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Original research

The role of ultrasound in the management of patients with occult groin hernias

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HIGHLIGHTS

- Ultrasound has a poor positive predictive value in diagnosing occult groins hernias.
- Study-to-study variations in diagnostic accuracy of USS for groin hernias are partly due to differences in patient selection.
- Lack of false negatives in our study suggests ultrasound may be a useful rule-out test for occult groin hernias.
- Interval reassessment of patients with equivocal ultrasound is recommended as they have a high incidence of hernias.

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ABSTRACT

Introduction: Groin ultrasound scanning is commonly used to examine patients with obscure groin pain or swelling. A recent study has shown ultrasound has a poor positive predictive value (PPV) in diagnosing groin hernias although earlier studies reported PPV values as high as 100%. Our aims were to calculate ultrasound's accuracy in diagnosing occult groin hernias in symptomatic patients and assess how management of these patients is affected by ultrasound result. **Methods**: We retrospectively analysed 375 symptomatic adult patients, who between February 2008 and March 2010, had ultrasound to diagnose groin hernias when clinical examination was inconclusive. Patients were identified on a prospective radiology database and all groin ultrasounds were performed by either one consultant radiologist or one radiographer. **Results**: Ultrasound was positive in 199 patients, of which 118 underwent surgery. Using operative findings as the gold standard, ultrasound's PPV for groin hernias was 70% (95% CI: 62–78%). Ultrasound was equivocal in 42 patients of which hernias were diagnosed in 7 of the 10 who had surgery. Ultrasound was negative in 151 patients of which none were later diagnosed with hernias during 3 years' median follow-up. **Conclusion**: Ultrasound is poor in diagnosing occult groin hernias with a PPV of 70% suggesting a 30% chance of negative groin exploration. The equivocal ultrasound group requires careful follow-up as a considerable number were later diagnosed with hernia. The absence of subsequent hernia diagnosis in the negative ultrasound group suggests it may be a useful rule-out test to exclude occult groin hernias in symptomatic patients.

1. Introduction

Inguinal hernias are usually diagnosed electively by a reducible groin mass in patients presenting with a groin lump and/or discomfort. Diagnostic radiological imaging may be required in patients with inconclusive clinical examination. Herniography was the radiological technique of choice for hernia diagnosis but has been superseded by ultrasonography which has advantages of being inexpensive, non-invasive, contrast-free, and dynamically able to demonstrate a cough impulse. The European and British Hernia Societies recommended ultrasound (USS) as the primary imaging modality to be used as an adjunct to physical examination in occult groin hernia diagnosis [1,2]. Historically, the reported positive predictive values (PPV) of USS in occult hernia diagnosis have been high in the range of 94–100% [3,4], but the most recently published study reports a more conservative PPV of 73% in diagnosing occult groin hernia [5]. Our primary objective was to determine the diagnostic accuracy of USS for occult groin hernias. Our secondary

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objective was to analyse the subsequent management and outcomes of patients depending on whether the result of USS for groin hernias was positive, negative or equivocal.

2. Method

Our CRIS (Computerised Radiology Information System) database identified 379 adult patients who, between February 2008 and March 2010, had USS scans to diagnose groin hernias. All the patients had history suggestive of hernia but inconclusive clinical examination leading to groin ultrasonography, either unilateral or bilateral. Most USS were requested after patients were examined in the outpatient clinic but a few were requested by general practitioners (GPs) prior to examination by a surgeon in outpatient clinic. Of the patients whose USS were requested by GPs prior to outpatient clinic attendance, we excluded four patients whose clinic examination in outpatient suggested a clinically obvious hernia. The resulting final cohort size was 375 patients. Details of clinical course following ultrasonography were obtained from the hospital records. A dedicated consultant radiologist or ultrasonographer scanned patients with a linear array probe 8–15 MHz on a superficial musculoskeletal setting, supine or erect, using Valsalva manoeuvres to identify groin hernias by direct of a sac or a positive cough impulse.

Logistic regression was used to assess the relationship between hernia presence and potential predictor variables: age, gender, presenting symptoms, previous surgery, and requestor of ultrasound. The Hosmer–Lemeshow goodness-of-fit test was used to assess the adequacy of the logistic regression models. Results were significant if two-sided p-value was $\leq$0.05 with 95% confidence intervals. All analyses were undertaken using STATA version 12 (StataCorp. 2011, Stata Statistical Software Release 12.0. College Station).

3. Results

Descriptive data are summarised in Table 1 and Fig. 1. The consultant radiologist performed 75% of the USS and the ultrasonographer 25%. Follow-up details were available for a median of 3.10 (min 1.80, max 4.90) years after USS. The cohort size of 375 patients is exceeded by the sum total of patients in the positive, negative and equivocal USS groups because 17 patients were represented in 2 of the groups after bilateral groin USS yielded different results in either groin.

3.1. Positive USS

3.1.1. Patients with positive USS who underwent surgery

Descriptive data are summarised in Table 1. The PPV of USS for groin hernia diagnosis was 0.70 (95% CI 0.62–0.78). The accuracy of USS at distinguishing inguinal from femoral hernias was 0.95 (95% CI 0.89–0.99), with 2 inguinal and 2 femoral hernias being mislabelled (Table 2).

All 66 groin hernias detected at open surgery were repaired with mesh, with the exception of 3 femoral hernias. Of the 20 patients with no hernia detected at open surgery, mesh was used to reinforce the deep inguinal ring of 7 patients (8 groins) and the femoral ring of 1 patient (1 groin).

At intended laparoscopic hernia repair in 39 patients, no hernia was detected in 10 patients. Of the 10 patients with no hernia at laparoscopy, total extra-peritoneal (TEP) repair was intended in 6 patients (11 groins) and trans-abdominal pre-peritoneal (TAPP) repair in 4 patients (5 groins). Mesh was used to reinforce the myopectineal orifice in 3 patients (3 groins) out of the 10 with no hernia detected at laparoscopy. Laparoscopic hernia repair in the other 29 patients was done by TEP repair in 17 patients (24 groins), TAPP repair in 11 patients (14 groins), while the final patient had unilateral TAPP repair followed 3 months later by contralateral groin TEP repair. This final patient had bilateral hernias which could not both be repaired at the initial operation and the contralateral repair was performed by a different surgeon, hence the difference in technique.

In cases of positive groin ultrasound, the odds of hernia being present at surgery were increased by presentation with pain (OR = 2.08 vs. no pain; 95% CI 0.72 to 5.98; $p = 0.175$) and age $\geq$65 years (OR = 1.9 vs. age <65 years; 95% CI 0.76 to 4.79; $p = 0.171$). Soft tissue diagnoses at groin exploration in 13 of the 30 patients with false positive USS were lipoma of spermatic cord ($n = 11$), lipoma of round ligament ($n = 1$), and lymphadenopathy ($n = 1$).

3.1.2. Positive USS and no surgery

Surgery was not performed on 81 patients with positive USS for the following reasons: symptomatic improvement at follow-up ($n = 69$), hernia absent on repeat imaging ($n = 6$), unfit for surgery ($n = 3$), diagnosis of neuropathic pain ($n = 2$), or a lack of perceptible hernia on subsequent re-examination of the patient ($n = 1$). Repeat imaging was by MRI ($n = 2$), CT ($n = 2$), or USS ($n = 2$). Of the 3 patients unfit for surgery, one was never offered surgery due to his poor general health while the other two had planned surgery cancelled due to per-operatively diagnosed transient ischaemic attack ($n = 1$) or hypertension ($n = 1$).

3.2. Negative USS

These patients were discharged after uneventful clinic follow-up ($n = 134$), referred to other clinics ($n = 16$) or had surgery for non-hernia lesions diagnosed on USS ($n = 1$). Most referrals were made to the pain clinic for neuropathic pain ($n = 10$) and all these

Table 1
Summary of descriptive patient data.

	Positive ultrasound	Negative ultrasound	Equivocal ultrasound
Total patients (m, f)	199 (156m, 43f)	151 (106m, 45f)	42 (37m, 5f)
Median age (range)	52 years (min 21, max 89)	51 years (min 17, max 85)	54 years (min 19, max 88)
Presenting symptom (% of patients in group)	Pain (73%), Lump (27%)	Pain (76%), Lump (24%)	Pain (79%), Lump (21%)
Ultrasound requestor (% of patients in group)	Surgeon (71%), GP (29%)	Surgeon (75%), GP (25%)	Surgeon (79%), GP (21%)
Patients operated (groins, bilateral cases)	118 patients (141 groins, 23 bilateral)	None	10 patients (10 groins, 0 bilateral)
Median time (range) from USS to surgery	169 days (min 2, max 993)	Not applicable	201 days (min 108, max 928)
Patients (groins) with hernia at surgery	88 patients (104 groins)	Not applicable	7 patients (7 groins)
Hernias at surgery	75 unilateral inguinal 15 bilateral inguinal 13 unilateral femoral 1 bilateral femoral	Not applicable	6 unilateral inguinal 1 unilateral femoral
Recurrent hernias	10 unilateral inguinal 2 unilateral femoral	Not applicable	5 unilateral inguinal
Prior ipsilateral hernia surgery (% of patients in group)	30 patients (15%)	41 patients (27%)	19 patients (45%)