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ORIGINAL ARTICLE

Recommendations for the diagnosis of occult inguinal hernias using a modified Delphi technique

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Abstract

Background Occult inguinal hernias are inguinal hernias that are not felt on physical exam but can often be seen on imaging. Their diagnosis can be challenging, leading to unnecessary surgeon referrals, undue patient stress, and even unneeded surgery. The aim of this project was to develop recommendations for the diagnosis of occult inguinal hernias using a modified Delphi technique.

Methods Iterative rounds of surveys were administered to an expert panel of surgeons and radiologists. Panelists were asked to rate potential hernia-related topics by levels of importance. Items with 80% agreement were included for further discussion. Panelists were asked to provide their opinion on each included subject. A virtual meeting was conducted to discuss areas without agreement and determine final recommendations.

Results Three surgeons and five radiologists participated. There was strong agreement that dynamic ultrasound is a good first/confirmatory imaging choice. There was agreement that the radiology reports for studies assessing inguinal hernias should include hernia contents (80%) and hernia size (100%). Information that should be provided to the radiologist when ordering an imaging study include indication for study, patient symptoms, prior hernia surgery. Items that should be included in a radiology report include whether the presence of an inguinal hernia was assessed, hernia contents, size of defect, +/- hernia type.

Conclusions This collaboration between surgeons and radiologists creates a diagnostic imaging pathway and standardizing imaging reporting which will be used to improve the diagnosis of occult inguinal hernias. Future studies testing these recommendations in a prospective study are warranted.

Keywords Hernia · Inguinal · Occult · Radiology · Imaging

Introduction

Inguinal hernias are one of the most common conditions treated by general surgeons [1]. Most inguinal hernias are diagnosed by physical exam, and no imaging is needed. However, the diagnosis of some inguinal hernias can be challenging by physical exam alone. This is often the case for very small inguinal hernias or on patients whose body habitus limits physical exam, such as those with obesity. Inguinal hernias that are unable to be detected by physical exam but are appreciated on radiographic imaging are known as occult inguinal hernias. It has been clearly demonstrated that imaging modalities can aid in the diagnosis of occult inguinal hernias [2, 3]. However, the use of frequent and widespread imaging in today's medicine has led to an increased frequency in the diagnosis of occult inguinal hernias. If these radiographic findings are not clinically significant and are asymptomatic, it could lead to excessive surgeon referrals from primary care providers, undue patient stress, and even unnecessary surgery. The best pathway for optimizing the diagnosis of occult inguinal hernias is unknown.

It has been established that surgeons and radiologists often interpret radiological studies differently [4]. For

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Table 1 Proposed discussion subjects on survey 1

(1) radiologic definition of an occult hernia
(2) criteria for diagnosing hernia
(3) size criteria for a hernia
(4) order of diagnostic tests
(5) best imaging modality
(6) what to include in radiology report:
(6a) contents
(6b) hernia size
(6c) location of hernia
(6d) absence of hernia

example, a radiologist may interpret fat in the inguinal canal as a hernia while a surgeon may see it as a cord lipoma. While radiologists have more training in interpreting imaging studies, surgeons have the advantage of being able to correlate imaging findings with clinical exam and intraoperative findings. We sought to improve the diagnosis of occult inguinal hernias in patients with a suspected inguinal hernia utilizing a modified Delphi process including experts in radiology and surgery.

Methods

Institutional review board approval was waived since no patients or patient data were used for this study. We used a modified Delphi method to develop recommendations for the diagnosis of occult inguinal hernias. The Delphi method is a well-established method of consensus building that uses iterative rounds of surveys among experts to achieve agreement [5]. An expert panel of surgeons and radiologists was invited to participate from a large academic medical center in Houston, Texas. Surgeons included were high-volume hernia surgeons. Radiologists were all attending radiologists with a focus on musculoskeletal radiology who had all authored previous publications in the radiographic diagnosis of hernia.

Online surveys were created using Google Forms™ and distributed to participants via email. The first survey included proposed subjects for discussion and asked participants to rate the importance of each on a 5-point Likert scale. These initial subjects were chosen by the study team (Table 1).

In addition, an open-ended question was included allowing participants to recommend further subjects. The results from the first survey were compiled and shared with participants via email. Items rated 4 or 5 (on a 5-point Likert scale) with 80% agreement were included for creation of our recommendations, and items not meeting our agreement cutoff were discussed at the virtual meeting to decide on inclusion. The second survey was distributed via email. It included open-ended questions asking each expert to provide their opinion on each subject determined through survey 1 (Table 2).

Following the conclusion of the surveys, a virtual meeting with participants was conducted to discuss results from both surveys. Results from both rounds of surveys were presented at the meeting. Subjects deemed most important from survey 1 and answers from survey 2 results were discussed and refined into recommendations. Agreement was defined as 80% agreement or more at the meeting. Any items not meeting our pre-determined agreement cutoff on the survey were discussed at the meeting to determine inclusion.

Results

Survey #1

Three surgeons and five radiologists completed the surveys.

There was agreement among the group that recommendations should include clear criteria for occult inguinal hernia diagnosis and suggest a best imaging modality for occult hernia detection. There was also agreement that the radiology reports should include hernia contents, hernia size, and hernia location. Three of the eight participants recommended additional subjects to discuss, which included providing clinical criteria when ordering a radiologic study, reporting fascial defect size of the hernia (diameter), and type of inguinal hernia (i.e. direct, indirect).

Survey #2

Eight participants (three surgeons, five radiologists) completed the second survey.

Our open-ended question format resulted in a broad variation of responses. In response to the probe "how do you determine if an occult inguinal hernia is present on imaging?" there was no single criteria mentioned by all respondents. Three of 8 of respondents mentioned using the presence of a hernia sac or indentation in the peritoneum, 3/8 mentioned the presence of intra-abdominal contents

Table 2 Questions included on survey 2

1) How do you determine if an occult inguinal hernia is present on imaging?
2) What is the best initial imaging study for diagnosing an occult inguinal hernia?
3) If a hernia cannot be detected on your initial imaging study (see question 2), what study do you recommend next?
4) Is it helpful to know any clinical information prior to reading an imaging study for an occult inguinal hernia? If so, what clinical information do you like to know?

herniating through the fascial defect, 1/8 mentioned change in measurements of inguinal area with and without Valsalva. Five of 8 respondents felt that ultrasound was the best initial diagnostic study for the diagnosis of an inguinal hernia, but the best second line imaging modality was not agreed upon by participants. Of these, 4/8 said CT should be next, 3/8 suggested MRI, 2/8 suggested ultrasound with Valsalva.

When asked what clinical information that should be provided to radiologist reading an imaging study, answers included whether a hernia is clinically present or absent (4/8), whether the patient is symptomatic (1/8), and clinical factors that predispose the patient to hernia development (prior surgery, hernia repair, obesity), (2/8).

Virtual meeting

The virtual meeting had a total of six participants (two surgeons, four radiologists). Participants who could not attend the meeting were asked to review recommendations after the meeting and agreement was confirmed through asynchronous review and feedback.

Survey 1 was addressed first. Radiologic definition of an occult inguinal hernia and criteria for diagnosis were combined into one recommendation. Size criteria for calling something an occult inguinal hernia was eliminated. All other items from survey 1 were ultimately included.

Next, the open-ended responses from survey 2 were displayed and discussed. The responses were compiled into recommendations (Table 3). All participants agreed to the recommendations shown in table. A pathway for determining which imaging modality to order when an occult hernia is suspected was created (Fig. 1).

Discussion

This is the first study to include experts in radiology and surgery in a collaborative effort to improve occult inguinal hernia diagnosis. The development of these recommendations using a modified Delphi technique is a step to creating a standardized approach for the diagnosis of occult inguinal hernias. While the traditional Delphi method uses iterative rounds of questions distributed among experts, we chose to modify it by including an in-person discussion at the conclusion of all surveys. The authors felt this was necessary to come to a final consensus and allowed for minor changes to the recommendations that were already decided on by the Delphi method. The goal of these diagnostic criteria is to improve in our diagnosis of occult inguinal hernias, which may serve to prevent unnecessary surgery and reduce patient stress. Given the substantial volume of inguinal hernia surgery performed, this has the potential to benefit a significant number of patients.

This agreement can provide some guidance on what to do with "hernias" detected incidentally. Hernias seen incidentally on non-dynamic imaging may not be true hernias. For example, a cord lipoma and an inguinal hernia are often read as the same thing. Per the criteria determined here, these should be classified separately. A dynamic study can be used to help differentiate a true occult hernia from a spermatic cord lipoma, normal spermatic cord fat, of a fatty inguinal canal. A dynamic study assessing for a hernia is performed with and without Valsalva. This can be done with an ultrasound, MRI or CT. However, in cases where a patient is asymptomatic, a dynamic study may not be necessary. It is still up to referring physicians or surgeons to determine

Table 3 Final recommendations for diagnosis of occult inguinal hernia

Criteria for diagnosis

- To determine presence of an occult inguinal hernia radiologically, there must be herniation of intrabdominal contents in the inguinal canal or a peritoneal reflection. If imaging is indeterminate (e.g. presence of fat in inguinal canal but unclear if intraabdominal origin or cord lipoma), a dynamic imaging study should be performed.

Imaging studies

- The best initial imaging study for patients with a suspected occult inguinal hernia—occult defined as no hernia on physical exam but suspected based on patient symptoms—is dynamic ultrasound (defined as an ultrasound with and without Valsalva maneuver). If results are indetermined due to a limited study, the dynamic ultrasound should be repeated with the help of another technologist or radiologist. If the results are still equivocal due to body habitus (e.g. obesity, contractures), a dynamic MRI should be performed. If there is suspicion of a femoral hernia based on on the ultrasound findings, MRI should be performed.

Clinical information to provide

- Clinical information that should be provided when ordering an imaging study for detection of an occult hernia includes:
  - o indication for ordering the study (i.e. rule out occult inguinal hernia)
  - o patient symptoms
  - o prior surgical history, particularly inguinal hernia repair

Radiology report

- Items that should be reported in the radiology report:
  - o Did you assess for an inguinal hernia? If yes, presence or absence of a hernia.
  - o Hernia contents
  - o Size of the defect, including 3 dimensions of hernia sac and 2 dimensions of fascial defect
  - o +/- hernia type (i.e. direct vs. indirect hernia) if using CT or MRI

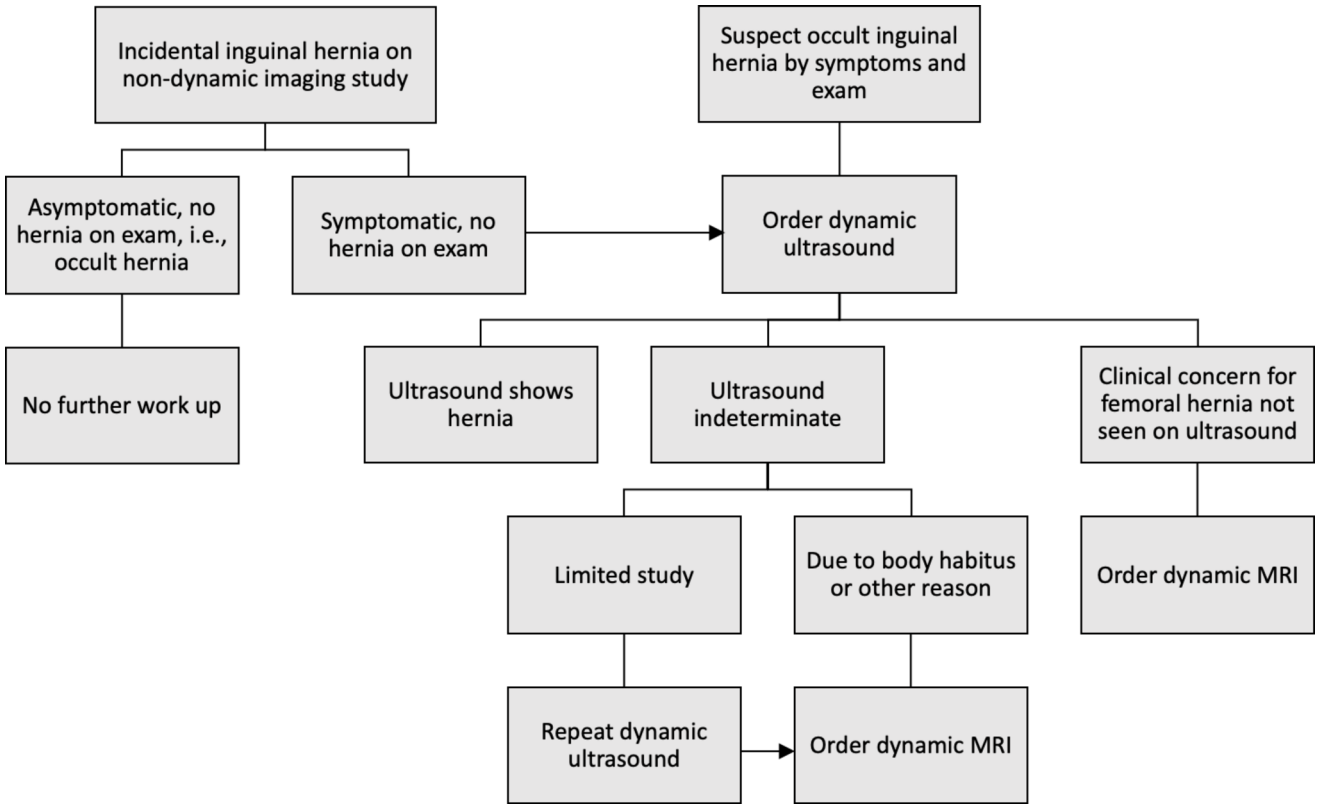

Fig. 1 Proposed diagnostic pathway for occult inguinal hernia diagnosis

when work up for a true occult hernia should be pursued. When indicated, a dynamic study (ultrasound or MRI) can be used to confirm or disprove the presence of a true occult inguinal hernia.

For symptomatic patients with a suspected occult inguinal hernia, this provides a diagnostic pathway for providers to follow. There is evidence to support this pathway. Reviews of imaging modalities for the diagnosis of occult inguinal hernias have been previously done. A 2013 systematic review compared herniography, ultrasound, and CT scan [2]. This review concluded that herniography, a technique where iodinated contrast is injected into the peritoneal cavity, was the most accurate modality for detecting occult inguinal hernias, with a sensitivity and specificity of 91% and 83%, respectively [6]. However, herniography is invasive and rarely used today. The second most accurate modality in this review was ultrasound, with sensitivity 86% and specificity 77%. A similar review in 2020 compared ultrasound, CT, and MRI for the diagnosis of inguinal hernias [3]. This study also showed ultrasound to be the most sensitive and specific imaging modality; however, the authors expressed concerns that ultrasonography can be user dependent. These results are in line with the conclusions from this study. Dynamic ultrasound, with and without a Valsalva maneuver, was agreed by surgeons and radiologists to be a best first imaging study. After ultrasound, evidence suggests that MRI is the next best study [7].

For femoral hernias, dynamic ultrasound is still the first initial imaging study recommended, but there was concern among the panel that femoral hernias could be missed by ultrasound. MRI has been shown to be much more sensitive and specific for the detection of occult hernia compared to ultrasound or CT [7]. Therefore, the authors recommend proceeding to MRI rather than repeating dynamic ultrasound when there is clinical concern for a femoral hernia. In addition, MRI can be performed as a dynamic study.

These recommendations emphasize the importance of using clinical information to guide imaging. Communication between surgery and radiology is a key step in improving our treatment of this problem. Radiologists can make a more accurate diagnosis if they have relevant clinical information [8, 9]. Too often in practice, this step is omitted [10]. Radiologists in this study usually receive minimal information, such as the ICD-10 code, as a reason for study. The accuracy and usefulness of these ICD-10 codes is highly variable depending on who ordered the study. Even when clinic notes are sent, they can get lost. The recommendations created here will help clarify what information is most useful to the radiologist interpreting the imaging study and provide physicians with a template for a concise summary to provide. Some electronic medical records allow questions

to be built in when a study is ordered. This could be utilized to streamline the ordering process and ensure that relevant information is always communicated. In addition, radiologists can use this to know what surgeons are looking for in a report on a study that they order for this indication. This agreement highlights the importance of good communication between specialties.

There are several limitations to this study. These recommendations are intended to help the clinician in determining an appropriate pathway for identifying occult inguinal hernias through imaging. However, these have not been evaluated in a trial setting. Future studies are needed to see if their use affects outcomes such as cost, patient satisfaction, and surgical outcomes. In addition, there are many experts not included in the creation of these recommendations. We chose to conduct this as a single institution study with plans to test out this algorithm prior to studying in a larger setting. The included physicians represent a wide variety of skill and experience in their various fields. Finally, these recommendations do not address the best management of occult inguinal hernias once detected. Future studies are needed on the clinical significance and best management strategies for these hernias.

Conclusions

This collaboration between surgeons and radiologists creates a diagnostic imaging pathway and standardizing imaging reporting which will be used to improve the diagnosis of occult inguinal hernias. There was strong agreement that dynamic ultrasound is a good first imaging choice. In addition, standardized pre-imaging clinical information should be provided by surgeons to radiologists, and radiologists should be sure to include certain items in their reports. Further studies are needed to test and validate these recommendations, including correlating this diagnostic approach to intraoperative findings. These are not intended to be definitive guidelines, as guidelines generally created by societies and involve many people. These are merely recommendations that can be used as a starting point for future study of this challenging problem.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10029-024-03177-8.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Conflict of Interest Todd Wilson is employed by Endoquest. Jonah Stulberg is a consultant for Intuitive Surgical.

Disclosures This was presented at Academic Surgical Congress 2023 in Houston, TX.

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