



CORRELATION OF CLINICAL, ULTRASONOGRAPHIC AND INTRA-OPERATIVE FINDINGS IN INGUINAL HERNIA: A PROSPECTIVE STUDY

Surgery

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ABSTRACT

Background: Inguinal hernia is one of the most common surgical conditions worldwide. While clinical examination remains the primary diagnostic tool, ultrasonography is increasingly used for pre-operative evaluation. However, discrepancies between clinical, radiological, and intra-operative findings persist. **Aim:** To evaluate the correlation between clinical examination, ultrasonographic findings, and intra-operative findings in patients with inguinal hernia. **Methods:** A prospective observational study was conducted over 21 months at a tertiary care center in India. A total of 120 adult patients with uncomplicated inguinal hernia were included. Clinical examination findings, ultrasonographic evaluation, and intra-operative findings were recorded and compared. Intra-operative findings were considered the gold standard. Statistical analysis included sensitivity, specificity, and Cohen's kappa. **Results:** The mean age was 54.67 ± 16.56 years, with a male predominance (99.17%). Right-sided hernias were most common (64.17%). Clinically, direct hernia was diagnosed in 56.67% of cases, while intra-operatively, direct, indirect, and pantaloon hernias were found in 45%, 35%, and 20% respectively. Ultrasonography demonstrated 100% sensitivity for detecting hernia presence but showed significant discrepancies in classifying hernia type and contents ($p < 0.001$). Pantaloon hernias were not detected pre-operatively. **Conclusion:** Clinical examination and ultrasonography are reliable for detecting inguinal hernia but have limited accuracy in classification. Intra-operative findings remain the gold standard. Selective use of imaging is recommended, and surgeons should anticipate intra-operative variations.

KEYWORDS

Inguinal Hernia, Ultrasonography, Clinical Diagnosis, Intra-operative Findings, Diagnostic Correlation

INTRODUCTION;

Inguinal hernia is one of the most common surgical conditions encountered in general practice and continues to impose a significant global health burden. It is defined as the protrusion of intra-abdominal contents through a weakness in the inguinal region, either through the deep inguinal ring (indirect hernia) or through a weakened posterior wall of the inguinal canal (direct hernia) [1]. Despite advances in surgical techniques, inguinal hernia repair remains one of the most frequently performed operations worldwide, accounting for nearly 75% of all abdominal wall hernias, with a strong male predominance due to anatomical and embryological factors [2,3].

In developing countries such as India, inguinal hernia constitutes a major proportion of surgical admissions. Delayed presentation is common due to socioeconomic constraints, lack of awareness, and limited access to healthcare facilities, often resulting in large or complicated hernias. This underscores the importance of accurate preoperative diagnosis and appropriate surgical planning to improve outcomes and reduce complications [4].

Traditionally, the diagnosis of inguinal hernia has been primarily clinical, based on detailed history and physical examination. Classical signs such as reducible groin swelling, cough impulse, and specific tests like the ring occlusion test have been used to differentiate between direct and indirect hernias [5]. However, clinical examination is subjective and highly dependent on the examiner's experience, patient cooperation, and body habitus. Studies have shown considerable inter-observer variability and reduced accuracy in detecting small, occult, bilateral, or recurrent hernias [6,7].

To overcome these limitations, imaging modalities, particularly ultrasonography, have been increasingly utilized. Ultrasonography is non-invasive, cost-effective, and allows dynamic assessment during Valsalva manoeuvre. It helps in identifying the hernia sac, its contents, and its relation to the inferior epigastric vessels, thereby aiding in classification [8]. However, it is highly operator-dependent, and false-positive or false-negative results may occur, especially in cases of small hernias or posterior wall defects. Consequently, radiological findings may not always correlate with intra-operative observations [9].

A thorough understanding of inguinal canal anatomy is essential for accurate diagnosis. Indirect hernias occur lateral to the inferior epigastric vessels and are usually congenital, whereas direct hernias occur medial to these vessels due to acquired weakness of the posterior

wall [10]. While this distinction is clearly evident intra-operatively, preoperative differentiation remains challenging in many cases.

Intra-operative findings are considered the gold standard for diagnosis and classification, as they provide direct visualization of the hernia anatomy, sac contents, and associated abnormalities [11]. However, discrepancies between clinical, radiological, and intra-operative findings are frequently encountered. Previous studies have shown variable correlation, particularly in cases of direct, recurrent, and occult hernias [12].

AIM:

1. To evaluate clinical diagnosis of inguinal hernia
2. To assess ultrasonographic findings
3. To correlate both with intra-operative findings
4. To determine diagnostic accuracy

MATERIALS AND METHODS:

This prospective, randomized Study was Undertaken from April, 2024 to September, 2025 on patients presenting to Department of General Surgery, American International Institute of Medical Sciences, Udaipur. The study protocol was approved by Institutional Ethics committee. The study was designed for Correlation Between Clinical, Ultrasonographic, and Intra-operative Findings in Inguinal Hernia

Inclusion Criteria;

1. Age between 18 and 60 years
2. Presence of an uncomplicated inguinal hernia (reducible, without obstruction or strangulation)
3. Admission for elective inguinal hernia repair
4. Willingness to participate and provision of written informed consent

Exclusion Criteria:

1. Were unfit for surgery due to severe systemic illness
2. Had complicated hernias (obstruction, strangulation, or incarceration)
3. Refused consent or withdrew consent during the study

A purposive consecutive sampling technique was employed. All patients fulfilling the inclusion criteria and providing informed consent during the study period were enrolled consecutively until the required sample size was reached. This approach minimized selection bias and ensured feasibility in a tertiary-care clinical setting.

RESULT:

*This study evaluated the demographic profile, clinical presentation,

radiological findings, and operative outcomes of 120 patients with inguinal hernia. The mean age of the study population was 54.67 ± 16.56 years, with a median age of 60 years, indicating a predominance of middle-aged and elderly individuals. Nearly half of the participants (48.33%) were above 60 years, highlighting the increased occurrence of hernia in older populations. A striking male predominance was observed, with 99.17% of participants being male. Occupational analysis revealed that the majority were engaged in moderate (51.67%) or heavy (41.67%) physical labor, suggesting a strong association between physical strain and hernia development. Clinically, most patients presented with right-sided symptoms (64.17%), while no bilateral cases were noted. The most common presenting features included groin swelling and increase in swelling on coughing or straining, both seen in 99.17% of patients. Pain or dragging sensation was reported by 66.67% of participants. Clinical examination findings were consistent with symptom laterality, with right-sided predominance in cough impulse, reducibility, and other diagnostic tests. Clinically, direct inguinal hernia was more common (56.67%) than indirect hernia (43.33%). Ultrasonography confirmed hernia in all patients and showed similar distribution between direct (56.67%) and indirect (43.33%) hernias. Omentum was the most common hernia content (84.17%), followed by mixed contents (15.83%). Intra-operative findings, considered the gold standard, demonstrated direct hernia in 45%, indirect in 35%, and pantaloon hernia in 20% of cases. Omentum was present in 99.17% of cases intra-operatively. Posterior wall weakness was observed in 85.83% of patients, indicating its significant role in hernia formation. Comparison between clinical, ultrasonographic, and intra-operative findings showed complete agreement in detecting hernia presence. However, ultrasonography provided better characterization than clinical examination, while intra-operative findings were superior in identifying complex types such as pantaloon hernia. Ultrasonography demonstrated 100% sensitivity, positive predictive value, and diagnostic accuracy in detecting hernia. These findings highlight its reliability as a non-invasive diagnostic tool. In conclusion, inguinal hernia predominantly affects older males engaged in physically demanding occupations. While clinical examination is effective for diagnosis, ultrasonography significantly enhances diagnostic accuracy and characterization. However, intra-operative evaluation remains the definitive standard for detailed assessment

Table 1: Age Distribution

Age (in years)	Mean ± Std.	Median (IQR)
	54.67 ± 16.56	60 (44-66)

Table 2: Age category

Variable	Category	Number (n) %
Age (years)	18–30	17 (14.71%)
	31–40	10 (8.33%)
	41–50	15 (12.5%)
	51–60	20 (16.67%)
	60 Above	58 (48.33%)
Total		

Table 3 :Distribution of Presenting Clinical Symptoms:

Symptom	Present N (%)	Absent N (%)
Groin swelling	119 (99.17%)	1 (0.83%)
Pain / dragging sensation	80 (66.67%)	40 (33.33%)
Increase on coughing/straining	119 (99.17%)	1 (0.83%)
Difficulty in reduction	0	120 (100%)
History of irreducibility	0	120 (100%)

Table 4; Clinical Examination Findings

Clinical Test	Right	Left	Bilateral
Impulse on cough	77 (64.17%)	43 (35.83%)	0
Reducibility	77 (64.17%)	43 (35.83%)	0
Ring occlusion test positive	33 (27.5%)	20 (16.67%)	0
Finger invagination test positive	77 (63.33%)	43 (35.83%)	0
Three-finger test suggestive	77 (64.17%)	43 (35.83%)	0

Table 5: Correlation Between Clinical and Ultrasonographic Findings

Parameter	Clinical Present	USG Present	p-value
Presence of hernia	120 (100%)	120 (100%)	1 (chi-square)
Type of hernia (Direct)	68 (56.67%)	68 (56.67%)	<0.001 (chi-square)

Type of hernia (Indirect)	52 (43.33%)	52 (43.33%)	
Hernia content (omentum)	101 (84.17%)	101 (84.17%)	<0.001 (chi-square)
Hernia content (mixed)	19 (15.83%)	19 (15.83%)	

Table 6; Correlation Between Ultrasonographic and Intra-operative Findings

Parameter	USG Present	Intra-operative Present	p-value
Presence of hernia	120 (100%)	120 (100%)	1 (chi-square)
Type of hernia (Direct)	68 (56.67%)	54(45%)	<0.001 (chi-square)
Type of hernia (Indirect)	52(43.33)	42(35%)	
Type of hernia (Pantaloon)	0 (0%)	24 (20%)	
Hernia content (omentum)	101 (84.17%)	119(99.17)	<0.001 (chi-square)
Hernia content (mixed)	19 (15.83%)	0(0%)	
Hernia content (bowel)	0 (0%)	1 (0.83%)	0.021 (chi-square)

CONCLUSION:

This table-wise discussion of our prospective study demonstrates that inguinal hernia in our setting predominantly affects older male labourers and that right-sided **direct** hernias are more frequent than in many published series. Ultrasonography proved invaluable for confirming hernia presence but overestimated direct hernias and mixed contents compared with intra-operative findings. Our finding of **100 % diagnostic accuracy** for detecting hernia underscores the modality's value, yet the significant discordance in hernia classification calls for cautious interpretation and reinforces the role of surgical exploration as the definitive diagnostic tool.

Comparisons with contemporary studies reveal both concordance and divergence. The consistent male predominance and high lifetime risk observed across series emphasise the need for awareness and early elective repair among at-risk populations. Differences in age distribution, hernia type and sac contents reflect variations in study populations and referral patterns. The heavy manual occupations and older age of our patients likely contributed to the high prevalence of direct and pantaloon hernias and the predominance of omental contents. Clinicians should therefore individualise diagnostic and therapeutic strategies based on patient demographics and risk factors, employing ultrasonography for detection while recognising its limitations in classification. Ultimately, integrating clinical evaluation, high-resolution imaging and operative assessment remains essential for optimal management of inguinal hernia.

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