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Causes of Acute Abdomen Diagnosed Through Gray-Scale Ultrasonography in Adults at A Tertiary Care Hospital, Lahore

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ABSTRACT

Acute abdomen is a severe and sudden onset of pain over a short span of time, requiring urgent diagnosis and treatment. The prevalence of acute abdomen is found to be 5 percent in emergency department cases and a lower percentage in the OPD cases. **Objectives:** To diagnose the causes of acute abdomen via gray-scale ultrasonography in adults at a tertiary care hospital. **Methods:** The Study design was a descriptive cross-sectional. Data was collected through proforma and reports, and collected from the Diagnostic Center CMH Lahore. Data analysis was done through IBM SPSS software version 26.0, and the association between causes and the gender of the patient was calculated via chi chi-square test. **Results:** Out of 186 patients, 45.7% were male and 54.3% female, with a mean age of 47.44 years. Common symptoms/signs included nausea/vomiting (72.6%), fever (50%), abdominal tenderness (52.7%), and abdominal distension (33.9%). Moderate pain was the most prevalent severity of pain in 41.9% patients. RHC was the most prevalent region of pain (71%). Ultrasound diagnoses included cholelithiasis (20.4%), hydronephrosis (13.4%), acute cholecystitis (12.4%), renal colic (11.8%), and acute pancreatitis (8.1%), respectively. Other diagnoses were liver abscess (2.7%), splenic lesions (1.6%), and an unremarkable study (18.82%). **Conclusions:** The Current study concludes that there is a significant association between acute cholecystitis and the gender of the patient. It also highlights the significance of ultrasound in diagnosing the causes of acute abdomen, with cholelithiasis, hydronephrosis, renal colic, and acute cholecystitis as the most frequent causes of acute abdomen.

INTRODUCTION

Acute abdomen refers to a wide range of surgical, medical, and gynecological issues, fluctuating from minor to mortal conditions that necessitate hospitalization, complete examinations, and handling [1, 2]. Acute abdominal pain is most prevalent in the 20-29 age group in the technologically advanced world, with a male superiority. It is accountable for 36.4% of surgical emergencies [3]. Due to the wide variety of causes of acute abdomen, differential diagnosis is problematic [4]. Acute abdomen symptoms vary from mild, persistent dull aches to pronounced guarding and rigidity. Diagnosing life-threatening conditions at early stages is somehow difficult because many serious and benign intra-abdominal complaints present with similar symptoms [5]. Mostly signs and symptoms of patients presenting with acute abdomen are vomiting, nausea, fever, abdominal tenderness [6]. The latest technology and a trained clinical eye are sometimes required to demonstrate it and compare it with surgical results [7]. While imaging techniques have increased diagnostic accuracy and reduced time to diagnosis, the history and physical examination are still the mainstays for evaluating acute abdominal discomfort [8]. Investigative studies play a key role in evaluating an acute abdomen. Laboratory tests alone are not enough; imaging studies are

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also vital for a thorough evaluation. Patients with an acute abdomen initially visit a primary healthcare provider, who usually has access to only a few diagnostic tests. The choice of diagnostic method should be based on the likelihood of making a diagnosis and the potential risks of radiation exposure [9]. Perhaps the most notable of the many notable technological developments in all areas of medicine is ultrasonography [10]. One of the most popular imaging modalities that aids in confirming the clinician's diagnosis is ultrasound [11]. USG is a noninvasive, real-time imaging modality that has made it a popular choice for assessing patients with an acute abdomen. It is particularly helpful when a diagnosis must be made quickly [12]. It is anticipated that this method will speed up and improve the diagnosis and care of individuals with acute pathology [13]. Causes of acute pain in the abdomen, such as appendicitis, acute pancreatitis, acute cholecystitis, ovarian torsion, ruptured aortic aneurysm, lacerated spleen or liver, and a lot of others, can be easily diagnosed on ultrasonography. These conditions may require emergency treatment because they can be life-threatening if not treated on an emergency basis. An untreated acute abdomen can cause various serious complications [14]. The diagnostic accuracy of ultrasound for the diagnosis of causes of acute abdomen has been the subject of numerous investigations; nevertheless, the results of these earlier studies have varied [15]. Previous studies have limited literature about the root causes of acute abdomen in adults diagnosed through gray-scale ultrasound. They have mainly focused on the comparison of imaging modalities to diagnose the acute abdomen. They have mainly discussed a single or major cause of acute abdomen, thus have limited clinical information about the minor causes like hydronephrosis, liver abscess, splenic lesions, etc. Most studies relied on retrospective data collection. The current study diagnoses the root causes of acute abdomen via gray-scale ultrasonography. This will help to enhance the patient outcomes for further treatments by diagnosing the root cause of acute abdomen at the acute/early stage of disease without sacrificing the patient's valuable time, and this will also support in minimizing the occurrence of pointless surgeries and lessening the likelihood of further subsequent complications.

This study aimed to determine the causes of acute abdomen diagnosed through gray-scale ultrasonography in adults at a tertiary care hospital.

METHODS

This descriptive cross-sectional study was conducted at the Diagnostic Center of Combined Military Hospital Lahore between September and December 2024. This study was conducted in line with ethical standards set by the ethical committee of Combined Military Hospital, Lahore Medical College, and Institute of Dentistry, Lahore, Pakistan. (Ref. No. 76/ERC/CMH/LMC). Written and verbal consent was taken from eligible participants. All information and data collection were kept confidential. Participants remained anonymous throughout the study. This study was conducted in accordance with the Declaration of Helsinki. Data were collected from 186 patients (both male and female), including young adults, middle-aged adults, and older adults [16]. The sample size was calculated through the WHO Geneva calculator. The prevalence of one of the causes of acute abdomen is found to be 14% [1]. The Cochran formul was used to determine the sample size n = $\frac{Z^2_{1-\alpha/s}(1-P)}{d^2}$ [17]. P (anticipated population proportion) = 0.14, d (absolute precision) = 0.05, 1-α (confidence level %) = 95, Z value (at 95% CL) = 1.96, and n (sample size) = 186. Patients were selected through a non-probability convenience sampling technique. Patients above 15 years of age, including both male and female patients, presenting with symptoms (e.g., pain, tenderness, nausea, vomiting, etc.) of acute abdomen were included in the study. However, bedridden patients from Intensive Trauma Care (surgical/medical) who were not able to come to the diagnostic center of a tertiary care hospital, patients with a history of recent abdominal trauma or injury, pregnant females, patients with known or suspected malignancy, and patients with a history of recent surgery (post-operative) were excluded. Ultrasound machine (company name: Toshiba, Aloka, XARIO 100G, LOGIC GE) and Transducers such as curved linear (3-5MHz), linear high frequency transducer (7 MHz above) were used as equipment. All patients who fulfilled the inclusion/exclusion criteria were included in the current study. Consent was taken from all patients. The procedure was explained thoroughly to the patient. Patient preparation was done carefully. History was taken, including previous or recent surgeries of the abdomen, previous or recent trauma of abdomen, diabetes, hypertension, etc. Symptoms like fever, pain, and nausea/vomiting were asked about by the patient. Any signs like abdominal tenderness, rigidity, swelling, or distension were noted. The region of pain was noted, and pain intensity was recorded according to NPRS [18]. Patient positioning was done by the Technologist according to the examination of the region of interest. Ultrasound was performed by using a curvilinear transducer (3-5MHz) or high frequency linear transducer (7MHz above) by a radiologist. Measurements of organs in the region of interest were noted and filled in the proforma after the examination, accordingly, by the approval of the radiologist. Size, texture, and echogenicities of abnormal findings were mentioned in the proforma. Final diagnosis was given by the radiologist, and we mentioned the final

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diagnosis in the proforma. Images were obtained, and the record was saved (including reports and diagnoses) according to the consent of the patient. The data collection tool was structured proforma and ultrasound reports/images. All data were analyzed through IBM SPSS (version 26). Descriptive analysis frequency and percentages were calculated for qualitative data (gender, history, sign/symptoms, region of pain, severity of pain, causes of acute abdomen, and association b/w gender and causes of acute abdomen), whereas mean and standard deviation were calculated for quantitative data (age of patients, pain duration). Inferential analysis was conducted using the Chi-square test to calculate the association between the gender of patients and causes of acute abdomen. A p-value ≤ 0.05 was considered a statistically significant value.

RESULTS

In the current study, 186 patients presenting with symptoms of acute abdomen were evaluated to determine the prevalence of its causes in adults using gray-scale ultrasonography. Among these, 85 (45.7%) were male and 101 (54.3%) were female. The mean age of the study population was 47.44 ± 16.76 years. Among all participants, 135 (72.6%) reported nausea/vomiting, 93 (50%) had fever, and 98 (52.7%) experienced abdominal tenderness, which were the most common clinical symptoms. Regarding pain severity, 51 (27.4%) had mild pain, 78 (41.9%) had moderate pain, and 57 (30.7%) experienced severe abdominal pain, with moderate pain being the most prevalent (Table 1).

Table 1: Descriptive Analysis of Patients' Symptoms

Variables	Responses	n (%)
Nausea/vomiting	No	51 (27.4%)
	Yes	135 (72.6%)
Fever	No	93 (50.0)
	Yes	93 (50.0%)
Tenderness	No	88 (47.3%)
	Yes	98 (52.7%)
Swelling	No	161 (86.6%)
	Yes	25 (13.4%)
Abdominal distension	No	123 (66.1%)
	Yes	63 (33.9%)
Guarding and rigidity	No	119 (64.0%)
	Yes	67 (36.0%)
Severity of pain	Mild (1 to 3)	51 (27.4%)
	Moderate (4 to 6)	78 (41.9%)
	Worst (7 to 10)	57 (30.7%)
Total		186 (100.0%)

The results showed that Out of 186 patients, 7 (3.8%) patients were diagnosed with Appendicitis through gray scale ultrasound, 15 (8.1%) patients were diagnosed with Acute pancreatitis, 23 (12.4%) patients were diagnosed with acute Cholecystitis, 22 (11.8%) patients were diagnosed with Renal colic on gray scale ultrasound, 25 (13.4%) patients were diagnosed with Hydronephrosis through ultrasonography, 2 (1.1%) patients were diagnosed with Inflammatory bowel disease, Intestinal obstruction was diagnosed in 1 (0.5%), 38 (20.4%) cases were reported for Cholelithiasis, Liver abscess was detected in 5 (2.7%) patients, 3 (1.6%) patients were diagnosed with Splenic lesions/abscess on ultrasound, 5 (2.7) cases were reported as hemorrhagic Renal cysts(single and multiple both), 1 (0.5%) case was reported as Choledocholithiasis and 35 (18.8%) patients were reported as Normal (had unremarkable study on ultrasound).

Table 2: Frequency of Causes of Acute Abdomen

Causes	Responses	n (%)
Appendicitis	No	179 (96.2%)
	Yes	7 (3.8%)
Acute pancreatitis	No	171 (91.9%)
	Yes	15 (8.1%)
Acute Cholecystitis	No	163 (87.6%)
	Yes	23 (12.4%)
Renal colic	No	164 (88.2%)
	Yes	22 (11.8%)
Hydronephrosis	No	161 (86.8%)
	Yes	25 (13.4%)
Inflammatory Bowel Disease	No	184 (98.9%)
	Yes	2 (1.1%)
Intestinal obstruction	No	185 (99.5%)
	Yes	1 (0.5%)
Cholelithiasis	No	148 (79.6%)
	Yes	38 (20.4%)
Liver abscess	No	181 (97.3%)
	Yes	5 (2.7%)
Splenic lesions/abscess	No	183 (98.4%)
	Yes	3 (1.6%)
Renal cyst (hemorrhagic)	No	181 (97.3%)
	Yes	5 (2.7%)
Choledocholithiasis	No	185 (99.5%)
	Yes	1 (0.5%)
Unremarkable study	No	151 (81.2%)
	Yes	35 (18.8%)
Total		186 (100.0%)

A male patient presented with severe pain in the right and left lumbar regions for the past 8 hours, accompanied by fever and hyperemesis. Laboratory tests were performed 2 hours before imaging. Transabdominal ultrasonography revealed multiple renal calculi in the right kidney, the largest measuring 3.9 mm (Figure 1).

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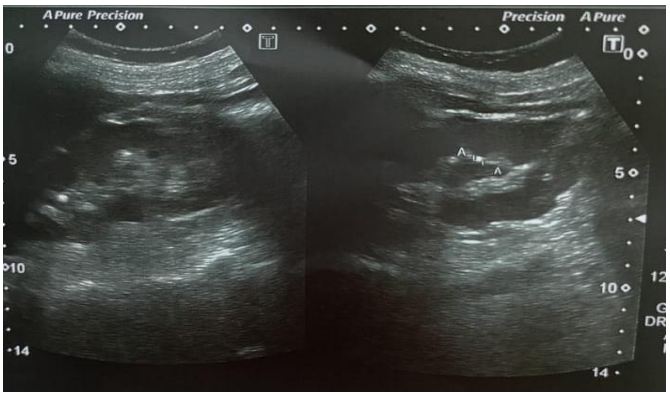

Figure 1: Transabdominal Ultrasound Showing Multiple Renal Calculi in the Right Kidney (Largest Measuring 3.9 mm)

Another case involved a female patient presenting with severe pain in the right hypochondrium region for 8 hours and marked abdominal tenderness. Transabdominal ultrasound revealed multiple tiny calculi (largest > 4 mm) with posterior acoustic shadowing, confirming cholelithiasis (Figure 2).

Figure 2: Transabdominal Ultrasound Showing Cholelithiasis with Multiple Tiny Calculi (Largest >4 mm) Producing Posterior Acoustic Shadowing

The study results showed that out of 186 patients (including males and females), 15 males and 8 females had acute cholecystitis with chi sq. value 4.029 and P value 0.045 showing significant association with gender of patient because it has P value less than 0.05, all other causes of acute abdomen such as appendicitis, pancreatitis, renal colic, cholelithiasis, liver abscess, intestinal obstruction, splenic lesion, hydronephrosis, IBD, renal cyst (hemorrhagic), choledocholithiasis had P=> 0.05, Chi-sq. The test shows a non-significant association between the gender of the patient and these causes of acute abdomen (Table 3).

Table 3: Association of Causes of Acute Abdomen with Gender

Variables		Gender of the patient		Total Count %	Chi sq. Value	p-Value
		Male Count & %	Female Count & %			
Appendicitis	No	81 (95.3%)	98 (97.0%)	179 (96.2%)	0.384	0.536
	Yes	4 (4.7%)	3 (3.0%)	7 (3.8%)		
Acute pancreatitis	No	80 (94.1%)	91 (90.1%)	171 (91.9%)	1.005	0.316
	Yes	5 (5.9%)	10 (9.9%)	15 (18.1%)		
Acute Cholecystitis	No	70 (82.4%)	93 (92.1%)	163 (87.6%)	4.029	0.045*
	Yes	15 (17.6%)	8 (7.9%)	23 (12.3%)		
Renal colic	No	77 (90.6%)	87 (86.1%)	164 (88.2%)	0.876	0.349
	Yes	8 (9.4%)	14 (13.9%)	22 (11.8%)		
Hydronephrosis	No	72 (84.7%)	89 (88.1%)	161 (86.6%)	0.462	0.497
	Yes	13 (15.3%)	12 (11.9%)	25 (13.4%)		
Inflammatory Bowel Disease	No	84 (98.8%)	100 (99%)	184 (98.9%)	0.15	0.0902
	Yes	1 (1.2%)	1 (1.0%)	2 (1.1%)		
Intestinal obstruction	No	85 (100.0%)	100 (99.0%)	185 (99.5%)	0.846	0.358
	Yes	0 (0%)	1 (1.0)	1 (0.5%)		
Cholelithiasis	No	68 (80%)	80 (79.2%)	148 (79.6%)	0.018	0.894
	Yes	17 (20%)	21 (20.8%)	38 (20.4%)		
Liver abscess	No	81 (95.3%)	100 (99.0%)	181 (97.3%)	2.436	0.119
	Yes	4 (4.7%)	1 (1.0%)	5 (2.7%)		
Splenic lesions /abscess	No	83 (97.6%)	100 (99.0%)	183 (98.4%)	0.54	0.462
	Yes	2 (2.4%)	1 (1.0%)	3 (1.6%)		
Renal cyst (hemorrhagic)	No	83 (87.6%)	98 (97.0%)	181 (97.3%)	0.067	0.795
	Yes	2 (2.4%)	3 (3.0%)	5 (2.7%)		
Choledo-cholithiasis	No	84 (98.8%)	101 (100)	185 (99.5%)	1.195	0.274
	Yes	1 (1.2%)	0 (0.0)	1 (0.5)		
Unremarkable study	No	72 (84.7%)	79 (78.2%)	151 (81.2%)	1.272	0.259
	Yes	13 (15.3%)	22 (21.8%)	35 (18.8%)		

DISCUSSIONS

Acute abdominal pain requires immediate attention and treatment. Surgeons and other medical professionals continue to face diagnostic challenges, as it remains one of the most frequent causes of hospital admissions worldwide. Early identification of the underlying cause is crucial for timely decision-making regarding appropriate management, whether conservative or surgical [19]. Patients who receive structured and focused diagnosis and treatment have much lower morbidity and mortality rates [20]. A 2023 study aimed to determine the causes of acute abdomen [21]. According to that study, the most frequent diagnoses were cholecystitis (7.9%), appendicitis (14.5%), and perforation (18.9%), indicating a higher prevalence of acute surgical conditions. In contrast, the current study, involving 186 patients, found that acute cholecystitis (12.4%), hydronephrosis (13.4%), and cholelithiasis (20.4%) were the most common diagnoses. Fewer cases of appendicitis (3.8%) and perforation were observed, suggesting a broader range of gastrointestinal problems in the present population. Both studies emphasized the diagnostic value of ultrasound in evaluating abdominal conditions. In 2015, another study reported that

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cholelithiasis was more prevalent in females (6.8%) than in males (4.7%) and identified age and female sex as major risk factors [22]. The current study also noted a higher frequency of cholelithiasis and related symptoms among females, with abdominal discomfort (24.7%), nausea or vomiting (72.6%), fever (50%), and abdominal tenderness (52.7%) being the most common clinical findings. The current study had several limitations. As ultrasound is operator-dependent, results may vary depending on the skill and experience of the examiner. Self-reported pain may introduce variability in symptom assessment. Furthermore, obesity and deeper lesions may limit ultrasound sensitivity.

CONCLUSIONS

The current study concludes that there is a significant association between acute cholecystitis and the gender of the patient. It also highlights the significance of ultrasound in diagnosing the causes of acute abdomen, with cholelithiasis, hydronephrosis, renal colic, and acute cholecystitis as the most frequent causes of acute abdomen. Future studies should compare the diagnostic accuracy of ultrasound with other imaging modalities like CT scans or MRIs. Follow-ups should be done by researchers in the future to determine how patients' conditions changed or how accurate the ultrasound diagnosis was. They should also concentrate on the management of causes of acute abdomen along with diagnosis.

Authors Contribution

Conceptualization: NS
Methodology: MS, ZS, AR
Formal analysis: AR
Writing review and editing: MS, ZS, AR, AA, HQ, MBB, YK

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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