

# Prevalence of adult paraumbilical hernia. Assessment by high-resolution sonography: a hospital-based study

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Received: 26 April 2011 / Accepted: 14 July 2011 / Published online: 28 July 2011  
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## Abstract

**Background** Abdominal wall hernias are a common imaging finding in the abdomen. Ultrasonography (US) is noninvasive and allows the examination of the patient in a physiological manner. High-frequency annular US probes have become an increasingly important diagnostic tool for detecting pathological lesions in superficial organs.

**Objectives** To determine the prevalence of paraumbilical hernias among adult patients by abdominal sonography in a tertiary care hospital and to describe the sonographic technique and findings.

**Materials and methods** During the 2-year period between January 2008 and December 2009, we performed high-resolution US of the anterior abdominal wall on 302 patients who were referred for different reasons other than the examination of the anterior abdominal wall. The images were taken by a radiologist with 12 years of experience in US, and the images were reviewed by three consultant radiologists with expertise in body imaging.

**Results** A total of 302 patients [169 females (56.0%) and 133 males (44.0%)], ranging in age from 17 to 85 years, with a mean age of 53.5 years, were enrolled in the study. The number of positive cases among females was 42 (24.9%) and that among males was 31 (23.3%).

**Conclusion** High-resolution US is an efficient tool for detecting the presence of paraumbilical hernias and accurately verifying not only their content, but also the possible associated complications.

**Keywords** Paraumbilical hernia · High-resolution sonography · Abdominal wall hernias

## Introduction

Abdominal wall hernias are a common imaging finding in the abdomen. Although most abdominal wall hernias are asymptomatic, they may develop acute complications that necessitate emergency surgery. Hernias may be complicated by strangulation, incarceration, or trauma. Because of the risk of developing complications, most abdominal wall hernias are surgically repaired, even if they are asymptomatic [1]. Acquired umbilical hernias usually develop in obese or multiparous women. They may become large and, in contrast to the congenital form, strangulation through even a small umbilical ring is common. Therefore, some surgeons advocate prophylactic closure of acquired umbilical hernias [2].

Complications related to external hernias represent the most common reasons for emergency surgery performed in patients over 50 years of age [3]. However, post-surgical complications are also common and include hernia recurrence, infected and noninfected fluid collections, and complications related to prosthetic material [1].

The familiarity of the radiologist with the locations and radiological appearances of abdominal hernias allow for the confident diagnosis of these entities [4]. Ultrasound is non-invasive and allows the examination of the patient in a physiological manner [2]. In recent years, high-frequency ultrasonography (US) probes, especially high-frequency annular US, have become an increasingly important diagnostic tool for detecting pathological lesions in the superficial organs [5]. The real-time capabilities of ultrasound facilitate the assessment of hernias by allowing the

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movement of herniated contents (including fat) to be visualized with the Valsalva's maneuver (made by increasing the intra-abdominal pressure). The visualization of peristalsis of herniated bowel loops also assists in the sonographic evaluation of ventral hernias. Diagnosis by ultrasound may be difficult unless a fascial defect or herniated bowel loops exhibiting peristalsis are visualized. The identification of hernias with ultrasound requires a dedicated examination with a high-frequency transducer. Unless the possibility of a hernia is raised, a routine abdominal or pelvic examination for nonspecific symptoms of pain may not be adequate for the identification of a hernia [2].

Sonography can be useful to rule out hernias in situations in which this disease is erroneously suspected by the clinician [6].

Computed tomography (CT) scanning is a highly sensitive technique for the assessment of anterior abdominal wall hernias, and the inclusion of a series taken while the patient performs Valsalva's maneuver is essential [7].

The aim of this study was to determine the prevalence of paraumbilical hernias among adult patients who were referred to the ultrasound unit for routine abdominal sonography in a tertiary care hospital and to describe the sonographic technique and findings.

## Materials and methods

Over a period of 2 years from January 2008 to December 2009, we performed high-resolution sonography of the anterior abdominal wall on 302 patients. US examination was performed for patients coming to the ultrasound unit for abdominal ultrasound for reasons other than examining the anterior abdominal wall. The images were taken by a radiologist with 12 years of experience in US, and the images were reviewed by three other consultant body imaging radiologists (with years of experience in ultrasound ranging from 12 to 22 years).

All of the cases were taken from patients coming to the US unit in the King Khalid University Hospital. Images were taken using GE Healthcare LOGIQ 9 (Milwaukee, WI, USA) with Speckle Reduction Imaging (SRI) (grading 1–6) and crossed-beam options (grading low, medium, and high), together with tissue harmonics, which facilitates the use of encoding and decoding algorithms for improving the image quality, in addition to extended field of view (EFV). All of the patients were examined in the supine position. After standard scanning of the abdominal organs using a curvilinear probe, a 9–14-MHz linear probe was used. After turning on the harmonics mode, scanning began from the xiphisternum, sweeping the probe in the midline slowly along the linea alba, and down to the umbilical region. Any defects detected along this region were reported; however,

only true full-thickness paraumbilical hernial defects were counted as positive cases. The movement on coughing and Valsalva's maneuver were used for the establishment of the diagnosis. The linear probe was angulated at both sides of the normally hypoechoic artifact made by the normal umbilical depression. Color and power Doppler imaging were applied and optimized according to each examination. The images were obtained in transverse, sagittal, and oblique views, and data were subsequently collected and analyzed.

Cases with para-umbilical masses, such as desmoid tumors or hematomas, were excluded from this study. Epigastric defects and fatty hernias of the linea alba were also excluded. In addition, cases with iatrogenic defects and post-laparoscopic defects were included.

The size of the hernial orifice defect ranged from 0.4 to 5 cm, and larger defects were excluded from the study, as CT is considered to be more accurate for their assessment.

## Results

A total of 302 patients were included in the study. There were 169 females (56.0%) and 133 males (44.0%), ranging in age from 17 to 85 years, with a mean age of 53.5 years. The number of positive cases among females was 42 (24.9%) and that among males was 31 (23.3%). We found no relationship between age, gender, and size of the defect, as the correlation coefficient ( $R$ ) was 0.078 and the  $P$ -value was greater than 0.05. The size of the hernia defect ranged between 0.4 and 5 cm (Figs. 1, 2 and 3). Valsalva's maneuver was applied during scanning and was positive in 60 of the 73 positive cases and appeared to be related to the size of the neck of the hernia defect, as it was positive when the neck was greater than 1.5 cm. The maneuver was negative in the remaining 13 cases that had a neck smaller than 1.5 cm. The content of the hernial sac was omental fat in all positive cases and it was fat and small bowel in four cases. Applying color and power Doppler did not add any appreciable benefit except in the four cases containing small bowel, where it helped in assessing the bowel vascularity.

## Discussion

Abdominal wall hernias are usually suggested by the patient's clinical history and confirmed by physical examination. The patient's clinical history, however, may be atypical, and the physical examination may be of limited use, particularly in patients with severe abdominal pain and distention, or in patients with small hernias located in uncommon sites [8]. The diagnosis of umbilical hernia can usually be made clinically, unless the hernial sac is small or

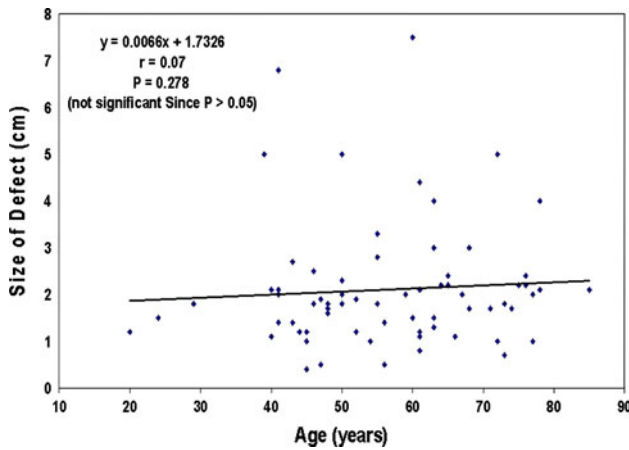


Fig. 1 Relationship between age and the size of the defect

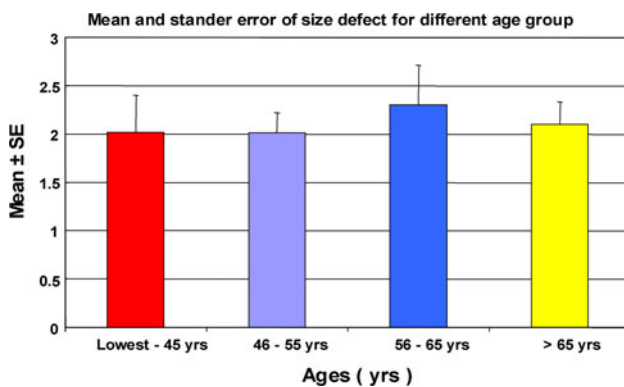


Fig. 2 Mean and standard error of the size of the defect and different age groups

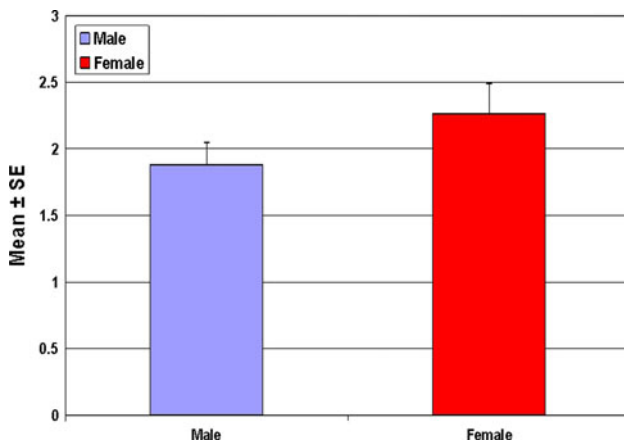


Fig. 3 Comparison between male and female patients with respect to the size of the defect

the patient body habitus interferes with adequate palpation [2]. Hernias may also cause clinical diagnostic problems in patients with scars or in women in whom a herniated sac protrudes between muscle layers [9]. Ultrasound can be used to evaluate the integrity of the anterior abdominal wall

and to exclude the possibility of umbilical hernia. The muscular and fascial layers of the abdominal wall are best imaged with high-frequency transducers. Comparison with the abdominal wall on the asymptomatic side may be necessary in order to help define the normal abdominal wall anatomy in some patients. Differences in muscle thickness and in fat echogenicity contribute to the variability in sonographic appearances. This variability is most marked in patients with significant atrophy of the anterior abdominal wall muscles. The fascial defect of a ventral hernia wall may be difficult to identify sonographically, especially if it is obscured by herniated-gas-containing bowel loops, due to posterior acoustic shadowing. When only the herniation of omental or mesenteric fat is present, the sonographic appearance is that of a nonspecific anterior abdominal mass. In this situation, the differential diagnosis includes other masses, such as hematomas, desmoid tumors, and other soft-tissue tumors [2].

US can detect visceral adhesions after mesh has been placed in the intra-peritoneal position for ventral repair [10]. The presence of a physician during the study or personal communication with the technician or radiologist is also recommended. The results of a study by Young et al. [10] indicated that there are certain clinical situations in which US can be of increased benefit in assisting the physician in making decisions, such as the presence of other midline defects, hernias, or other abdominal masses.

When we started to design the sonographic protocol for the examination of these cases, this protocol was discussed with the surgeons so as to meet their operative needs. Post-operatively, positive cases were correlated with operative data, CT, or US follow-up findings.

Imaging modalities, such as sonography and CT, can aid in the differential diagnosis of palpable abdominal wall masses and can help to define hernial contents, such as fatty tissue, bowel, other organs, or fluid. Hernia complications, such as incarceration, are also detected at clinical presentation. However, cross-sectional imaging is required when the clinical presentation is misleading or inconclusive, or when the surgeon believes that it is important to preoperatively assess the contents of an incarcerated hernia [8]. The size of the defect and the status of the contents, which are clearly identified in our study, will greatly affect the procedure and outcome of the surgical management.

Ultrasound has the benefit of being a dynamic study, but it is also highly operator-dependent. Correct radiological interpretation requires knowledge of the anatomy of the anterior abdominal wall and an understanding of the indications and limitations of multiple imaging modalities [11].

Our technique helped us to establish a simple and fast way to confirm the diagnosis, keeping in mind that all of the details need to be documented before subjecting patients to surgery. Moreover, the details provided by this

technique help the surgeons to omit some patients, decide on the optimal method of management, and even cancel some emergency operations.

Young et al. [10] stated that the US examination should be done with Valsalva's maneuver in both the erect and the supine positions. They also recommended the use of documenting images with Valsalva's maneuver.

Jaffe et al. [12] found that scans obtained in the CT studies with Valsalva's maneuver aided in the detection and characterization of suspected abdominal wall hernias; however, in our study, Valsalva's maneuver was only done in the supine position.

We found no study in the literature examining the size of the defect for the assessment of paraumbilical hernias in adults.

We found that huge hernias with a large defect are poorly assessed by ultrasound, due to the poor coverage of the probe, and, therefore, we have recommended CT as a better imaging modality, as it allows the proper assessment of the size of the defect and the content of the hernial sac compared with ultrasound.

The ease of US as a fast modality with a safe procedure and requiring a short period of time (the approximate time in our study was 3–5 min) favors its use as a primary imaging technique.

## Conclusion

High-resolution ultrasonography (US) is an efficient tool for detecting the presence of paraumbilical hernia and accurately verifying not only its content, but also the possible associated complications.

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