Sonography for diagnosing the presence and type of groin herniae

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Aims and objectives

Introduction

In most patients, inguinal and femoral hernia are clinically apparent and no referral for imaging confirmation is needed. However, in a significant minority of patients, either a groin hernia may not be clinically apparent or the site of origin of this hernia may not be clearly recognizable.(1) These patients are increasingly being referred for imaging assessment with either ultrasound, CT or MRI. The main purpose of this imaging assessment is to determine first the presence of a hernia and second to determine the type of groin hernia present.

The high accuracy of both CT and MRI in diagnosing the presence and type of groin hernia has been reported with sensitivity, specificity and accuracy of almost 100%.(2) Sonography has clear practical advantages over CT and MRI in being more readily available, cheaper and no ionizing radiation. While the sonographic appearances of groin hernia have been reported(3,4), there is no report on the accuracy of sonography in the assessment of groin hernia. This need to be assessed before sonography can be advocated as an accurate alternative means to CT or MRI in the assessment of groin hernia.

The aim of this study is to evaluate the accuracy of sonography in diagnosing the presence of groin hernia and differentiating which type of groin hernia is present.
Methods and materials

The study was approved by the institutional ethics committee. The study cohort comprised all subjects who underwent groin ultrasound for suspected hernia between Jan 2002 and Dec 2012 and subsequently underwent either subsequent surgery or subsequent CT/MRI. Twenty patients that had sonographic assessment but had no surgery or no follow-up CT or MRI were not included in the study cohort. The final study cohort comprised sonographic assessment of 172 groins in 151 patients (101 men; 50 women; mean age: 59 years, range 20 - 89 years). The sonographic findings in these patients were evaluated.

Sonographic assessment.

All sonographic examinations were performed by one of five fellowship-trained musculoskeletal radiologists (musculoskeletal sonography experience ranging from 6-17 years). All sonographies were performed on one of two machines (Siemens Sonoline Elegra, Issaquah, WA. Or Philips iU22, Bothell, WA.) with a 9-17 MHz linear-array transducer depending on patient body habitus. The affected side of the groin and upper femoral region was examined in all patients and the upper scrotal area in men were routinely examined in both longitudinal and transverse planes. Patients were examined in both at rest and whilst straining (Valsalva's maneuver or cough). Patients were also examined in a standing position if symptoms or signs were only demonstrated in the standing position.

The presence and type of groin hernia were determined by sonography. Groin hernia was recognized by protrusion of a mass of fat ± bowel through an abnormal fascial defect. For indirect inguinal hernia, this abnormal fascial defect is at the deep inguinal ring from where the hernia sac extends along the inguinal canal(fig. 1 and 2). For direct inguinal hernia, the abnormal fascial defect is in the posterior inguinal wall through the transversus abdominis fascia and from here along the inginal canal(fig. 3 and 4). For femoral hernia, the abnormal fascial defect is in the posterior wall of the femoral canal(fig. 5 and 6).

Anatomical landmarks and structures routinely assessed were the inguinal canal with the spermatic cord or round ligament, the deep and superficial inguinal rings, the femoral canal, inferior epigastric artery (IEA) and vein, and the inguinal ligament.

The IEA was first identified superiorly at the posterior aspect of the rectus muscle and traced down inferiorly to the origin from the femoral vessels. The spermatic cord, round ligament and inguinal ligament were then identified first in the high scrotal area (or corresponding region for women) and traced laterally. The relationship between any hernia sack neck and the inguinal ligament, femoral vessels and IEA was also routinely assessed. Inguinal hernia protrude above the inguinal ligament while femoral hernia
protrude below the inguinal ligament. The neck of an indirect inguinal hernia protrudes lateral to the IEA (fig. 1 and 2) while a direct inguinal hernia protrudes medial to the IEA (fig. 3 and 4). Femoral hernia exit alongside the femoral vein (fig. 5 and 6). In all cases the sonographic report noted the presence or absence of a groin hernia and, if present, the type of groin hernia (direct inguinal, indirect inguinal or femoral).

Follow-up.

The majority of sonographic positive patients underwent surgery. The operative records of all surgical cases were reviewed as to the presence and type of groin hernia.

A minority of patients either refused surgery or were unfit for surgery. In addition, a minority of sonographic negative patients will underwent surgery because of suspicious clinical features of hernia. Most of these patients and most sonographic negative cases were follow-up with either CT or MRI examinations to confirm the presence or absence of hernia and, wherever necessary, determine type of hernia.

CT was performed by on a multidetector CT scanner (Lightspeed 64 VCT, GE Healthcare, Sweden) using a standard clinical CT protocol (20 x 0.625mm acquisitions with 400mA, 120kV, pitch of 1:1). MRI examination was performed on a 3.0 Tesla MR whole-body scanner (Achieva TX-series, Philips Medical Systems, Best, The Netherlands). The protocol consisted of axial T1-weighted (slice thickness 3mm, TR 573ms, TE 10ms, FOV 257x247mm, matrix 512x 512). Sonographic findings were compared with either operative findings or CT/MRI findings.

To investigate any change in sonographic accuracy with time, overall sensitivity/specificity and accuracy of ultrasound for diagnosing the presence and type of groin hernia was assessed.

Statistical analysis. Results are expressed as mean ± standard deviations. The sensitivity, specificity and accuracy of ultrasound for diagnosing the presence and type of groin hernia was assessed.
Fig. 1: Transverse sonography of left groin: indirect inguinal hernia arising from deep inguinal ring (arrows), lateral to inferior epigastric artery (arrowhead)

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Fig. 2: Longitudinal sonography of left groin: indirect inguinal hernia arising from deep inguinal ring (arrows), superior to inguinal ligament (arrowhead)

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Fig. 3: Transverse sonography of left groin: direct inguinal hernia (arrows) arising medial to inferior epigastric artery (arrowhead)

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Fig. 4: Longitudinal sonography of left groin: direct inguinal hernia (arrows) arising superior to inguinal ligament (arrowheads)

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Fig. 5: Transverse sonography of right groin: femoral hernia arising from femoral canal (arrows), medial to femoral vein (arrowhead)

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Fig. 6: Longitudinal sonography of right groin: femoral hernia (arrows) arising inferior to inguinal ligament (arrowheads)

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Results

Clinical findings:

172 groins in 151 patients were referred for sonography for clinically suspected groin hernia. There were 101 men and 50 women (mean age 59 years, range, 20 - 89 years). Patients presented primarily with a groin mass (n = 62), groin pain (n=40), groin discomfort (n= 29) or recurrent symptoms after inguinal or femoral herniorrhaphy (n=41). Clinical palpation revealed the presence of a hernia in 115 (66%) groins, an equivocal hernia in 20 (12%) groins and no hernia in 37 (22%) groins.

Sonographic findings:

A total of 119 groin hernias in 107 patients were diagnosed on sonography. There were 71 indirect inguinal hernias, 23 direct inguinal hernias, 22 femoral hernia and 3 combined hernias (direct + indirect inguinal hernia) diagnosed by sonography. Of the 119 hernias, 59 (50%) hernias were on the right side and 60 (50%) hernias were on the left side. Bowel content was presence in 36 (30%) groin hernias. No strangulated hernia was present.

Sonography compared to surgery:

Of the 119 groin hernia found at sonography, 107 (90%) hernias in 100 patients underwent subsequent surgery. Mean sonography to surgery time interval was 9.0 ± 7.8 months. At surgery, 67 indirect inguinal hernias, 20 direct inguinal hernias, 9 femoral hernia and 3 combined hernias (direct + indirect inguinal hernia) were found. Comparing the sonographic findings with surgical findings, there were three false negative cases and one false positive case on sonography. The false positive case was a patient with spermatic cord lipoma found in operation which was misdiagnosed as indirect inguinal hernia.

Follow-up of non-surgical cases.

Sonographic positive cases who did not undergo surgery (n=12) and all sonographic negative cases (n= 53) were followed up with either MRI or CT examinations for confirmation. CT and MRI were performed within a mean 3.4 ± 4.8 months from sonography. Comparing sonographic findings with MRI/CT findings, there were two false negative cases and one false positive case on sonography. The two false negative cases were not operated as they were unfit for surgery. One of the false negative cases was related to the surgical mesh obscuring the hernia on ultrasound. The false positive case was a patient with a spermatic cord lipoma which was misdiagnosed as an indirect inguinal hernia.
Sonographic accuracy for presence of groin hernia.

The overall sensitivity/specificity/accuracy of sonography in diagnosing the presence of groin hernia was 95%/96%/96% (Fig.7/Table 1). With greater experience, this improved from 92%/88%/91% prior to 2011 (n=54) to 98% /100%/98% after 2011 (n=118)(Fig.7/Table 1).

Sonographic accuracy for type of groin hernia.

The overall sensitivity/specificity/accuracy of sonography in determining the type of groin hernia was 84%/92%/92% (Fig.8/Table 2). The overall sensitivity/specificity/accuracy of sonography in diagnosing the type of hernia improved from 80%/90%/90% prior to 2011 (n= 77) to 95%/98%/97% after 2011 (n=30) (Fig.8/Table 2).
Fig. 7: Table 1 Diagnostic accuracy of sonography in determining the presence of groin hernia

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<table>
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<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Accuracy</th>
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<tbody>
<tr>
<td>Overall 2002-2012 (n=107)</td>
<td>84%</td>
<td>92%</td>
<td>92%</td>
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<tr>
<td>2002-2010 (n=30)</td>
<td></td>
<td></td>
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<tr>
<td>Overall</td>
<td>80%</td>
<td>90%</td>
<td>90%</td>
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<tr>
<td>Direct Inguinal Hernia</td>
<td>84%</td>
<td>72%</td>
<td>80%</td>
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<tr>
<td>Indirect Inguinal Hernia</td>
<td>67%</td>
<td>96%</td>
<td>90%</td>
</tr>
<tr>
<td>Femoral Hernia</td>
<td>80%</td>
<td>92%</td>
<td>90%</td>
</tr>
<tr>
<td>2011-2012 (n=77)</td>
<td></td>
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<tr>
<td>Overall</td>
<td>95%</td>
<td>98%</td>
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<tr>
<td>Direct Inguinal Hernia</td>
<td>96%</td>
<td>93%</td>
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</tr>
<tr>
<td>Indirect Inguinal Hernia</td>
<td>92%</td>
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<tr>
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<td>100%</td>
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<td>Combined-Type Inguinal Hernia</td>
<td>66%</td>
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**Fig. 8:** Table 2 Diagnostic accuracy of sonography in determining the type of hernia.

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Conclusion

Sonography is highly accurate at diagnosing the presence and type of groin hernia. This accuracy improves with greater experience.
References


