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Review Article

Sonographic evaluation of inguinal lesions

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ABSTRACT

Abnormalities in the inguinal region are varied. The most common abnormality in the inguinal region is the hernia: direct or indirect inguinal hernia and femoral hernia. There are many hernia-mimicking lesions, such as spermatic cord hydrocele, undescended testis, hematoma, inflammation, abscess, benign or malignant tumors, metastatic or benign lymph node enlargement, round ligament varicosities or mesothelial cyst, and herniated ovary. Ultrasonography is currently the primary imaging modality used in assessing inguinal lesions and helpful for the differential diagnosis of a broad spectrum of these diseases. Familiarity with clinical setting and certain ultrasonography details will facilitate prompt and accurate diagnosis and treatment.

1. Introduction

Inguinal lesions can vary widely, from benign to malignant, from cystic to solid, from tumorous to nontumorous, and from congenital to acquired [1–5]. Therefore, the differential diagnosis of inguinal lesions is important, although it is challenging because the abnormalities have similar clinical appearances, such as tender palpable masses [3].

Ultrasonography (US) is considered the imaging modality of choice for patients with suspected inguinal abnormalities [3,4]. Inherent advantages of US include accessibility, quick scan time, low cost, multiplanar capability, and the ability to perform dynamic real-time imaging with contralateral comparison [6]. The modality is accurate for distinguishing between solid and cystic lesions [3,4]. The purpose of this article is to describe the broad spectrum and imaging features, especially of US, with regard to these inguinal lesions.

2. Normal anatomy

The inguinal region consists of the inguinal canal and the femoral triangle [1,3]. The normal inguinal canal is a narrow diagonal tunnel lined by the aponeuroses of three abdominal wall muscles (external oblique, internal oblique, and transversus abdominis) [7]. The inguinal canal runs from the deep inguinal ring to the superficial inguinal ring from superiorly posterolateral to inferiorly anteromedial direction [7]. The inguinal ligament, the folded and thickened lower border of the external oblique aponeurosis, attaches at the anterior superior iliac spine and pubic tubercle and medially forms the inferior floor of the inguinal canal [8]. The deep or internal inguinal ring is a gap in the transversalis fascia just superior to the inguinal ligament and posterolateral to the inferior epigastric vessels. The superficial or external inguinal ring is an opening in the external oblique aponeurosis just superior and lateral to the pubic tubercle [7].

The inguinal canal contains vascular and neural structures, and the spermatic cord (in men) or round ligament (in women) [2,8]. The Hesselbach triangle is anatomically bounded inferiorly by the inguinal ligament, medially by the lateral margin of the rectus abdominis, and superolaterally by the inferior epigastric artery (Fig. 1). The inferior epigastric artery originates from the external iliac artery proximal to the inguinal ligament, initially passing along the medial boundary of the deep inguinal ring, and eventually anastomoses above the umbilicus with the superior epigastric artery along the rectus abdominis muscle [7,8]. Inguinal hernias are classified as direct and indirect, depending on their relationship to the inferior epigastric artery [3]. In indirect hernias, the herniated structures enter the inguinal canal [2] lateral to the inferior epigastric artery and superior to the inguinal ligament [5] and extend for a variable distance through the inguinal canal. In direct hernias, the herniation is at the inferior aspect of the Hesselbach triangle that originates medial to the inferior epigastric artery [5,7,8] (Fig. 1).

The femoral triangle contains the femoral sheath, which is formed by the deep fascia lata of the thigh and surrounds the femoral artery, femoral vein and femoral canal, from lateral to medial direction [1,7].

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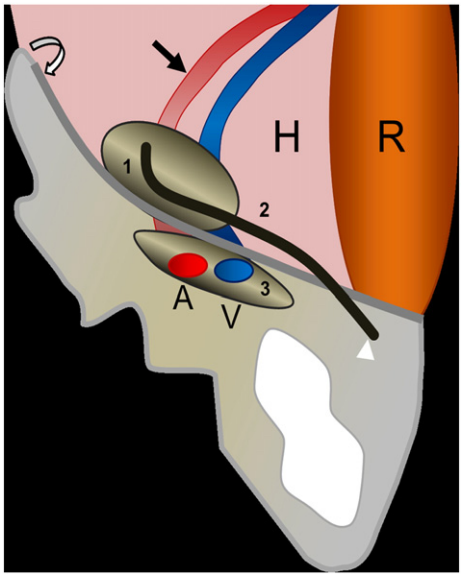

Fig. 1. Diagram of man's right inguinal region from anterior view shows predisposed locations for indirect inguinal hernia (1), direct inguinal hernia (2), and femoral hernia (3). Note locations of inguinal ligament (curved arrow), rectus abdominis muscle (R), and the lateral boundary of the Hesselbach triangle (H) defined by the inferior epigastric artery (black arrow) and spermatic cord (arrowhead).

In femoral hernias, the herniation occurs at the femoral canal, which is inferior in relation to the inguinal ligament, typically medial and adjacent to the femoral vessels [8] (Fig. 1).

3. US technique

Because the inguinal region structures are superficial, a linear transducer of 10 MHz or greater is effective; others have reported that a transducer of at least 7 MHz is effective [8,9]. Initially, an examination of the inguinal region is done with the patient supine. It is essential to ask the patient to strain (increase abdominal pressure, the Valsalva maneuver) at each of the US steps to identify transient hernias (Fig. 2). The Valsalva maneuver is a critical component of the examination because, in many patients, the hernia may be completely reduced at rest [8]. In addition, the characteristic movement of the herniating tissues often clinches the diagnosis [8]. If necessary, the patient will be asked to stand up to improve detection of an inguinal hernia [3] (Fig. 1). Reexamination with the patient standing is also recommended if the supine evaluation does not reveal a herniation or particularly in the case of a suspected femoral hernia [8,9]. Because bilateral inguinal hernias may occur, the contralateral unapparent asymptomatic side should be also evaluated.

The split-screen function that is available on most US units can expand the field of view to approximately double the width or can be used for side-by-side comparisons [6]. The extended field-of-view function can display a very large continuous section of the anatomy, preserving spatial resolution without distorting structural relationships [6]. Color and power Doppler US features show the degree of vascularity associated with inflammatory processes and solid masses and the viability of the herniated bowel loops [8]. US may also be used as guidance for biopsy or aspiration of inguinal masses or enlarged lymph nodes [3].

4. Inguinal hernia

The most common abnormality in the inguinal region is the hernia, which contains bowel loops, omental fat, and peritoneal fluid [3]. A hernia is “the protrusion of a part or structure through the tissues that normally contain it,” either through an opening in the tissues or via stretching of the tissue wall [8]. External abdominal hernias are most

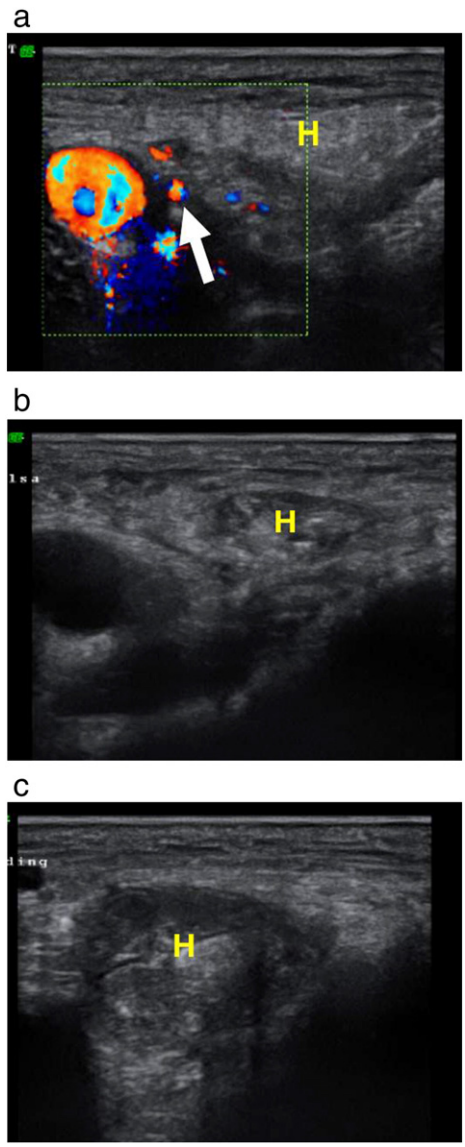

Fig. 2. A 73-year-old man with right direct inguinal hernia. **(A)** Color Doppler US shows herniated bowel loop (H), which is located on the inferomedial aspect of the inferior epigastric artery (arrow). **(B, C)** Gray scale US after Valsalva maneuver (B) and standing US (C) show provocation of the herniated bowel loop (H).

commonly found in the inguinal region, where most are direct and indirect inguinal hernias and femoral hernias [7,8]. Indirect inguinal hernias are the most common regardless of sex; femoral hernias are more common in women [7,8]. Hernias may be associated with significant morbidity and even mortality [8,10]. The risk of strangulation is lowest for direct inguinal hernias, which can often be monitored and managed conservatively. Indirect inguinal hernias are at a moderate risk of strangulation, whereas approximately 40% of femoral hernias manifest with strangulation [7].

Although they are traditionally diagnosed clinically, hernias may be difficult to identify and even more difficult to classify. US is used to evaluate in patients with equivocal physical findings and in those with acute inguinoscrotal swelling [3,11]. On US, the hernia contents can be hyperechoic because of omental fat, anechoic because of fluid, or of mixed echogenicity with reverberations caused by air in the bowel loops [3,5] (Figs. 2, 3). US allows for the direct visualization of the bowel loops and peristalsis. It is important to evaluate for both reducibility and bowel viability identified by peristalsis or mucosal blood flow [8]. The hernia sac may be hard to discern on US [3]. US may be useful not only in providing the diagnosis but also in identifying the variety