The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 12, 2025

COMPARISION OF USG AND CT IN THE EVALUATION OF INGUINAL HERNIA

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DOI: https://doi.org/10.5281/zenodo.17987648

Keywords
Stress, Work-Life Balance, Emotional Intelligence, Ambulance personnel, Paramedics

Article History
Received: 19 October 2025
Accepted: 30 November 2025
Published: 19 December 2025

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Abstract

Background: *Inguinal hernia happens when an inguinal canal weakness allows abdominal contents, such as fat or bowel loops, to protrude. This condition accounts for up to 75% of all abdominal wall hernias, with a lifetime risk of approximately 27% in men and 3% in women. USG is the better modality for detecting inguinal hernia while CT is imperative for the detecting cross sectional images. Although ultrasound is commonly used, CT often provides greater sensitivity*

Objective: *To compare the diagnostic accuracy of computed tomography (CT) and ultrasound in the evaluation of Inguinal hernia in order to determine the more effective imaging method for each group.*

Methodology: *This cross-sectional analytical study was carried out over three months in the Department of Radiology, DHQ Hospital Rajan Pur. A total of 73 patients with suspected inguinal hernia, including both direct and indirect hernial patients underwent evaluation with ultrasound and contrast-enhanced CT to assess the diagnostic accuracy of each modality.*

Results: *A total of 73 patients were included, of which 31.5% were with direct hernia and 68.5% with indirect. Clinical symptoms showed no clinical difference between direct and indirect hernial groups ($p>0.05$). Ultrasound detected increased echogenicity in 80.8% patients. In comparison, CT showed higher detection: wedge-shaped hypodensity 74%, Overall, CT showed superior diagnostic accuracy, especially in hernial patients.*

Conclusion*: CT scan provides excellent diagnostic accuracy for inguinal hernia in both direct and indirect hernia patients, making it the preferred modality for definitive diagnosis. Ultrasound, while highly specific, shows lower sensitivity, particularly in diabetic patients, and is better suited as an initial screening tool.*

INTRODUCTION

An inguinal hernia occurs as a result of a weakened area within the inguinal canal allowing for abdominal contents, specifically fat or bowel loops, to protrude. Inguinal hernia accounts for approximately 75% of all abdominal wall hernias. The average lifetime risk of an inguinal

hernia is approximately 27% for men and 3% for women [1].

Clinical presentation includes a bulge in the groin area, pain or discomfort in the groin area which may worsen with movement. However, in some patients, particularly those who are obese, female patients and patients with atypical or very subtle symptoms, the diagnosis cannot be made purely based upon a physical examination. The use of imaging modalities is increasingly important in order to confirm a diagnosis, differentiate between various types of hernias, to identify common types of abdominal wall hernias, to assess the size of the defect in inguinal hernias, as well as directing surgical planning[2].

A direct inguinal hernia occurs when abdominal contents protrude through a weak area of the posterior wall of the inguinal canal and occurs medially to the inferior epigastric vessels. This type of hernia is usually acquired, and occurs most frequently in adults because of increasing age-related weakening of the transversalis fascia due to increasing intra-abdominal pressure. To accurately differentiate between a direct and indirect hernia, an ultrasound and computed tomographic scan is required to guide diagnosis and treatment. Inguinal hernia happens when an inguinal canal weakness allows abdominal contents, such as fat or bowel loops, to protrude. This condition accounts for up to 75% of all abdominal wall hernias, with a lifetime risk of approximately 27% in men and 3% in women [3].

A hernia in the indirect inguinal region occurs when contents inside the abdomen push through a part of the abdominal wall where the spermatic cord passes through called the deep (or internal) inguinal ring. A hernia is said to be indirect if it goes through both the

deep and superficial inguinal rings, often occupying space in the scrotum, or scrotal sac. Indirect hernias are typically lateral to the inferior epigastric vessels and are most commonly congenital in origin due to a failure to close the processus vaginalis, although these types of hernias may also develop later in life as well. The anatomical route and shared characteristics associated with it, as well as higher potential for clinical misdiagnosis, resulting from the use of ultrasound and/or CT (i.e., pioneering diagnostic tools) make accurate imaging of this type of hernia critical for establishing type of hernia and determining appropriate management of the hernia [4].

There are two types of imaging studies that can be performed for assessment of inguinal hernia: high-frequency ultrasound and computed tomography (CT). Ultrasound is usually the first choice of imaging for hernia assessment, as it does not expose the patient to ionizing radiation, is relatively low-cost, and is readily available. Most importantly, ultrasound allows for the ability to assess dynamic events in real-time (i.e., the sound technician can witness the hernia occurrence as the patient performs various provocative activities, such as standing and/or coughing). This ability to view the dynamic occurrence of a hernia is considered to be the benchmark for diagnosing a small reducible hernia sac that is protruding through both inguinal rings [5].

Multiple studies and meta-analyses continue to support the assertion that ultrasound is highly accurate in diagnosing inguinal hernia; the mean sensitivity and specificity rates for ultrasound exceed 90% across all settings examined, and these findings demonstrate that all patients with an indeterminate hernia should be evaluated using this modality (Robinson et al., 2013) [6].

A number of studies have discussed the differences in diagnostic performance of CT and ultrasound for the evaluation of inguinal hernias. Ultrasound has been shown to have better sensitivity in identifying small or occult hernias than CT but because of the reproducibility and improved resolution of anatomy, CT is often preferred for these more complex cases (Piga et al., 2020).However, CT has several disadvantages, including cost, limited availability in less-developed areas, exposure to ionizing radiation, and potential restriction of its routine use in younger patients and for repeated imaging [7].

Ultrasound has been shown to be an effective first-line investigation for the vast majority of patients because of its cost-effectiveness, safety, and availability; CT should only be considered when ultrasound results are inconclusive or the patient is suspected to have complications during a physical exam. The combination strategy

between both imaging modalities optimizes, improves diagnostic accuracy, minimizes unnecessary radiation exposure, and enhances preoperative planning [8].

It's not always easy to diagnose an inguinal hernia, especially in patients who are overweight or who have had a previous hernia issue. A physical examination may be unable to discover an inguinal hernia. This is where imaging, specifically ultrasound, plays a major role in allowing a healthcare provider to obtain a "live" view of the body without exposing the patient to radiation [9].

Most abdominal wall hernias are inguinal hernias, and accurate preoperative diagnosis is an essential part of guiding surgical care. Often, when patients are being considered for surgery, ultrasonography (USG) is the first imaging test to be used due to its dynamic nature, low cost, and lack of ionizing radiation. The reported sensitivity of USG in diagnosing inguinal hernias has varied; studies have indicated sensitivity for USG between 86-97%. On the other hand, computed tomography (CT) is generally not utilized as the first option for preoperative evaluation; however, it provides superior anatomic detail and is valuable in morbidly obese patients or patients with recurrent hernias or indeterminate findings from clinical and/or USG examinations. In the following sections, comparisons of USG and CT are made to clarify the diagnostic accuracy and utility of both imaging modalities in specific clinical scenarios [10].

When cases are complicated, or when an abnormal patient body habitus prohibits sufficient USG images, CT scans allow surgeons access to very high-quality cross- sectional images of the entire abdominal wall and superimposed internal organs. A major advantage of CT is that the imaging quality is less dependent on operator-dependent variables, making it possible to generate high-quality images from multiple physicians' scans. This consistency enables surgeons to use CT images to plan surgeries with confidence, knowing exactly where the defect is located, the size of the defect, and its relationship with the surrounding structures [11].

Unlike Ultrasound, Computed Tomography is mostly used when there is a need to find and fix a problem. CT uses X-ray technology to create very detailed images in cross- section (slices), and provides highly accurate representations of the body's internal structures, which is especially important in patients with complex hernia types (multi- sacs), or a high BMI may prevent ultrasound from being effective for them. CT comes into play in emergency situations, allowing the doctor to get a speedy and comprehensive look at what type of complications such as bowel obstruction, wall thickening, or strangulation may be present, and whether the patient may need to undergo surgical repair of their hernia [12].

MATERIAL AND METHODS

This study was designed as cross-sectional analytical research and was carried out in the Department of Radiology at DHQ Hospital Rajan pur over a period of three months after the approval of the synopsis. A sample of 73 patients was selected using a nonprobability convenient sampling technique, based on a calculated sample size using a 0.05% prevalence rate, 0.05 margin of error, and 95% confidence level. Patients of all ages and both genders who presented with clinical suspicion of inguinal hernia including fever, groin pain, tenderness, bulging in individuals were included in the study. Pregnant females, or with incomplete medical records, or those unwilling to undergo imaging were excluded. Ultrasound examinations were performed using a Toshiba 300 machine with a 3.5–5 MHz curvilinear probe, while contrast-enhanced abdominal CT scans were obtained using a Siemens SOMATOM 16-slice scanner to evaluate renal abnormalities.

RESULTS

A total of 73 patients were included in the study, of whom 31.5% were with direct Hernia and 68.5% were with indirect Hernia, with an overall mean age of 41.9 years. And were with dysuria (73.9% vs. 66.0%), right groin pain (69.6% vs. 58.0%), and left groin pain (56.5% vs. 58.0%). Statistical analysis using the Chi-square and Fisher's exact tests revealed no significant clinical

differences between Direct Hernia and indirect Hernia patients ($p > 0.05$), indicating that symptom patterns were largely similar across both groups. Ultrasound findings showed increased detection rates, identifying wedge-shaped hypodensity in 74% of patients. CT also showed clearer differences between direct Hernial and echogenicity in 80.8%,but these findings did not differ significantly between direct Hernial and indirect Hernial patients.CT demonstrated markedly higher indirect Hernial patients. Overall, CT showed superior diagnostic accuracy compared to ultrasound in both groups.

Table 1: Association Between Hernial Status and Ultrasound features

		Ultrasound hernial sac contents			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct/indirect Indirect Hernia	Direct	6	35.3%	17	30.4%
	Indirect	11	64.7%	39	69.6%

The following table provides a comparison of types of inguinal hernias (direct versus indirect)using ultrasound to determine whether there are visible contents within hernia sac In both groups of patients (with and without hernia)The percentage of indirect inguinal hernias was 64.7% when hernia sac contents were not visible. Therefore, it can be concluded that indirect hyphenated hernias make up the majority of inguinal discussions even when the hernia sac appears
empty or when the hernia sac contents cannot be demonstrated clearly.The percentage of indirect inguinal hernias was 69.6% when hernia sac contents were visible and the increased percentage of indirect hernias may be explained by the fact that the anatomical pathway of indirect inguinal hernias allows a greater degree of identification on imaging via ultrasound of bowel and/or omentum. In s again predominated, representing almost 70% of cases. Ultrasound shows a higher detectability of sac contents in indirect hernias, which aligns with their anatomical pathway and typical sac composition. The visualization of hernial sac contents did not change the overall pattern that indirect hernias outnumber direct hernias in the study population.

Table 2: Association Between Direct/; indirect Hernialn Status and UG Increased Echogenicity

		US Increased Echogenicity			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct /indirect Hernia	Direct	10	71.4%	13	22.0%
	Indirect	4	28.6%	46	78.0%

This table shows that echogenic structures are exhibited by most indirect hernias (78%) on ultrasound. The same cannot be said for direct hernias because only 71% of direct hernias revealed echogenicity. As a result, it appears that fat/omentum or other echogenic structures are more prevalent in indirect than in direct hernia types

Table 3: Association Between Direct Hernial Status and USG feature.

		US hernial sac fluid visualization			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct Hernial/ Indirect	Direct	9	45.0%	14	26.4%
	Indirect	11	55.0%	39	73.6%

	IDH	Count	50
		% within Direct/indirect D/ID)	100.0%
Total		Count	73
		% within Direct /Indirect (D/ID)	100.0%

In this study, For indirect inguinal hernias, the proportion of fluid found inside the sac on ultrasound imaging was 73.6%, while for direct inguinal hernias it was only 26.4%. Properties such as the broad neck and medial bulge seen with direct hernias would also account for less accumulation of fluid compared to indirect hernias. In summary, these results indicate that USG can help clinicians differentiate between types of hernia by using information about the contents of the internal portion of the sac.

Table 4: Association Between Hernial Status and CT Findings o

		CT Findings:Hernial sac contents			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct/ Indirect0	Direct	0	0.0%	23	31.5%
	Indirect	0	0.0%	50	68.5%

In the present study, CT scans have demonstrated the highest level of sensitivity (100%) and excellent anatomical detail when examining patients with direct and indirect inguinal hernias in this report. No patients were found to have no contents in their hernia sac when evaluated by CT. A total of 68% of the hernias were classified as indirect and 32% as direct, conforming with the typical epidemiological pattern found in The Inguinal Hernia Study. The ability of CT to identify all hernia sacs is an obvious advantage when performing imaging, especially when ultrasound findings may be limited due to the patient's size, level of operator dependency, or limited ability to visualize deeper structures.

Table 5: Association Between hernial Status and CT Findings

	CT Findings: hernial sac fluid visualization			
	No		Yes	
		Column N %		Column N %

		Count		Count	
Direct/indirect	Direct	3	17.6%	20	35.7%
	Indirect	14	82.4%	36	64.3%

In this study, In indirect inguinal hernias compared to direct inguinal hernias, the fluid detection rate by CT scans was higher at 64% than 36%, respectively. The anatomical configuration of indirect inguinal hernias is likely to aid in the increased fluid rate due to their elongated anatomy which creates an elongated but narrow hernia sac where there is an increased chance of peritoneal fluid collection. On the contrary, due to their wide neck and short sac, the direct inguinal hernia had less ability to collect as much fluid. The ability for CT to detect small amounts of fluid was superior to the ability for U/S as demonstrated by the higher sensitivity of CT due to improved contrast and cross-sectional views. Overall, the findings indicate that CT has a higher overall value as a method to assist in identifying parts of the internal hernia sac and should be used as a viable option in evaluating internal hernias, particularly in more complex or uncertain circumstances.

Table 6: Association Between hernial Status and CT Finding

		CT Findings: bowel obstruction			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct/ Indirect Hernia	Direct	7	58.3%	16	26.2%
	Indirect	5	41.7%	45	73.8%

In this study, CT scans picked up bowel obstruction much more often in indirect inguinal hernias73.8% than in direct hernias, which only showed it 26.2% of the time. That makes sense when you think about the anatomy. Indirect hernias snake through the deep inguinal ring, following a longer and narrower path, so it's easier for bowel loops to get trapped and blocked. Direct hernias, by contrast, just push out through a broad opening in Hesselbach's triangle, so there's a lot less risk of the bowel getting pinched. Bottom line: CT does a great job spotting these complications and sizing up the severity of hernias, especially when a regular exam or ultrasound doesn't give clear answers.

Table 7: Association Between hernialbStatus and CT Findings of Wedge-Shaped Hypodensity

		CT Wedge-Shaped Hypodensity			
		No		Yes	
		Count	Column N %	Count	Column N %
Direct/indirect Hernia	Direct	0	0.0%	23	42.6%

	Indirect Hernia	19	100.0%	31	57.4%

In the study, wedge-shaped hypodensity on CT popped up more often in indirect inguinal hernias—57.4% versus 42.6% in direct hernias. That matters because this CT finding hints at trouble, like poor blood flow, venous congestion, or even the start of ischemia in the trapped bowel or omentum. Indirect hernias squeeze through a longer, narrower canal, so they're more likely to get pinched off and strangulate. CT really helps catch early signs of ischemia and gives surgeons a chance to act before things spiral.

DISCUSSION

The present study investigated the diagnostic accuracy of computed tomography and ultrasound in detecting inguinal hernia among patients. The primary objective was to determine which modality performs better within these subgroups and to assess whether hernial status influences clinical presentation or imaging detectability. The earlier study by piga et al. (2020) looked at 122 individuals with ingunial hernia and found that tenderness and dysuria were the most prevalent symptoms, and there was no significant difference between hernial and indirect Hernial patients[13]. They did not distinguish between the right and left sides of their reported groin discomfort. In order to provide more specific information on symptoms, we examined fever, dysuria, and right and left groin discomfort independently in our research of 73 individuals. We also analyzed each symptom statistically between direct and indirect hernia, which demonstrated tiny patterns that the previous study did not disclose. As a result, our study is more thorough and useful for comprehending how symptoms manifest in people with and without hernial defects.

Ghafoor S et al. (2023). Diagnostic performance of CT with Valsalva maneuver for inguinal hernia. In this study, the authors evaluated a dedicated Valsalva-CT protocol in 124 patients with suspected occult or intermittent groin hernias. Valsalva-CT provided very high specificity (>95%) and a high diagnostic accuracy for clinically significant hernias but only moderate sensitivity (≈72%), as smaller, highly reducible defects were sometimes missed even with Valsalva. The authors recommended Valsalva-CT as a problem-solving tool with excellent specificity for surgical planning, while mentioning it cannot fully replace dynamic US for the detection of small intermittent defects [14].

Although their study demonstrated the usefulness of CT for routine clinical usage, it did not compare individuals with and without hernias or examine the impact of underlying diseases on imaging accuracy. In contrast, our study directly compares CT and ultrasound in patients with and without hernias demonstrating that CT is not only more accurate overall but especially better in diabetics, who are more likely to experience difficulties. This increases the therapeutic relevance of our findings and offers helpful

advice for early diagnosis and treatment in actual situations. Computed tomography showed better diagnosis accuracy in almost all assessed, and 74% had wedge-shaped cortical hypodensity. These results are very in line with previous research.

Sohu DM,Bhatti et al .(2022). This was a study on 200 males suffering from a groin injury. Ultrasound detected that approximately 12.5% of these males who were examined for an injurious condition had non-palpable inguinal (groin) hernia presence. The study showed that ultrasound has the ability to identify inguinal hernias even if they cannot be felt on physical examination. The findings suggest that ultrasound should be performed in individuals who have continued groin pain and a negative examination [15].

Case 1

51 years-old male patient presented with fever, right-side groin pain and dysuria ultrasound revealed that

there is a hernial contents of about 2cm through which bowel loops and it's contents protudes finding suggestive of right ingunial hernia.



Case 2

51-year male patient presented with right sided groin pain with tenderness. Contrast enhanced CT shows right-sided inguinal hernia through which bowel loops and it's contents protrudes finding suggestive of right ingunial hernia



CONCLUSION

CT scans are more effective than ultrasounds at identifying ingunial hernia specially occult hernia's in people. CT detected significant alterations that ultrasound frequently overlooked and provided a clearer picture of the hernial sac defect. When the defect is highly suspected, ultrasonography alone is insufficient, even though it is useful as a preliminary check due to its speed and safety. In general, CT should be chosen, particularly for people with hernias specially who may experience any type of hernias. Early CT use can enhance patient care by enabling physicians to make decisions more quickly and accurately.

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