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ORIGINAL ARTICLE

Diagnostic Accuracy of Clinical Finding for the Diagnosis of Acute Peritonitis

Muhammad Inam ul Haq[1], Tayyaba Ismail[2], Wajeeha Rafi[3], Samlan Iftikhar[4], Imran Amin[5]

[1,3,4,5]Department of General Surgery, Gujranwala Teaching Hospital

[2]Department of General Surgery, Benazir Bhutto Hospital

ABSTRACT

Objective: To evaluate the diagnostic accuracy of clinical findings in identifying acute peritonitis, using computed tomography (CT) and surgical results as the gold standard, among patients presenting to a surgical emergency department.

Methodology: Over the course of six months, this prospective cross-sectional research was conducted in the emergency ward, surgery department, Gujranwala Teaching Hospital. 240 patients presenting with acute abdominal pain were included. The patients were subjected to either surgical exploration, CT scanning, or ultrasonography. The gold standard was considered to be CT and surgical findings. Positive predictive value (PPV), negative predictive value (NPV), sensitivity, and specificity were used to determine the diagnostic performance of the clinical examination. Independent determinants of diagnostic accuracy were found using binary logistic regression.

Results: Of the 240 patients, 75% were male and the mean age was 38.8 ± 15.6 years. The most frequent presenting symptom was abdominal pain (100%), followed by abdominal distension (66.3%) and vomiting (51.7%). Compared with surgical/CT confirmation, clinical diagnosis showed sensitivity 98.8%**,** specificity 52.5%**,** PPV 80.6%**,** and NPV 95.5**%**. Logistic regression identified fever as the only significant independent predictor of correct diagnosis (p = 0.046). Other symptoms, including vomiting and abdominal distension, were not significant predictors.

Conclusion: In emergency and resource-constrained situations, clinical diagnosis of acute peritonitis is a dependable tool for initial triage and early decision-making due to its great sensitivity and NPV.

Key words: Acute Abdomen; Clinical Diagnosis; Computed Tomography; Diagnostic Accuracy; Peritonitis; Sensitivity; Specificity;

Authors' Contribution:

[1,2]Conception; Literature research; manuscript design and drafting; [2,3]Critical analysis and manuscript review; [3,4]Data analysis; Manuscript Editing.

Correspondence:

Tayyaba Ismail

Email: Aminatayyaba2@gmail.com

Note: All the authors were working in the same institute at the time of the study.

Article info:

Received: July 10, 2021

Accepted: September 20, 2022

Cite this article. Haq MI, Ismail T, Rafi W, Iftikhar S, Amin I. Diagnostic Accuracy of Clinical Finding for the Diagnosis of Acute Peritonitis. J Islamabad Med Dental Coll. 2025; 14(4): *416-422*. *DOI: https://doi.org/10.35787/jimdc.v14i4.1446*

Funding Source: Nil

Conflict of interest: Nil

Introduction

One of the most frequent surgical department emergencies is peritonitis. After intestinal obstruction and appendicitis, it is the third most common cause of abdominal surgery and a serious condition with a death rate of up to 20%.[1] Peritonitis shows various etiological differences between developed and developing countries. It has been shown that whereas perforation rates are higher in wealthy nations, infectious peritonitis is more common in developing nations. Patients in high-income nations are more likely to suffer from colon perforation, while those in low-income countries are more likely to experience proximal bowel perforation (which is usually secondary to infectious etiology).[2] Peritonitis may present in upto 22%

general surgery emergency cases.[3] One of a surgeon's biggest challenges is diagnosing and treating a patient with an acute abdomen. It calls for a wide range of abilities. Laboratory testing and radiographic investigations may help in making a diagnosis, which is still based on the surgeon's clinical history and physical examination.[4] Signs and symptoms of stomach pain and discomfort that frequently need for immediate surgical treatment are referred to as acute abdomen.[5]

Because of this, people could mistakenly believe that surgical abdomen and acute abdomen are interchangeable. Although it is the most often seen surgical emergency, surgery is not always used to address severe abdominal pain, for example, acute pancreatitis does not require upfront surgery.[6] Acute abdominal pain cannot be diagnosed only by clinical assessment, x-rays, or ultrasound. The number and precision of pre-operative diagnoses in acute abdomen are increased when clinical evaluation is paired with x-rays and ultrasonography.[6] The diagnosis of acute abdomen is mostly made by clinical judgment; investigations are merely supplemental and cannot take the place of a good and thorough clinical evaluation.[5] According to one study, in patients with acute abdomen, the clinical diagnosis of acute peritonitis had a sensitivity of 91.80% and a specificity of 33.33%.[7]

This study's purpose is to evaluate the diagnostic precision of clinical findings for acute peritonitis, using CT imaging and surgical results as the gold standard. According to published research, clinical findings have a high sensitivity but a low specificity. However, there hasn't been much research done on the subject, and there isn't any local data to support the use of a more suitable approach for acute peritonitis in the community. Thus, the purpose of this study is to gather local information so that we can apply the findings in a local context to lessen future surgical needs and post-operative difficulties. Additionally, this will enhance our expertise and practice.

Methodology

A cross-sectional study was conducted over six months in the Emergency Ward of the Department of Surgery at Gujranwala Teaching Hospital. With a calculated sample size of 210 cases, determined using the WHO sensitivity and specificity calculator for a 95% confidence level, a total of 240 patients were ultimately enrolled via non-probability, consecutive sampling. Eligible participants were aged 16 to 75 years, of either gender, presented with an acute abdomen, and were classified as ASA I or II. Exclusion criteria encompassed patients with a documented history of colon, liver, or gastrointestinal tract malignancy, hepatitis B or C, HIV, pregnancy, gynaecological conditions, burst abdomen, previous gunshot injury, or penetrating trauma. Following ethical approval and informed consent, enrolled patients presenting with abdominal pain, constipation, and vomiting underwent a thorough history and clinical examination. Resuscitation and immediate medical management, including analgesia, antibiotics, and fluids, were initiated concurrently. All patients underwent ultrasound and chest and abdominal X-rays. Based on these clinical and radiological assessments, a provisional diagnosis of ‘suspected peritonitis’ was made. In cases with discordant findings, a CT scan was performed for further clarification. Patients suspected of peritonitis subsequently underwent emergency exploratory laparotomy. A ‘confirmed peritonitis’ diagnosis was assigned based on either CT scan or perioperative findings, which served as the gold standard. Data on demographics, clinical parameters, comorbidities, and investigative findings were recorded on a preformed proforma. Statistical analysis was performed using SPSS version 23, with continuous variables summarized as mean and standard deviation and categorical variables as frequencies and percentages. The diagnostic accuracy of clinical findings was evaluated by constructing a 2x2 table against the gold standard, calculating sensitivity,

specificity, positive predictive value, and negative predictive value. Cases where clinical and CT/operative findings concurred were classified as an 'accurate diagnosis.'

Table I: Contingency Table Comparing Clinical and Surgical Findings

		Surgical findings			Total
		Positive	Negative		
Clinical findings	Positive	TP	FP		TP+FP
	Negative	FN	TN		TN+FN
Total		TP+FN	TN+FP		N

Sensitivity: TP / (TP+FP) * 100 Specificity: TN / (TN+FP) * 100

PPV: TP / (TP+FP) * 100 NPV TN / (TN+FN) * 100

Diagnostic accuracy: (TP+TN) / N * 100

Ethical approval was taken from the review board of Gujranwala Teaching Hospital (NO. admn 307/GMC dated 22-02-2021.

Results

A total of 240 patients were included in the study out of whom 75% (N=180) were male and 25% (N=60) were female. The mean age of study participants was 38.8 +/- 15.61 (range 14-71) years. Among the study participants 11.7% (N=28) were diabetics and 26.7% (N=64) were hypertensive. 53% (N=128) patients were chronic smokers and 1.7% (N=4) had history of alcohol intake. The most frequent symptom in the study population was abdominal pain, that was present in 100% (N=240) patients, followed by abdominal distention that was present in 66.3 (N=159) patients and vomiting in 51.7% (N=124) patients. The frequency of other symptoms is shown in the graph below.All the patients included in the study (N=240) had positive clinical signs of tachycardia and abdominal tenderness. Ultrasound was unremarkable in 18.3% (N=44) patients, while it showed minimal ascites in 55% (N=132) and gross ascites in 26.7% (N=64) patients. X ray chest and abdomen was unremarkable in 38.3% (N= 92), while it showed multiple air fluid levels in 25% (N=60) patients and air under diaphragm in 36.7% (N=88) patients. Based on the history, physical examination and ultrasound and x-ray findings, clinical diagnosis of peritonitis was made in 196 patients. Of these 189 were directly proceeded to laparotomy and 7 were subjected to CT scan owing to previous history of blunt abdominal trauma within the previous 1 week, their CT showed mild solid organ injury and hemoperitonium leading to clinical features of peritonism but no peritonitis, so they were not subjected to surgical intervention. Of the laparotomies performed in clinically suspected patients, 31 were negative laparotomies, while 158 confirmed peritonitis on laparotomy (true positive). There were 38 false positive patients in the clinically suspected group (31 proved on laparotomy at 7 on CT). 44 patients were clinically not suspected of having peritonitis. All were subjected to CT scan. Of these, CT scan confirmed that 42 patients did not have peritonitis (true positive), while 2 patients were shown to have peritonitis secondary to viscus perforation (false negative), these 2 patients then underwent laparotomy. These figures are better explained with a flow chart below. Overall, CT scan was performed in 21.25% (N=51) patients. 191 laparotomies were performed in total, out of which 16.2% (N=31) were negative laparotomies. In the study, clinical diagnosis of peritonitis was compared to CT and surgical findings (taken as gold standard). Accurate diagnosis (true positive and true negative) was made clinically in 83.3% (N=200) patients, while in 16.7% (N=40) patients' clinical diagnosis was incorrect yielding false negative and fall positive results.

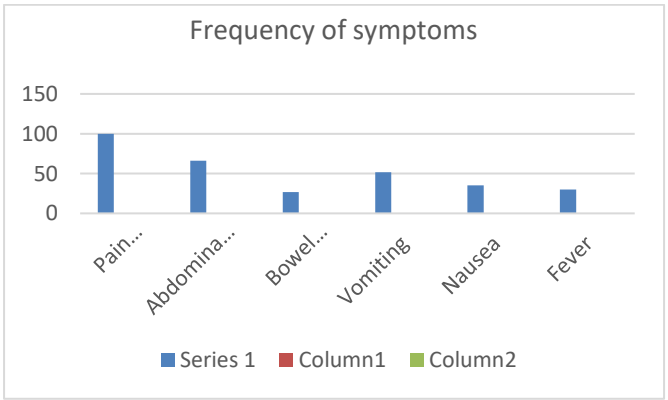

Figure 1: Frequency of symptoms in patients included in the study

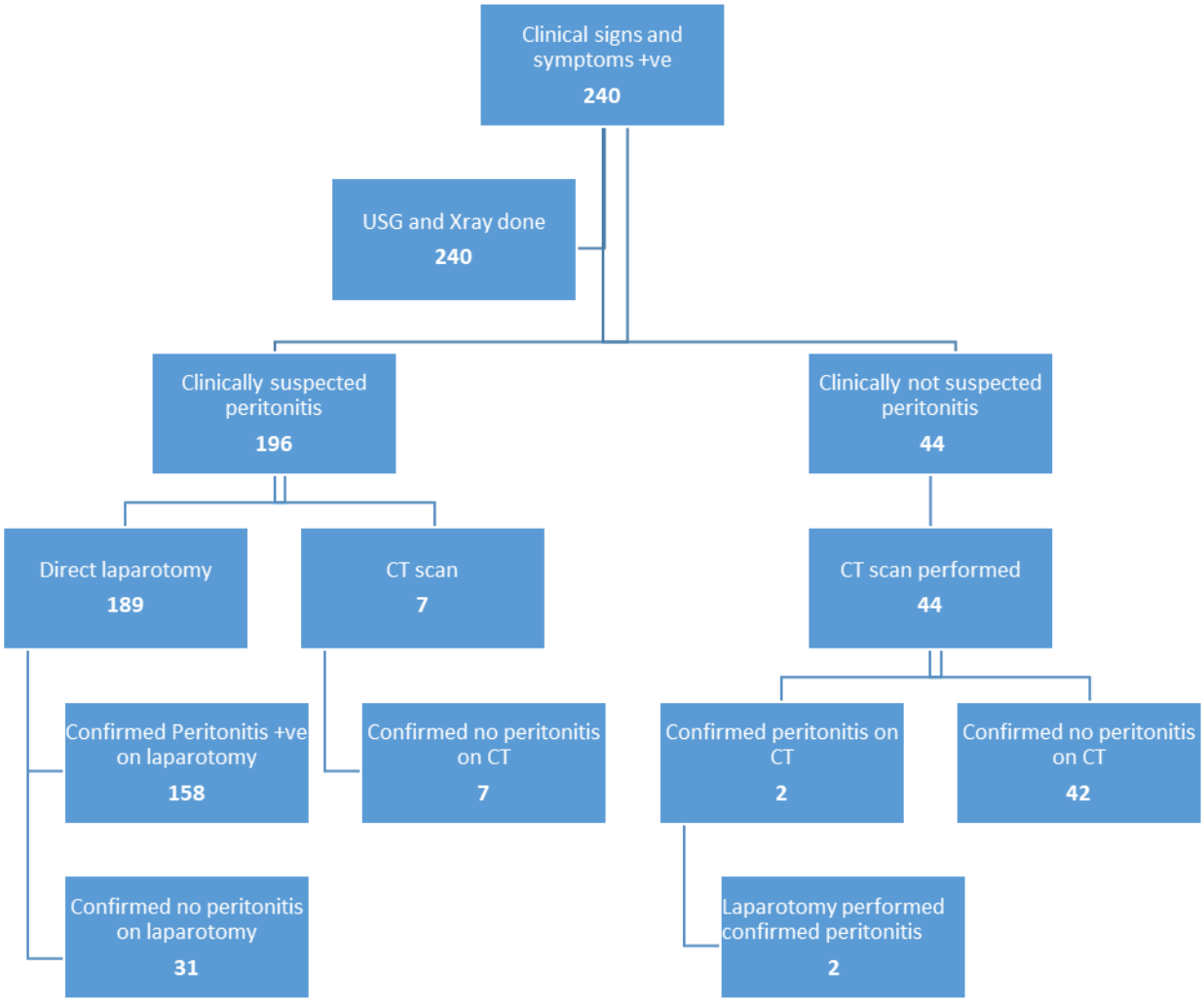

Figure 2: Flow sheet showing distribution of patients in the study

A 2x2 contingency table comparing clinical suspicion of peritonitis with surgical or CT confirmation yielded the following diagnostic accuracy measures:

Table II: Contingency between clinically suspected peritonitis and confirmed peritonitis

	Confirmed Peritonitis	**No Peritonitis**	**Total**
Clinically suspected	158 (True Positives)	38 (False Positives)	196
Clinically not suspected	2 (False Negatives)	42 (True Negatives)	44
Total	160	80	240

From this, the following diagnostic metrics were derived:

- Sensitivity of clinical diagnosis: 98.8%
- Specificity: 52.5%
- Positive Predictive Value (PPV): 80.6%
- Negative Predictive Value (NPV): 95.5%

The clinical diagnosis of peritonitis showed excellent sensitivity (98.8%) and NPV (95.5%), indicating that clinical suspicion is very effective at identifying true cases and ruling out the condition when it is not present. However, the specificity was modest (52.5%), and the positive predictive value was 80.6%, reflecting a tendency toward over-diagnosis in some patients. These findings highlight the strength of clinical judgment in ruling in peritonitis but also emphasize the need for confirmatory

imaging or surgical evaluation to reduce false positives.

Binary logistic regression was performed to assess the effect of various clinical symptoms on the likelihood of a correct diagnosis of acute peritonitis, as confirmed by surgical findings. A total of 240 patients clinically suspected of peritonitis were included in the analysis. Fever was the only significant independent predictor ($p = 0.046$). Patients presenting with fever had 64% lower odds of incorrect diagnosis. Nausea showed a borderline association ($p = 0.063$) with correct diagnosis, suggesting a possible trend. Bowel disorder as a group was significant ($p = 0.024$), but none of the subtypes (constipation, diarrhea, alternating) were individually significant. Classic signs such as vomiting and abdominal distention did not significantly predict true peritonitis in this cohort.

A chi square test showed significant association between ultrasound findings and diagnosis of confirmed peritonitis on CT or per op findings, $\chi^2(2, N = 240) = 30.682$, $p = .000$. Likewise, there was a significant association between x-ray findings and confirmed peritonitis $\chi^2(2, N = 240) = 138.635$, $p = .000$.

Discussion

The clinical diagnosis in this cross-sectional investigation of 240 patients suspected of having acute peritonitis had only moderate specificity (52.5%) but extremely high sensitivity (98.8%) and high NPV (95.5%). This pattern reflects the more extensive research on the acute abdomen, where numerous symptom complexes restrict the solo specificity of clinical examination.

Numerous national and international comparative studies have evaluated the clinical examination's diagnostic accuracy in relation to radiological and surgical results. When diagnosing acute abdomen, Batra et al. found that CT and ultrasound had a stronger connection with operative findings in some patients, although their clinical sensitivity was high, while their specificity was rather poor.[3] Likewise, Singh et al. showed that the inclusion of imaging greatly increased specificity while maintaining the high sensitivity of clinical examination.[4] Additionally, compared to clinical examination alone, the accuracy of preoperative diagnosis for acute abdomen was improved by combining clinical symptoms with radiological assessment, according to Ali and Maddu's analysis.[5]

These trends are further supported by direct head-to-head study that uses surgical confirmation as the gold standard. Chen et al. demonstrated that ultrasonography accurately identified peritonitis in 83.3% of patients In contrast to 51.0% for clinical impression alone.[8] Arora et al. also discovered that, especially in less evident cases, imaging modalities—CT in particular—had a stronger connection with operative diagnoses than clinical evaluation alone.[7] According to Sharma et al., clinical evaluation worked well for illnesses that were readily apparent, like perforation peritonitis, but accuracy increased with the addition of plain radiography and ultrasonography.[6]

When it comes to undifferentiated presentations, CT, particularly multidetector CT (MDCT), has continuously shown excellent sensitivity and specificity in distinguishing peritonitis from other acute abdominal diseases as well as in identifying the extent and source of contamination. For acute abdominal diseases, MDCT can obtain sensitivities in the range of 85–95%, with specificity often surpassing that of clinical examination alone, according to a pattern-based CT evaluation.[9] Adding MDCT to the diagnostic pathway improves overall accuracy and alters management for a significant percentage of patients, according to emergency-department cohorts.[10-12]

Although in recent literature, CT scan is used for diagnosis of various acute surgical abdominal conditions like appendicitis, bowel obstruction, internal hernias and intra-abdominal sepsis, clinical findings hold their place in the initial evaluation and emergency management of such patients.[13-16]

Latest research focuses on even more advanced techniques such as Metagenomic Next-Generation Sequencing for the early diagnosis of peritonitis through early and accurate identification of microorganisms causing peritonitis. This not only detects the microbs but also identifies antibiotic sensitivity patterns for early treatment of peritonitis.[17]

Limitations: First, this investigation was conducted in a single location, and the large percentage of surgically confirmed peritonitis might have caused spectrum bias, which would have increased sensitivity. Second, a direct within-cohort comparison of clinical vs imaging accuracy was not possible due to inconsistent imaging practices. Last but not least, a few comorbidity subgroups were too tiny for reliable statistical examination

Conclusion

When compared to surgical confirmation, this study showed that thorough clinical evaluation based on established diagnostic criteria produced very high sensitivity (98.8%) as well as high negative predictive value (95.5%) for the diagnosis of acute peritonitis. These results support the validity of clinical examination as a first-line method for quickly identifying cases of actual peritonitis, especially in emergency situations and situations with limited resources. The modest specificity (52.5%), however, highlights the potential of needless surgical procedures by reflecting a propensity for over diagnosis. Comparative national and international research continuously demonstrates that combining clinical evaluation with imaging modalities like CT and ultrasound can greatly increase specificity and direct surgical planning. Other typical symptoms could not independently predict genuine peritonitis, but fever was the sole significant independent predictor of diagnostic accuracy. A two-step strategy first clinical triage, then targeted imaging in cases that are unclear seems ideal in light of our findings. More extensive, multicentre research using consistent imaging techniques is necessary to confirm these results and improve acute peritonitis diagnosis algorithms.

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