Role of Imaging in the Diagnosis of Occult Hernias

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**IMPORTANCE** Occult hernias are symptomatic but not palpable on physical examination. This is more commonly seen with inguinal hernias. Early diagnosis and treatment of occult hernias are essential in relieving symptoms and improving patients’ quality of life.

**OBJECTIVE** To determine the effectiveness of imaging—ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI)—in the diagnosis of occult inguinal hernia.

**DESIGN, SETTING, AND PARTICIPANTS** A retrospective medical records review of surgical patients with groin and pelvic pain, 2008-2013, was conducted in a single-surgeon hernia specialty practice. Thirty-six patients met the following inclusion criteria: (1) examination findings suggestive of but not necessarily diagnostic for inguinal hernia; (2) imaging of the groin and/or pelvis with US, CT, and MRI; and (3) an operation to address the groin or pelvic pain. Fifty-nine groins were included.

**MAIN OUTCOMES AND MEASURES** Sensitivity, specificity, and predictive values of US, CT, and MRI for detection of occult inguinal hernia.

**RESULTS** The number, sensitivity, specificity, positive predictive value, and negative predictive value of each modality were, respectively: US (9, 0.33, 0, 1.00, and 0), CT (39, 0.54, 0.25, 0.86, and 0.06), and MRI (34, 0.91, 0.92, 0.95, and 0.85). Among multiply imaged groins in which CT examination missed a diagnosis of hernia, MRI correctly detected an occult hernia in 10 of 11 cases (91%).

**CONCLUSIONS AND RELEVANCE** Ultrasonography and CT cannot reliably exclude occult groin abnormalities. Patients with clinical suspicion of inguinal hernia should undergo MRI as the definitive radiologic examination.

Published online August 20, 2014.

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mal and efficient use of imaging to precisely diagnose hidden hernias among patients with chronic groin and/or pelvic pain.

Methods

A retrospective review of medical records was performed for all patients referred to a hernia-centric specialty surgical practice from January 1, 2008, to December 31, 2013. This study was approved by the Cedars-Sinai Medical Center institutional review board; a waiver of informed consent was provided. Inclusion criteria included all patients with (1) examination findings suggestive of but not necessarily diagnostic for inguinal hernia (eg, no palpable inguinal defect or reducible mass); (2) imaging of the groin and/or pelvis with US, CT, and MRI; and (3) an operation to address the groin or pelvic pain. Demographic and physical examination findings were recorded. All imaging studies were independently analyzed by study staff (J.M. and R.S.) without knowledge of the operative findings.

Sensitivity, specificity, and positive and negative predictive values for diagnosis of occult inguinal hernia were calculated for each imaging modality (US, CT, and MRI). In circumstances of missed diagnosis of occult inguinal abnormalities when multiple imaging studies had been performed, a comparison was made to determine the ideal modality for evaluation.

Results

During the study period, 322 patients were evaluated for groin or pelvic pain suggestive of inguinal abnormalities. Of these, 224 patients underwent surgical exploration of at least 1 inguinal region. Seventy-six patients (126 inguinal regions) met all of the inclusion criteria: clinical suggestion of inguinal hernia, preoperative imaging, and surgical exploration. The mean patient age was 53.1 years with a male to female ratio of 1.0:1.4. Among these patients, 36 individuals (47%) presented without typical physical examination findings of inguinal hernia (ie, no palpable inguinal defect or reducible mass), representing 59 inguinal regions (47%). This subset of individuals with potential hidden hernias had a mean age of 48.5 years and male to female ratio of 1.0:3.0.

Of the 126 inguinal regions evaluated with preoperative imaging, 18 US studies, 99 CT studies, and 45 MRI studies were acquired. Magnetic resonance imaging demonstrated the greatest sensitivity, specificity, and negative predictive value (Table 1). Positive predictive values were comparable. The only patient with false-positive MRI findings was found to have a surgically correctable abnormality at exploration (fascial tear of external oblique), and no inguinal hernia was observed.

Among the 59 inguinal regions that lacked typical physical examination findings diagnostic of inguinal hernia, 9 US studies, 39 CT studies, and 34 MRI studies were acquired. Magnetic resonance imaging remained the most sensitive imaging study for diagnosis of occult inguinal hernia (Table 2). A total of 19 inguinal regions without typical examination findings for hernia were evaluated by more than 1 imaging modality. Of the studies with false-negative CT results, MRI evaluation resulted in correct (true positive) identification in 10 of 11 groins (91%) (Figure 1 and Figure 2).

Discussion

Most patients with symptomatic inguinal hernias do not require preoperative imaging because physical examination find-
The current recommendation for the treatment of occult groin or pelvic pain without diagnostic imaging findings is watchful waiting. Most patients are offered trials of nonsurgical options, such as pain management, physical therapy, and hormonal suppression for some women. This practice relies on the supposition that US or CT imaging is diagnostic for groin abnormalities and that no further intervention is necessary if the results are negative. In our practice, which is a referral center exclusively for hernia-related conditions, we commonly see patients with extensive prior workup consisting of multiple imaging studies with negative results collected over many years. Most of these patients have not been offered surgical exploration, which may have definitively treated their chronic groin and pelvic pain. In our experience, MRI has allowed us to more accurately diagnose inguinal hernias in these patients and offer curative herniorrhaphy.

Analysis of our experience confirms this suspicion. Magnetic resonance imaging is by far the most sensitive, specific, and reliable modality to diagnose inguinal hernias; some authors have suggested that, although MRI is likely more effective than the alternative imaging techniques, the theoretical improvement is not enough to justify the increased expense.
line diagnostic tool for patients with typical physical examination findings of inguinal hernias, but it is of poor reliability for evaluating any patient with a possible occult hernia.

Based on our results, we recommend that patients with clinical suspicion of inguinal hernia, without typical physical examination findings, undergo MRI (Figure 3). Certainly, if clinical suspicion exists in light of negative US and/or CT scan results, MRI should be pursued because other modalities are not reliable in the evaluation of hidden hernias.

Our practice is relatively skewed in its patient population because it serves as a referral center for patients with chronic inguinal and pelvic pain of unknown causes. For example, a larger-than-expected proportion of our patients have occult hernias. Also, we have significantly more women than expected in a hernia practice. The typical male to female ratio of patients with inguinal hernias in the United States is 7:1.0. Our hernia practice at large has a mean ratio of 1.0:1.4, and, notably, hidden hernias among our population are 3 times more commonly seen among women (ratio, 1.0:3.0).

The strength of our study lies in the additional data provided regarding the comparison of imaging modalities in the underdiagnosed population of patients with hidden hernias. Patients referred to us often have undergone multiple imaging studies performed over many years, with the associated delay in diagnosis resulting in additional cost to both the patient and society. In these situations, MRI would be a cost-efficient modality in patients with groin or pelvic pain with occult causes, reducing the time to diagnosis, treatment, and cure. Although our study population allows for evaluation of the effectiveness of imaging in occult inguinal hernias, this necessarily limits the application of our findings to patients outside of this narrow group.

Conclusions
Hidden hernias are nonpalpable hernias, more commonly seen among women. The primary symptom is pain, without a noticeable bulge. Ultrasonography and CT do not reliably detect hidden hernias. Patients with clinical suspicion of an inguinal hernia should undergo imaging, with MRI as the most sensitive radiologic examination. If results of US or a CT scan are negative for inguinal hernia, then MRI should be performed to definitively rule out hernias.

ARTICLE INFORMATION
Accepted for Publication: March 10, 2014.
Published Online: August 20, 2014.

Author Contributions: Dr Miller had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Miller, Towfigh.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Miller, Towfigh.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Miller, Michael, Towfigh.
Administrative, technical, or material support: Cho.
Study supervision: Saauf, Towfigh.

Conflict of Interest Disclosures: None reported.
Previous Presentation: This paper was presented at the 85th annual meeting of the Pacific Coast Surgical Association; February 15, 2014; Dana Point, California.

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