

# The use of ultrasound in the diagnosis of abdominal wall hernias

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Received: 27 August 2004 / Accepted: 22 March 2007 / Published online: 26 April 2007  
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## Abstract

**Background** The diagnosis of abdominal wall hernias is not always straightforward and may require additional investigative modalities. Real-time ultrasound is accurate, non-invasive, relatively inexpensive, and readily available. The value of ultrasound as an adjunctive tool in the diagnosis of abdominal wall hernias in both pre-operative and post-operative patients was studied.

**Study design** Retrospective analysis of 200 patients treated at the Hernia Institute of Florida was carried out. In these cases, ultrasound had been used to assist with case management. Patients without previous hernia surgery and those with early and late post-herniorrhaphy complaints were studied. Patients with obvious hernias were excluded. Indications for ultrasound examination included patients with abdominal pain without a palpable hernia, a palpable mass of questionable etiology, and patients with inordinate pain or excessive swelling during the early post-operative period. Patients were treated with surgery or conservative therapy depending on the results of the physical examination and ultrasound studies. Cases in which the ultrasound findings influenced the decision-making process by confirming clinical findings or altering the diagnosis and changing the treatment plan are discussed.

**Results** Of the 200 patients, 144 complained of pain alone and on physical exam no hernia or mass was palpable. Of these 144 patients with pain alone, 21 had a hernia identified on the US examination and were referred for surgery.

The 108 that had a negative ultrasound were treated conservatively with rest, heat, and anti-inflammatory drugs, most often with excellent results. Of the 56 remaining patients who had a mass, with or without pain, 22 had hernias identified by means of ultrasound examination. In the other 34, the etiology of the mass was not a hernia.

**Conclusions** Abdominal wall ultrasound is a valuable tool in the scheme of management of patients in whom the diagnosis of abdominal wall hernia is unclear. Therapeutic decisions can be influenced by the ultrasound findings that can provide more efficient and economical treatment by expediting their clinical management.

**Keywords** Hernia · Diagnosis · Ultrasound · Management

## Introduction

History and physical examination are the primary methods for diagnosis of abdominal wall hernias. There are, however, certain clinical situations in which examination may be limited because of local tenderness or body habitus. The diagnosis of hernia may be in doubt. Additional investigative modalities may be used to help with clinical decisions.

Diagnostic tests that may be used include plain radiography, herniography, ultrasound (US), computed tomography (CT) scan, and magnetic resonance imaging (MRI). Advances in these technologies, such as helical or spiral CT scans, dynamic MRI, and high-resolution US have increased the accuracy of the diagnosis of hernias to over 97% [1, 2]. Real-time US is accurate, non-invasive, relatively inexpensive, and readily available. The value of US as an adjunctive tool in the diagnosis of abdominal wall hernias was studied in patients who had undergone previous surgery and in those who had not.

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## Methodology

Retrospective analysis of 200 patients treated at the Hernia Institute of Florida from 2000 to 2003 was carried out. In these cases, US had been used to assist with case management.

Indications for US examination included patients with abdominal pain without a palpable mass and patients with a palpable mass with or without pain, where the diagnosis of hernia was questionable. Patients were separated into primary and post-operative groups and into other groups depending on the location of the problem—inguinal and femoral problems were grouped as groin location (groin), while epigastric, umbilical, incisional, and Spigelian hernias were included in the abdominal location problems. They were also sub-grouped according to their complaints—pain alone or a mass with or without pain. The US studies were done in the office, in the hospital, or in the outpatient diagnostic center. US done in the office was performed by a certified US technician using 5- and 7-MHz transducers and an Acuson 128 machine (Acuson, Mountain View, CA). Patients were studied in the supine and standing positions, with and without Valsalva maneuvers. The treating surgeon was present during the studies done in the office or had communication with the radiologist or technologist regarding cases done elsewhere.

A positive US reading included cases with clear-cut hernias, small herniating lipomas, and other diagnoses such as a mass, seroma, hematoma, or lymphadenopathy. A negative US was defined as a study that did not show any abnormality in the area examined. Results of the US examinations were correlated with the response to treatment. The value of US was determined for different clinical situations. Data was compiled and analyzed using Microsoft Access database and SPSS analysis software (SPSS, Chicago, IL).

## Results

The median age was 47 years—the patients were grouped by gender (Table 1) and location of symptoms (Table 2). There were 149 patients in the groin group, of which 54 had prior surgery and 95 were primary (Table 3). There were 51 patients in the abdominal group, of which 28 had prior surgery and 23 were primary.

**Table 1** Age and gender—200 patients

Age	15–40 years	41–60 years	61–90 years
Male (131)	58	64	9
Female (69)	15	23	31
Total	73	87	40

**Table 2** Location of symptoms

	Primary	Post-operative	Total
Groin	95	54	149
Abdominal	23	28	51
Total	118	82	200

**Table 3** Types of symptoms

	Pain	Mass	Total
Groin (149)			
Primary	73	22	95
Post-operative	43	11	54
Total groin	116	33	149
Abdominal (51)			
Primary	14	9	23
Post-operative	14	14	28
Total abdominal	28	23	51
All locations	144	56	200

## Patients with pain

### Groin location

There were 116 patients in the groin group with pain as their only symptom—73 were primary and 43 had prior surgery. Of the 73 *groin* patients with pain alone and no prior surgery, 50 (68%) had a negative US, 11 (15%) had an US that identified a hernia, and 12 (17%) had a small herniating lipoma (lipoma). Of the 43 with pain alone and a history of prior surgery, 36 (84%) had a negative US, 4 (9%) had an US that identified a hernia, and 3 (7%) had a lipoma (Table 4).

**Table 4** Ultrasound results—patients with pain—(144)

	Groin (116)		Abdominal (28)	
	Primary (73)	Post-operative (43)	Primary (14)	Post-operative (14)
Negative	50	36	9	13
Hernia	11	4	5	1
Lipoma	12	3		

### Abdominal location

In patients from the abdominal group with pain alone, there were 14 primary and 14 that had prior surgery. Of the 14 primary *abdominal* patients with pain, 9 (64%) had a negative US, and 5 (36%) had an US that identified a hernia. However, of the 14 post-surgery patients with pain, only 1 (7%) had an US that identified a hernia.

### Combined groin and abdomen group

In this group of patients with pain alone, 75% (108 of 144) had a negative US and were treated conservatively with rest, anti-inflammatory medication, and local heat. Depending on the severity of the pain, all patients returned to work (light duty progressing to regular duty) or regular activities after their pain diminished. None of these patients required surgery during the 6-month period following the negative US.

### Positive ultrasounds

There were 36 patients in total in the pain group who had a positive US (Fig. 1)—21 had a hernia and 15 a lipoma (Table 4). Surgery was recommended without delay for the patients with hernias. Of the 21 patients, 20 had surgery, and a hernia was identified in the operating room in all cases. One patient with a small, minimally symptomatic hernia elected not to have an operation. The 15 patients with a small herniating lipoma were initially managed conservatively. Of these patients, 3 returned with persistent pain and went on to have surgery. The operative findings in these patients confirmed the presence of a lipoma. In two of these patients a small hernia was also noted. The remainder returned to normal activity and did not require surgery.

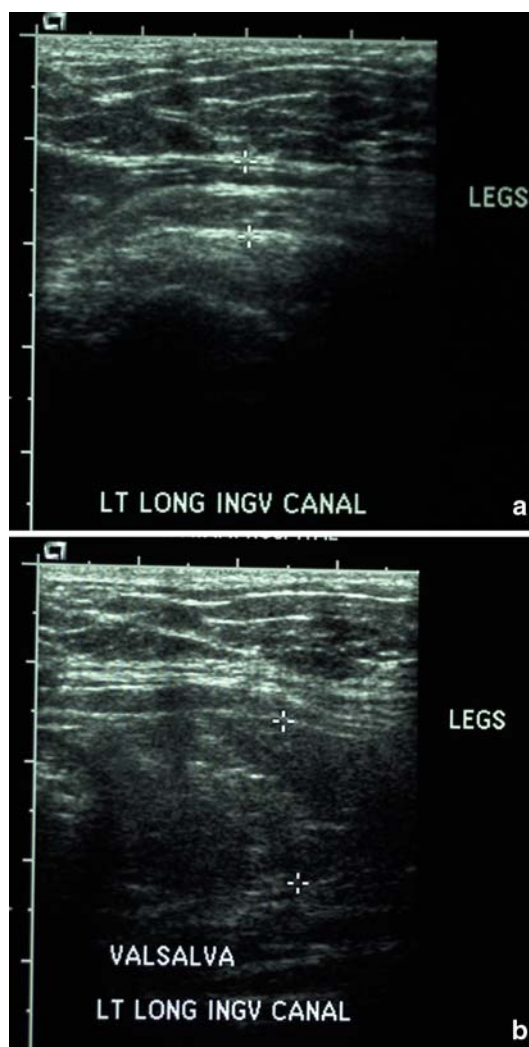
### Negative ultrasounds

All patients with a negative US returned to work (light duty progressing to regular duty) or regular activities after their pain diminished. None of these patients required surgery during the 6-month period following the negative US.

## Results—patients with a mass

### Groin location

In the groin group, there were 33 patients with a mass—22 were primary and 11 had prior surgery. Of the 22 with a mass and no prior surgery, 12 (54%) had a hernia, 7 (32%) had lymphadenopathy (Fig. 2), 1 a varix, and 2 had a negative US. Of the 11 patients with a mass and a history of prior surgery, 4 had a hernia, 4 had lymphadenopathy,



**Fig. 1** Inguinal ultrasound at rest and with Valsalva. Note separation of external oblique and floor with Valsalva

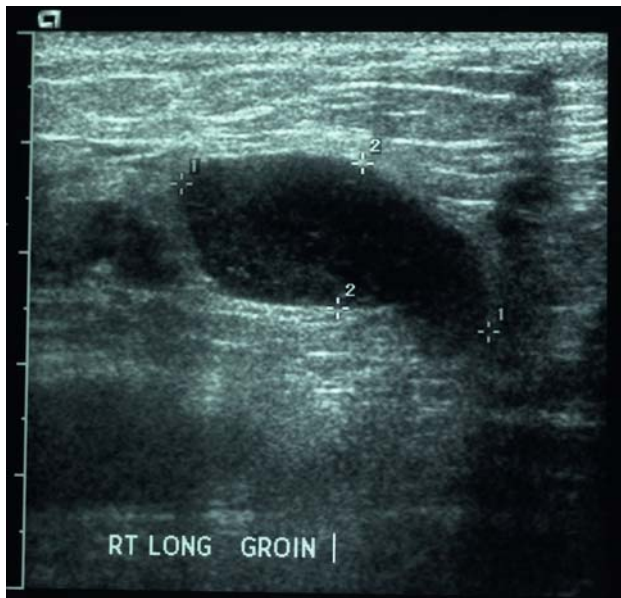
1 (5%) some thickened scar, and 2 (9%) had a negative US (Table 5).

### Abdominal location

In 23 patients from the abdominal group with a mass, there were 9 primary and 14 who had prior surgery. Of those 9 primary patients with a mass, 6 (68%) had a negative US and 3 (33%) had a hernia. Of the 14 post-surgery patients with a mass, there were 7 (50%) who had a negative US. Recurrent hernias were identified in 3 (21%) at least 6 months following their repair. Seromas were identified and aspirated in 4 (29%) patients at less than 3 months post-operatively.

### Combined groin and abdomen

Of 31 (45%) primary patients with a mass, 14 had a hernia identified and had surgery. In the post-operative group,



**Fig. 2** Right groin lymph node

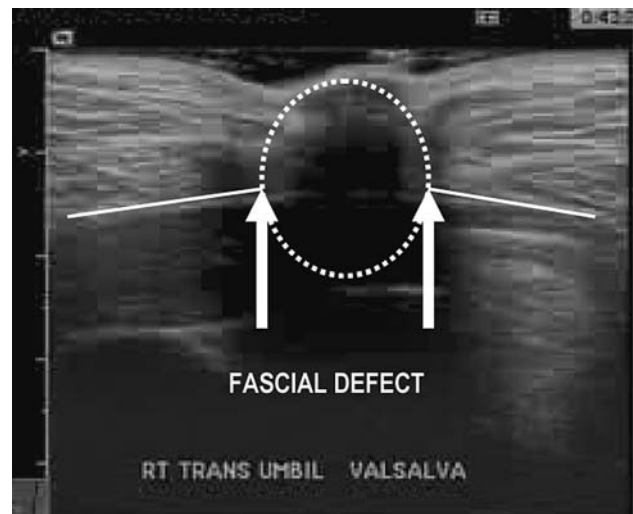
only 7 of 25 (28%) had hernias. Other positive findings included lymph nodes and a varix in the groin and 4 patients with early post-operative seromas that were successfully aspirated.

**Discussion**

There are several clinical situations in which the diagnosis of abdominal wall hernias may be difficult, and other diagnostic modalities can be helpful [1, 2]. Although plain X-ray is readily available, it is generally of limited clinical value in determining the presence of a hernia that is not easily felt on physical examination. CT scan and MRI can be helpful in situations where a defect or protuberance is present, but provocative studies such as spiral CT or dynamic MRI with a Valsalva maneuver are needed to identify hernias that may not be evident in the resting supine position. CT and MRI are more expensive studies and are often more difficult to certify and schedule.

The use of US in these situations was described by Spangen in 1975 [3]. US is able to clearly delineate the layers of

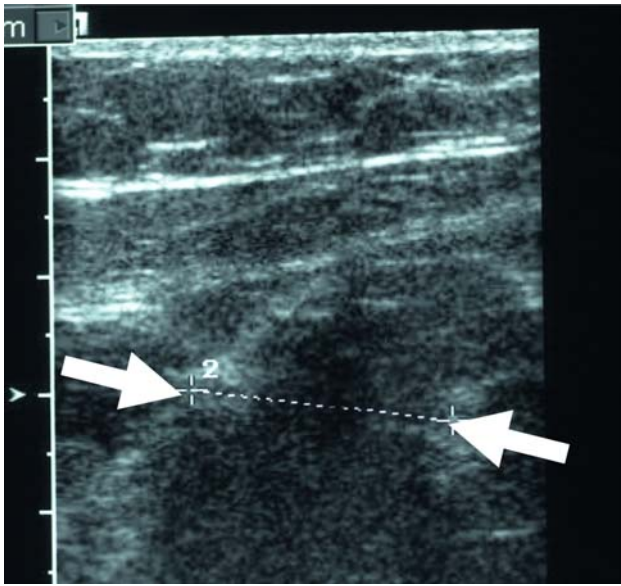
muscle and fascia of the abdominal wall (Fig. 1). Initially, US techniques used gray scale technology, which limited the output to static images or “snapshots” of the area studied. Real-time US technology allows dynamic visualization of the inguinal canal, so the motion of the muscles can be seen and hernias can be observed traversing down and through the defect, separating the anterior external oblique layer from the floor of the inguinal canal (Fig. 1). Arregui [4] and Korenkov [5] pointed out that the addition of color-flow Doppler with visualization of the deep epigastric and femoral vessels can help to distinguish between direct and indirect hernias. US can also differentiate fluid-filled masses from true hernias in cirrhotic patients [6] and identify epigastric hernias in obese patients [7] and umbilical (Fig. 3) and Spigelian hernias as well (Fig. 4). US can also detect visceral adhesions after mesh has been placed in the intra-peritoneal position for ventral and incisional hernia repair [8]. US may also be useful to check for additional hernias when planning abdominal hernia surgical procedures, particularly large or multiple recurrent hernias. In our experience, to be of maximum benefit, the US exam should be done with a Valsalva maneuver, with the patient standing as well as supine. It is helpful to write “with Valsalva” on the



**Fig. 3** Umbilical hernia. Note fat (within circle) protruding through the defect in the fascia

**Table 5** Ultrasound results—patients with a mass—(56)

	Groin (33)		Abdominal (23)	
	Primary (22)	Post-operative (11)	Primary (9)	Post-operative (14)
Negative	2	2	6	7
Hernia	12	4	3	3
Lymph nodes	7	4	–	–
Varix/scarring	1	1	–	–
Seroma	–	–	–	4



**Fig. 4** Spigelian hernia

prescription and instruct the patient to discuss this with the technician when he goes for the study. The presence of the physician during the study or personal communication with the technician or radiologist is also recommended.

The results of our study indicate that there are certain clinical situations in which US can be of increased benefit in assisting the physician in making decisions:

- Patients with pain, no mass, and a negative US can be managed conservatively with confidence that no hernia is present.
- Patients with pain, no palpable hernia, and a hernia present on US can be recommended to have surgery without delay.
- Patients with groin pain and a small herniating lipoma can be initially treated with conservative management which will usually be successful. Many of these patients have pain due to causes other than the small herniating lipoma, such as muscle sprains. If pain persists, surgery can be recommended.

- Patients with a mass of uncertain diagnosis who show a hernia on US can be treated with surgery. In other cases, problems such as lymph nodes, vascular malformation, testicular or cord abnormalities, or seromas and hematomas can be identified and appropriately managed.

## Conclusions

Abdominal wall and groin US is a valuable tool in the diagnosis and management of hernias in patients whose physical examination may be limited by pain or body habitus. US is non-invasive, accurate, reliable, relatively inexpensive, and readily available. Therapeutic decisions may be influenced by US findings resulting in more efficient patient treatment and cost savings.

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