Sonography in Identification of Abdominal Wall Lesions Presenting as Palpable Masses

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Objective. Abdominal wall lesions often present as palpable masses. The purpose of this presentation is to provide an overview of the sonographic appearances of different abdominal wall lesions. Methods. Patients were scanned with high-frequency (5- to 12-MHz) linear transducers. Extended or panoramic views were recorded often to show the lesion in perspective to adjacent structures in the abdominal wall. Results. The different layers of the abdominal wall could be clearly shown on high-frequency sonography, and the abdominal wall abnormalities were recognized in all the patients. Conclusions. Hernias are the most common abdominal wall lesions. Herniated bowel loops have variable appearances depending on their air-fluid content and degree of obstruction. Localized fluid collections in the abdominal wall (seromas, liquefying hematomas, and abscesses) can be well visualized. More infrequently, tumors or vascular lesions can be identified in the abdominal wall. Key words: abdominal sonography; abdominal wall; hernia.

Abdominal wall lesions often mimic intra-abdominal conditions and frequently present as palpable masses. This is more common with patients who have a thick abdominal wall with a large layer of fat. Pathologic processes that may involve the abdominal wall occasionally raise diagnostic challenges because of the low specificity of physical findings. The most common situation when a sonographic examination of the abdominal wall is needed is when there is a doubt about a palpable abdominal mass to decide whether it is in the abdominal wall or inside the abdominal cavity. Sometimes a clinically suspected intra-abdominal mass proves to be in the wall, and sometimes an abdominal wall lesion is seen as an incidental finding on abdominal sonography performed for some other reason. Often patients with chronic abdominal pain need an examination of the abdominal wall, especially when a positive Carnett sign suggests the cause of pain to be in the abdominal wall.1,2
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Materials and Methods

Patients were scanned with a Voluson 730 Expert system (GE Healthcare, Milwaukee, WI), an AU4 Idea system (Esaote SpA, Genoa, Italy), and an HDI 5000 system (Philips Medical Systems, Bothell, WA) with high-frequency (5- to 12-MHz) linear transducers. Extended or panoramic views were recorded often to show the lesion in perspective to adjacent structures in the abdominal wall. There was no need for any abdominal preparation. Any abdominal wounds were cleaned and, if possible, covered with a thin, sterile, plastic adhesive membrane, or, more simply, the probe was covered with a sterile cover or glove. Patient's ages ranged from neonate to 68 years.

Anatomy

The abdominal wall is a laminated structure. The different layers are skin, superficial fascia, subcutaneous fat, muscle layer, the transversalis fascia, and a layer of extraperitoneal fat (Figure 1). The anterior muscle layer is composed of paired midline rectus muscles and anterolaterally situated internal and external oblique and transverse abdominis muscles. The rectus abdominis muscles are attached superiorly to the anterior arcs of 5 to 7 ribs and inferiorly to the pubic crest. They are enclosed within the anterior and posterior layers of the rectus sheath, which is a continuation of the aponeurosis of the internal oblique, external oblique, and transverse abdominis muscles. The posterior rectus sheath ends at the arcuate line, midway between the umbilicus and symphysis pubis. In midline, the anterior and posterior layers of the rectus sheath fuse to separate the 2 recti and form the linea alba.

The skin is echogenic. The subcutaneous fat layer is variable in thickness and is usually hypoechoic. The muscles reveal medium-level echoes. A typical lamellar pattern of the muscle fibers usually can be recognized.

Fluid Collections

Localized fluid collections in the abdominal wall are seromas, abscesses, or liquefying hematomas. Noninfected seromas after surgery are usually anechoic collections. Fluid collections complicated by infection or hemorrhage appear more complex, with variable degrees of internal echoes, layering, and septa (Figure 2).

Tuberculous abscesses from caries of the ribs can present as palpable lumps per se. They are localized collections of fluid, typically seen around the lower ribs and at or a little inferior to the costal margin (Figure 3A). They may reveal internal echoes, depending on the debris inside. Destruction of the corresponding rib may be seen on the sonographic examination (Figure 3B).

Hernias

Hernias are the most common abdominal wall lesions seen in sonographic practice. Depending on their location and cause, they are divided into different categories. With a high-frequency transducer, the fascial defect can be visualized underlying the hernia. Herniated bowel loops have a variable appearance depending on their air-fluid content and degree of obstruction. During the real-time examination, induction and reduction of a hernia can be observed. The patient is asked...
to cough or perform a Valsalva maneuver while scanning over the suspected site is performed, and with an increase in abdominal pressure, suddenly the hernia will precipitate, and any doubts will be resolved.

**Ventral Hernias**

A ventral hernia occurs typically where there is no muscle support along the linea alba in the midline in the epigastrium (Figure 4) or periumbilical region (Figure 5). The hernia very often contains only fatty tissue but may be large and contain bowel loops also.6,7

**Figure 2.** Abdominal wall seroma after surgery.

**Figure 3.** A, Tuberculous abscess inferior to the costal margin. B, Tuberculous abscess surrounding rib caries. Note rib destruction. A indicates abscess.

**Figure 4.** Ventral hernia with omental fat protruding through the defect in the rectus sheath. Arrows point to the defect in the rectus sheath.

**Figure 5.** A, Periumbilical hernia containing fat. H indicates hernial sac. Arrows point to the defect in the rectus sheath. B, Three-dimensional rendering of a periumbilical hernia containing fat.
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Spigelian Hernia
A spigelian hernia occurs because of a defect in the aponeurosis of the transverse abdominis muscle and the rectus sheath. The most common site is the point where the linea semilunaris crosses the arcuate line. The hernia may sometimes extend laterally and present as a flank lump (Figure 6).

Incisional Hernia
An incisional hernia develops as a late complication of abdominal surgery. It also has been seen after laparoscopic procedures. Most incisional hernias will present within the first year; however, some go unnoticed by the patient and are incidentally detected on sonography or computed tomography. Sonography is very useful in ruling out a hernia at surgical sites and in monitoring the integrity of wire mesh implants (Figure 7).

Inguinal Hernia
An indirect inguinal hernia occurs as a result of protrusion of the peritoneal sac and contents through the internal inguinal ring into the inguinal canal and sometimes into the scrotum. The internal inguinal ring is a defect in the transversalis fascia anterior to the femoral vessels, lateral to the inferior epigastric artery, and...
above the inguinal ligament. The superficial inguinal ring is a defect in the external oblique aponeurosis. Direct inguinal hernias protrude through a weakened inguinal canal floor, medial to the inferior epigastric artery. Depending on the content, namely, fluid, air-containing bowel, or fluid-containing bowel, inguinal hernias will have different appearances on sonography (Figure 8, A–C). Distended, adynamic bowel indicates obstructed loops (Figure 8D). The inferior epigastric artery can be visualized on color Doppler sonography, and then differentiation of a direct or an indirect inguinal hernia is possible (Figure 8, E–G). In female neonates and infants, ovaries may prolapse into the hernia and can be identified by their typical appearance (Figure 9).

**Femoral Hernia**

A femoral hernia protrudes through the femoral canal (Figure 10A). Sonographic differentiation depends on demonstration of the hernia medial to the femoral vein (Figure 10B). Most patients are elderly and obese and have abdominal or groin pain with or without a palpable mass.

**Miscellaneous Lesions**

**Urachal Cyst**

A urachal cyst may be seen in between the umbilicus and the bladder. It is usually situated in the lower third of the urachus but can be seen just inferior to the umbilicus. These cysts may appear totally anechoic or may reveal low-level internal echoes (Figure 11).

**Endometriosis**

Endometriosis of the abdominal wall may occur as a long-term complication of uterine surgery. It has no specific appearance but is seen as a focal mass at the scar of previous surgery with attacks of cyclic pain and swelling (Figure 12).

**Abdominal Wall Hematoma**

A rectus sheath hematoma may develop after paroxysms of coughing or sneezing or after seizures. The underlying cause is usually either anticoagulant therapy or some bleeding disorder. Because these hematomas are limited within the rectus sheath, they are not very big. Their shape depends on their location. Above the arcuate line, they are usually ovoid in shape with the long axis superoinferior and are seen on one side.
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Figure 8. (continued) D, Inguinal hernia containing obstructed bowel loop. E, Inguinal hernia, longitudinal section. Arrows outline the small hernial sac. F, Direct right inguinal hernia medial to the inferior epigastric artery. G, Indirect right inguinal hernia lateral to the inferior epigastric artery.

Figure 9. A, Inguinal hernia in an infant girl containing a prolapsed ovary. B, Inguinal hernia in an infant girl with an ovary reduced in the peritoneal cavity. H indicates hernial sac; and OV, ovary.
(Figure 13A). Below the arcuate line, because of the absence of the linea alba, they can extend across the midline. Then the hematoma may be seen as a padlike lesion with its maximum length along the transverse axis.\textsuperscript{21–23} In one neonate, an abdominal wall hematoma was seen to spread transversely in the supraumbilical region (Figure 13, B and C). In patients with postsurgical disseminated intravascular coagulation, large hematomas are seen in the abdominal wall in the vicinity of the surgical scar (Figure 13D).

**Everted Xiphisternum**

This may present as a palpable mass in the epigastrium, which is not painful and is firm to hard on palpation (Figure 14).

**Neoplasms**

Lipomas are occasionally seen in the abdominal wall. They appear as well-defined ovoid or padlike masses (Figure 15A). Most lipomas in the abdominal wall are isoechoic to slightly hyperechoic compared with the muscles (Figure 15B). A thin echogenic capsule can usually be seen.\textsuperscript{3,24}

**Figure 10.** A, Femoral hernia. H indicates hernial sac. B, Color Doppler scan of a femoral hernia at 2 different levels showing the mass medial to the femoral vessels.

**Figure 11.** A, Urachal cyst. The cyst is infected and contains faintly echogenic fluid. B, Urachal cyst. The anterior wall of the tense cyst produces reverberation artifacts.

**Figure 12.** Endometriosis in a cesarean delivery scar.
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Figure 13. A, Rectus sheath hematoma in an elderly woman after severe cough. Arrows point to the fascia transversalis. B, Abdominal wall hematoma in a neonate. C, Abdominal wall hematoma overlying umbilical vein insertion in a neonate. UV indicates umbilical vein. D, Abdominal wall hematoma in a cesarean delivery scar in a patient with disseminated intravascular coagulation.

Figure 14. A, Prominently everted xiphisternum (Xiphi-Str) presenting as a lump in the epigastrium. Arrows point to the xiphisternum. B, Prominently everted xiphisternum presenting as a lump in the epigastrium, extended view. Liv indicates liver; P, pancreas; Rcts, rectus sheath; St, stomach; and XS, xiphisternum.
The other tumor that occurs in the abdominal wall is the desmoid tumor, which arises from the fascia or aponeurosis of muscles. They often occur at site of previous laparotomy scars. They occur more commonly in female patients than in male patients (Figure 16).25,26

The most frequent malignant nodules are metastatic melanomas. Metastases from lymphoma and lung, breast, ovary, and colon cancer are less common (Figure 17).

**Inguinal Masses**

Apart from hernias, other lesions may present as small, palpable masses in the inguinal area.

**Undescended Testis**

Testicular descent can get arrested at any point from the renal hilum to the external inguinal ring. Of all the undescended testes, 90% to 95% are low and in the inguinal canal. Sonography is very useful in detection of undescended testes. The undescended testis is usually small. It is ovoid and reveals a homogeneous, hypoechoic structure. The presence of an echogenic hilum distinguishes a lymph node from a testis (Figure 18).27,28,29

**Figure 15.** A, Lipoma. B, Multiple lipomas.

**Figure 16.** A, Desmoid tumor in a previous scar. B, Color Doppler scan of a Desmoid tumor in a previous scar revealing some vascularity in the lesion.

**Figure 17.** Metastatic nodular deposits in a patient with ovarian cancer.

**Figure 18.** Undescended testis.
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**Lipoma of the Spermatic Cord and Inguinal Canal**
Lipoma is the most common tumor in the inguinal canal and spermatic cord. It appears as a spindle-shaped, echogenic mass along the inguinal canal or in the upper part of the scrotum. Lipoma of the cord is a poorly recognized entity that can be present with groin symptoms and clinical findings indistinguishable from those of an inguinal hernia (Figure 19).\(^{30,31}\)

**Lymph Nodes**
Sonography is helpful for categorizing a palpable inguinal mass. Most lymph nodes are ovoid. They typically have an echogenic central area and a hypoechoic peripheral zone (Figure 20).\(^{25}\)

**Pseudoaneurysm**
With the widespread increase in transfemoral vascular interventions and vascular reconstruction procedures, pseudoaneurysms in the groin are not uncommon. The pseudoaneurysm is seen as a localized fluid-filled structure, which may reveal pulsations. Swirling of echogenic blood may be seen on real-time examination within the cystic fluid-filled cavity. On Color Doppler examination, it reveals a typical yin-yang flow (Figure 21).\(^{32,33}\)

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**Figure 19.** Lipoma of the inguinal canal.

**Figure 20.** A. Enlarged inguinal lymph node. Note the echogenic hilum. B. Color Doppler scan reveals the vascular hilum of the lymph node.

**Figure 21.** Pseudoaneurysm of the common femoral artery.
References


