closure site.
• Tissue necrosis.
• Bacterial infection.
• Late fungal infection. Although uncommon, a fatal *Pseudallescheria boydii* (eumycotic mycetoma) infection was reported in a 2-year-old dog after presenting with abdominal dehiscence following ovariohysterectomy at 6 months of age.

RECOMMENDED READING

