

THE ACCURACY OF PRE-OPERATIVE DIAGNOSIS IN ACUTE ABDOMEN

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ABSTRACT

Background: Acute abdominal pain is a common presentation that requires in most cases immediate management. It is sometimes crucial to reach a diagnosis at the onset and to make a decision as to operate if needed. Therefore it is necessary for the physician to be familiar both with the presentations of common causes of abdominal pain and the validity of diagnostic tests. This study is to compare the accuracy of preoperative diagnosis in the acute abdominal cases and find most common causes of acute abdomen. To see the negative laparotomy rate and diagnostic accuracy and predictive values of different investigations in acute abdomen. **Patients & Methods:** This was an observational prospective study, conducted from February to December 2011. The study included 343 patients referred to 3rd surgical unit in Baghdad Teaching Hospital, presented with symptoms and signs of acute abdomen. Any patient aged above 14 years was included. All patients operated as a case of acute appendicitis had Alvarado score of more than 7. The patients with acute pancreatitis included those not responding to medical treatment or rapidly deteriorating or have suspicion of necrotizing pancreatitis. **Results:** All 343 patients with diagnosis of acute abdomen underwent emergency laparotomy. Acute abdomen was most common in the age group 20-29 years with male predominance. Acute appendicitis (53.06%) was the most common cause of the surgical condition followed by peritonitis (19.8%), bowel obstruction (13.9%), pancreatitis (3.79%), gall bladder diseases (2.9%), complicated ovarian cyst (4.37%) and ectopic pregnancy (2.04%) in female patients. The negative laparotomy rate was 9.23% (P value < 0.05). In 286 (83.38%) of patients, the pre and post laparotomy diagnoses were the same. The diagnostic accuracy rates were 90.6%. In our study total WBCs had the highest sensitivity (87%) and abdominal X-ray had the highest specificity (88.8%). The highest positive predictive value was related to abdominal x-ray (88.6%), while urinalysis showed the highest negative predictive value (93.3%). **Conclusion:** It is true that the diagnosis of acute abdomen is based on history, clinical examination and investigation; nevertheless it is rather clinical in most of the case. The most common cause of acute abdomen by far was acute appendicitis followed by peritonitis and bowel obstruction. The accuracy of clinical diagnosis was quite significant in acute appendicitis and significant in peritonitis. The rest of surgical conditions contributing to acute abdomen did not show statistically significant diagnostic accuracy. The reason for that lies in the fact that the number of cases studied for them were inadequate to refute any statistical chance factors.

KEYWORDS: Acute abdomen, Laparotomy, Diagnosis.

INTRODUCTION

The term "acute abdomen" denotes an episode of severe abdominal disorder, which may require urgent surgical intervention. Many medical and gynecological diseases also manifest as acute abdomen and differentiating them at many times is quite difficult.

Pre-operative diagnosis of acute abdomen with limited facilities is very crucial to minimize the morbidity and mortality in the developing countries like ours, where the

facilities of diagnosis are limited and clinical acumen play a pivotal role in the diagnosis and management of acute abdomen. Thus surgeons in developing countries need to improve diagnostic acumen and decision-making in the management of the acute abdomen.^[1]

Previous studies have demonstrated that management errors can be significantly reduced by accurate pre-operative diagnosis in acute abdomen.

Accurate and confirmative pre-operative diagnosis of acute abdomen ensures definitive per-operative surgical treatment, which in turn minimizes the negative laparotomy.

The complexity of acute abdomen is such that a careful, methodical diagnostic approach is necessary in order to arrive at a correct diagnosis.^[2]

Correct pre-operative diagnosis of acute abdomen remains challenging despite proper history taking and clinical examination, as well as advancement in new imaging techniques like computer-aided diagnosis, ultrasound imaging, computed tomography and laparoscopy.^[3]

In this study, attempts had been made to compare the pre-operative diagnosis with perioperative findings so as to guide the practicing physicians to manage the cases of acute abdomen properly.

The syndrome of acute abdominal pain generates a large number of hospital visits. Conditions resulting in an acute abdomen can cause serious complications or even death, especially if there is a delay in diagnosis and appropriate therapy, but as pointed out by Cope, (The term acute abdomen should not be equated with the invariable need for operation.^[4] The range of disease extends from the relatively trivial to the immediately life-threatening conditions, and attempts to reach a diagnosis must sometimes be curtailed in the interest of immediate treatment.^[4]

More commonly there is time to take a history, to examine the patient, and to organize the investigations, which will be helpful in establishing a diagnosis and planning treatment.

Accurate recording of the relevant facts is vital and a clear understanding of the anatomy and pathophysiology of intra-abdominal disease is necessary for both diagnosis and treatment. These patients are therefore ideal for training junior members of a surgical team.^[4]

The immediate feedback that an emergency operation provides on the accuracy and the adequacy of the preoperative assessment and preparation is another reason why the patient with an acute abdomen is an important part of surgical training. The acute abdomen is test of clinical acumen of the clinician. An accurate and comprehensive history of the events surrounding the onset of pain and knowledge of the nature of pain, its location and accompanying symptoms are crucial in developing a differential diagnosis.

The vital signs may be normal during the initial phases of the illness, with an elevated temperature and hypotension occurring in the later stages. Information from the patient's history, physical examination, laboratory tests, and imaging studies usually permits a

reasonably correct diagnosis, but uncertainty can still remain. Because appendicitis is a common disease, it must remain in the differential diagnosis of any undiagnosed patient with persistent abdominal pain, particularly the right lower quadrant pain.^[5]

AIM OF STUDY

1. This study is to compare the accuracy of preoperative diagnosis in the acute abdominal cases (pre and post-operative diagnosis in acute abdomen).
2. To evaluate the negative laparotomy rate.
3. Diagnostic accuracy and predictive values of different investigations in acute abdomen.

PATIENTS AND METHODS

This was an observational prospective study performed in emergency surgical ward of Baghdad teaching hospital (Iraq) from February to December 2011, to compare the pre-operative diagnosis based on clinical examination and investigations with the post-operative diagnosis of acute abdomen.

The study included 343 cases of age groups above 14 years in both genders with clinical manifestations suggestive of acute abdomen that underwent laparotomy. Cases that underwent laparotomy for the diagnosis of acute abdomen were considered in the sample. Those patients managed conservatively were excluded.

Patients were examined by the admitting surgical team after taking a thorough history, relevant points in the history included the patient's gender, age, site of pain, character of pain, fever, loss of appetite, change in bowel habit, vomiting, abdominal distension and urinary or genital symptoms. In terms of clinical examination, the factors that gave a solid basis to the diagnosis of acute abdomen included fever, tachycardia, abdominal tenderness, localized or generalized guarding & rigidity.

In all studied cases, white blood cells (WBC) were requested on admission. Urinalysis (UA) was done in 95% of patients. Abdomen X-ray, abdominal U/S and serum amylase level were performed in some cases according to the clinical suspicion.

Pre-operative diagnosis was made by surgical residents based on clinical examination and investigations & this was compared to the post operative diagnosis.

Statistical analysis was performed using SPSS software version 18. Student's t-test and Chi-square test were used to calculate the significance level and a P-value of <0.05 was considered significant.

Rate of negative laparotomy, sensitivity, specificity, positive and negative predictive values were all calculated.

$$\text{Sensitivity} = \frac{\text{true positive}}{\text{true positive} + \text{false negative}}$$

$$\text{Specify} = \frac{\text{True negative}}{\text{true negative} + \text{false positive}}$$

$$\text{Positive predictive value} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}}$$

$$\text{Negative predictive value} = \frac{\text{True Negative}}{\text{True Negative} + \text{False Negative}}$$

$$\text{Accuracy rate} = \frac{\text{True Positive} + \text{True Negative}}{\text{Total}}$$

Study Design

Prospective non-interventional (comparative) type.

1. Sampling technique: all cases with acute abdomen that underwent laparotomy were included.
2. Sample size: 343 patients were included in the study.
3. Inclusion criteria:
 - a. Patients of age groups above 14 years old.
 - b. Both male and female patients.
 - c. All patients were operated as a case of acute appendicitis had an Alvarado score more than 7.
 - d. The patients with acute pancreatitis included those not responding to medical treatment or rapidly deteriorating or have suspicion of necrotizing pancreatitis.
4. Exclusion criteria: Patients with medical causes of acute abdomen.

Data were collected from the patient's questionnaire forms and results were analyzed by calculating the frequencies of the causes of acute abdomen. The preoperative and postoperative causes of these cases were then compared to find out the clinical accuracy of diagnosis.

RESULTS

Out of 343 patients who underwent emergency laparotomy with the provisional diagnosis of acute abdomen, 227(66.1%) were males and 116 (33.9%) were females.

Mean age of the patients was 35.3± 18.6with the range of 14-85 years. Majority of patients 221 patients (64.4%) were 20-29 years old.

The most common symptoms was abdominal pain while other symptoms like nausea, loss of appetite and vomiting were (56.85 %), (48.39), (44.89%) respectively.

The most common clinical signs were abdominal tenderness (97.9%), guarding (69.3%) and rebound tenderness (67.6%). The signs and symptoms of the patients are summarized on table 1.

Table 1: shows frequencies & percentages of Signs and symptoms in patients.

Symptom	No. (%)	Sign	No. (%)
Abdominal pain	343(100)	Tenderness	
Severity of pain		Abdominal tenderness	336(97.9)
Mild	63(18.3)	Rebound tenderness	232 (67.6)
Moderate	203 (59.1)	guarding	
severe	77(22.4)	Generalize guarding	90(26.2)
Character of pain		Localize guarding	153(44.6)
colicky	130(37.9)	rigidity	
constant	213(62.09)	Generalize rigidity	85(24.7)
		Localize rigidity	153(44.6)
Nausea	195(56.85)	Vital sign	
Vomiting	154(44.89)	Hypotensive	47(13.7)
Loss of appetite	166(48.39)	Respiratory rate ≥ 25	20 (5.83)
Change in bowel motion	46(13.41)	Pulse rate ≥ 100	115 (33.3)
Abdominal distention	40(11.66)	Temp. ≥ 38c	77(22.4)

Acute appendicitis was the most common cause of acute abdomen 154 (44.89%) and this figure included acutely inflamed appendix in 101 (65.58 %) patients, gangrenous

or perforated appendix in 30 (19.5%), appendicular mass in 3 (1.94%), and normal appendix in 20 (12.9%).

Table 2: shows the frequencies and percentages of intra operative findings in acute appendicitis.

Intra operative Findings	No. (%)
Acutely inflamed appendix	101 (65.58%)
Gangrenous or perforated appendix	30 (19.5%)
Appendicular mass	3 (1.94%)
Normal appendix	20 (12.9%)
Total	154 (100%)

The 20 patients with normal appendix had associated findings including one patient with ovarian cyst, five patients with mesenteric adenitis and one patient with

pelvic abscess. In the rest of the cases, the diagnosis was not reached.

The findings at histology are shown in figure 1. Acutely inflamed appendicitis 91(59.09%), acute suppurative appendicitis 30 (19.4%) or gangrenous appendix 10

(6.49%) accounted for cases, chronic appendicitis 11 (7.1%) and normal appendix comprised 12 (7.8%).

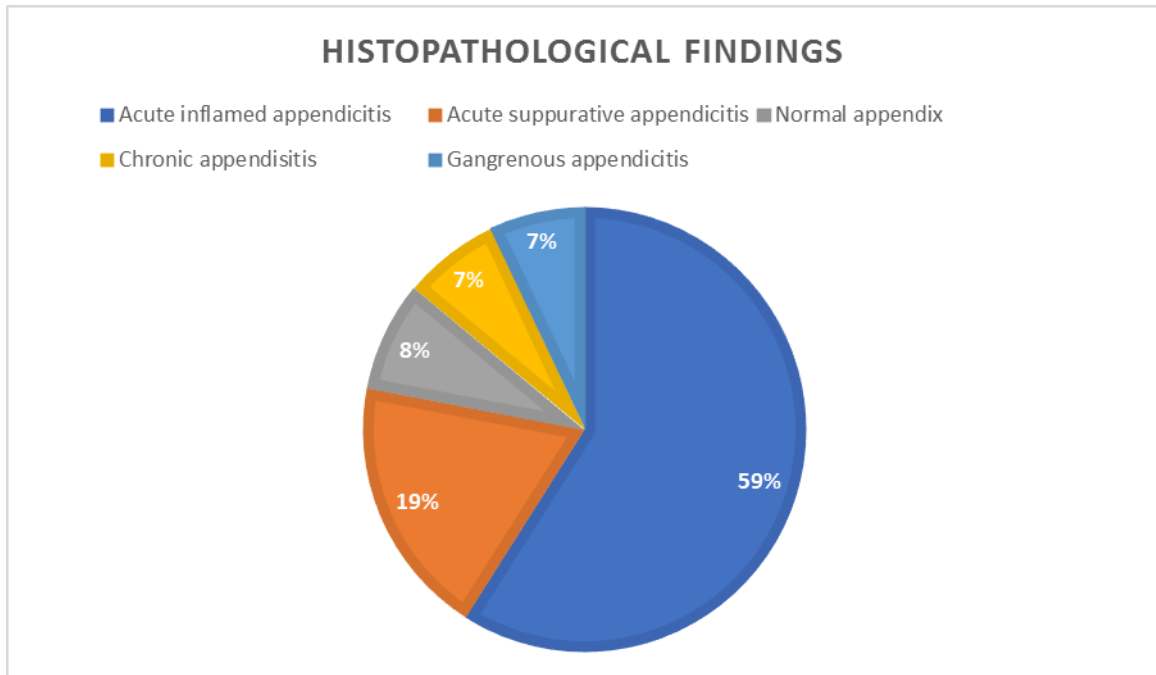


Figure 1: the percentages of histopathological findings in acute appendicitis.

Other common causes of acute abdomen were peritonitis 68 (19.8%), bowel obstruction 48 (13.9%), and other

causes shown in the pre and post laparotomy diagnosis are reported in table 3.

Table 3: preoperative and postoperative diagnosis.

Pre operative diagnosis	No (%)	Post operative diagnosis	No (%)
Acute appendicitis	182 (53.06)	Appendicitis	154(84.6)
		-ve laparotomy	18(5.2)
		Meckel's diverticulum	3 (0.87)
		AMI	3 (0.87)
		Ovarian cyst	1 (0.29%)
		Pelvic abscess	1 (0.29%)
		Crohn's disease	1 (0.29%)
		Pyosalpingitis	1 (0.29%)
		Peritonitis	68(19.8)
Perforated typhoid ulcer	18		
AMI	7		
T.B peritonitis	2		
Perforated gall bladder	1		
Pelvic abscess	1		
-ve laparotomy	12		
Acute Intestinal obstruction	48(13.9)		
		Volvolus	7(14.5)
		Hernia	9(18.75)
		Tumor	9(18.75)
		Gall stone ileus	1 (2.08)
		Pseudo obstruction	1 (2.08)
		Internal hernia	1 (2.08)
		-ve laparotomy	Zero
Complicated ovarian cyst (ruptured or twisted)	15(4.37)	Rupture ovarian cyst	10
		Twisted ovarian cyst	2
		Pyosalpingitis	1
		Mucinous cyst adenoma of	1

		appendix Appendicular mass -ve laparotomy	1 Zero
Acute pancreatitis	13(3.79)	Pancreatitis T.B peritonitis Primary peritonitis -ve laparotomy	10(2.9) 1 1 1
Gall bladder diseases	10 (2.9)	Empyema Perforation Pancreatitis -ve laparotomy	8 1 1 Zero
Ectopic pregnancy	7(2.04)	Ectopic pregnancy Twisted ovarian cyst Appendicitis -ve laparotomy	5 1 1 1

In 286 (83.38%) patients, pre and post laparotomy diagnoses were the same. The diagnostic accuracy rates were 90.6%.

In all of the cases with bowel obstruction, gall bladder diseases, complicated ovarian cyst, there were no negative laparotomies.

Table 4: Comparison between pre and intra-operative diagnosis.

Pre-operative diagnosis		Intra operative diagnosis		
		Correct Dx	-ve Laparotomy	Incorrect Dx
Appendicitis	182 (53.06%)	154 (44.8%)	18 (5.2%)	10 (2.9%)
Peritonitis	68 (19.8%)	52(15.16%)	12 (3.49%)	4 (1.16%)
Bowel obstruction	48 (13.9%)	45(13.1%)	zero	3 (0.87%)
Pancreatitis	13 (3.79%)	10 (2.9%)	1 (0.29%)	2(0.58%)
Gall bladder diseases	10 (2.9%)	9(2.62%)	zero	1 (0.29%)
Complicated ovarian cyst	15(4.37%)	12 (3.49%)	zero	3 (0.87%)
Ectopic pregnancy	7(2.04%)	4 (1.16%)	1 (0.29%)	2(0.58%)
Total	343	286(83.38%)	32(9.32%)	25(7.28%)

Most of the cases with incorrect diagnoses and negative laparotomies were in appendicitis. The total incorrect diagnosis was 25 (7.28%).

Table 5: frequencies and percentages of correct pre-operative diagnosis and p-value.

Pre operative diagnosis	No. (%)	Correct pre-operative diagnosis	% correct	P- value
Appendicitis	182 (53.06)	154	84.6	0.005
Peritonitis	68 (19.8)	52	64.7	0.003
Intestinal obstruction	48 (13.9)	45	93.7	0.242
Complicated ovarian cyst (rupture or twisted)	15 (4.37)	12	80	0.645
Pancreatitis	13 (3.79)	10	76.9	0.326
Gall bladder diseases	10 (2.9)	9	90	1.0
Ectopic pregnancy	7 (2.04)	4	57.14	0.192
Total	343 (100%)	286	83.38	0.0005

The negative laparotomy rate was 32 (9.32%) and they were a statistically significant (p-value <0.05), and those patients were suffering from signs and symptoms of acute abdomen they were diagnosed postoperatively as having a disease which did not need surgical intervention, and still about 15 patient we did not reach a definitive diagnosis neither preoperative nor postoperative (laparotomy).

Table 6: Causes of negative laparotomies.

Disease	No.
Acute mesenteric adenitis	8
Pelvic inflammatory diseases	2
Ureamic patients	2
Ruptured graafian follicle	3
Diabetic ketoacidosis	1
Acute gastroenteritis	1
Other undiagnosed	15
Total	32

Regarding the results of the investigations performed to diagnose acute abdomen. Total Leukocyte Count was found raised in 69.6% of patients. Urinalysis showed abnormality in 26.5% of patients whereas Plain abdominal X-ray was positive in 43.1% of patients.

Abdominal Ultrasonography was 69.6% of reports had positive findings. Serum amylase was estimated in 29 patients and in 34.4% there was positive finding (>1000U/L).

Table 7: Investigation performed to diagnose acute abdomen.

Investigation (n=343)	Positive findings	%
WBC	239	69.6%
GUE	91	26.5%
PAX	148	43.1%
Us	239	69.6%

Table 8: predictive values of investigations.

	WBC	US	PAX	GUE
Sensitivity (%)	87	69.4	68.4	75
Specificity (%)	66.7	81.5	88.8	85.4
Positive predictive value (%)	84.5	69.4	88.6	55.6
Negative predictive value (%)	70.9	75.8	68.9	93.3

Acute appendicitis had the diagnostic accuracy of 90.1% . Overall diagnostic accuracy was 90.6%. There was statistically significant difference between the pre-operative and operative diagnosis (P=0.0005).

Table 9: the complication rate and types of the complications post-operative.

Complications	No. (%)
Wound infection	63 (18.36)
Occult burst abdomen	4 (1.16)
ARDS	4 (1.16)
Small bowel fistula	3 (0.87)
Pancreatic fistula	1 m(0.29)
Bleeding	1 (0.29)
Intra-abdominal collection	0
Paralytic ileus	22 (6.4)
Total	97 (28.2)

Table 10: diseases and causes of mortality.

Disease	Cause of death	No. (%)
Acute myocardial infarction	Sepsis	2 (0.58)
Pancreatitis	ARDS	1 (0.29)
Perforated terminal ileum	Sepsis	1 (0.29)
Appendicitis	Pulmonary embolism	1 (0.29)
Perforated DU	Myocardial infarction	1 (0.29)
Total		6 (1.74)

DISCUSSION

In this study, 227 patients (66.1 %) were male and 116 patients (33.9%) were female. Acute abdomen was found

Total Leukocyte count had the highest sensitivity of 87% and the lowest specificity of 66.4%. , Plain abdominal X-ray had the highest specificity 88.8 % and had the highest positive predictive value of 88.6% and with lowest negative predictive value of 68.9%.

Urinalysis had the highest negative predictive value of 93.3% while plain abdominal X-ray had the highest diagnostic accuracy of 82.4% was seen with obstructive causes with no statistically significant difference (P=0.242).

Lowest diagnostic accuracy of 82% was observed with causes of peritonitis.

All small bowel fistulae occurred in cases of AMI, and the pancreatic fistula was in a case of postoperative pancreatitis.

The bleeding occurred in a case of post-operative appendicitis due to iatrogenic injury to inferior epigastric artery which needed re-exploration. Four patients from the negative laparotomy developed wound infection.

Five female patients from total number were pregnant, in 4 of them the pregnancy passed uneventfully and all of them were diagnosed as having acute appendicitis, and the last pregnant female had acute abdomen due to (perforated viscous) there was premature delivery and death of baby after few hours after delivery and death of the mother after 5 days due to sepsis.

In this study the mortality rate was 1.74%, the table no. 10 determined the causes of death and the diseases.

most commonly in the age group 20-29 years comprising 221 (64.4%) of patients.

This result showed similar statistics to other studies, reporting the prevalence of acute abdomen mostly in 20-29 years old patients as the study by (Chhetri RK et al).^[6]

The most common symptom was abdominal pain 100% and most common sign was abdominal tenderness 97.9%.

Despite improvement in clinical evaluations and advancement in diagnostic methods, correct diagnosis of acute abdomen is still sometimes challenging. Patients with acute abdominal pain represent a heterogeneous group that consumes a great deal of a surgical department's resources.^[7]

In cases where the diagnosis is suspected, laparotomy has been advised to be performed³, but this policy has increased the rate of negative laparotomies.^[8]

Among the etiologies leading to laparotomy, in this study, acute appendicitis was the commonest and observed in 44.8% of cases. Peritonitis and bowel obstruction were observed in 15.16% and 13.1% of cases respectively.

Most common operative finding was acutely inflamed appendix 101 (65.58%), while histopathological examination revealed 91 (59.09%) acutely inflamed appendices, which still represents a high percentage.

Other studies, reported acute appendicitis to be the leading cause of acute abdomen in 55% cases (Chhetri RK, et al).^[6]

In the study by Datubo - Burwn DDetal, acute appendicitis was the commonest cause constituting 17% to 51% of acute abdomen, while other common causes were intestinal obstruction constituting 15% to 24% and visceral perforation comprising 8% to 12%.^[9]

In the study by Laal, M. & Mardanloo et al, acute appendicitis was the commonest and observed in 56.8% of cases. Peritonitis and bowel obstruction were observed in 14.4% and 7.9% of cases respectively.^[10]

In our study the total negative laparotomy was 32 (9.32%), and in 286 (83.38% of patients) the pre and post laparotomy diagnosis were same. Peritonitis and bowel obstruction were observed in 15.16% and 13.1% of cases respectively. Visceral perforation and bowel obstruction in 8-12% and 15-24% of cases of laparotomy, respectively were found in the study by (Heelar M, et al).^[11]

The diagnostic accuracy rates were 90.6%.

In the study done by (Laal, M. & Mardanloo et al) Diagnostic accuracy is about 80% with experienced clinician while younger doctors are right in 50%.^[2]

In the study by (Laal, M. & Mardanloo et al) the total negative laparotomies were 12.2% (P-value less than 0.05) and in 77.7% of patients, the pre and post laparotomy diagnosis were same.^[10]

Though negative laparotomy rate of as low as 7% to up to 22% are observed in literature in our series.^[11]

In the study by (Chhetri RK et al), overall negative laparotomy rate was 17.6%, which was statistically significant.

Highest rate of negative laparotomy was seen in patients of peritonitis and lowest with bowel obstruction.^[6]

In our study acute appendicitis had 5.2% negative rate, which was statistically significant though negative appendectomy rate of 15% to up to 30% are reported in other series.^[12]

Many surgeons advocate early surgical intervention for the treatment of acute appendicitis to avoid perforation, accepting a negative laparotomy rate of about 15-20%.^[13]

The overall negative laparotomy rate (i.e. no histological evidence of appendicitis) of 5.2% in this study is comparable to some reported series in Nigeria^[14], but much higher figures of 29.5% and 32.2% have been reported from other centers in Nigeria respectively.^[15]

In this study and others mentioned above, the largest number of misdiagnoses occurred in women of reproductive age group where other pelvic diseases could make diagnosis difficult.

In such cases clinical examination should be complemented with laparoscopy or diagnostic imaging such as CT scan to minimize the rate of negative appendectomy.^[15]

However, a large population based study suggested that the rate of negative appendectomy (15-20%) has not declined for 15 years despite the increasing use of such tests.^[16]

It is interesting to note that all the patients with histologically normal appendix appeared to have been cured of their problems.

Our study showed total Leukocyte Count was moderately sensitive with low specificity.

In other studies total Leukocyte Count was non-specific and relatively insensitive, thus neither test is sufficiently sensitive or specific to be a good predictor of surgical acute abdomen.^[17]

Plain Abdominal X-ray has actual indication in less than 5% of patients with acute abdomen and can change the diagnosis and management of acute abdomen in up to 6%.^[18]

It has its most useful role in evaluating patient with mechanical obstruction of gastrointestinal tract. Routine and indiscriminate use of plain abdominal X-ray is not recommended in the acute abdomen.^[12]

In our study it had sensitivity of 68.4%, specificity of 88.8%, positive predictive value of 88.6% and negative predictive value of 68.9%.

Our study showed urinalysis was performed for 95% of patients and in 91 (26.5%) cases had positive findings.

In a study performed by (Heelar M, et al), urinalysis had sensitivity and specificity 75% and 85.4% respectively.

Regarding previous studies, UA is advised to be performed for all acute abdomen patients to exclude urinary tract infection (UTI), diabetes, renal stones, ectopic pregnancy and normal pregnancy (Heelar M.).^[11]

Ultrasonography had very low sensitivity in our study, but quite high specificity.

In our study, the sensitivity and specificity of U/S were 69.4% and 81.5% respectively and the diagnostic accuracy for Gall bladder diseases was as high as 100%.

Other studies like (Laal, M. & Mardanloo et al) show the sensitivity and specificity of 79% and 73% for U/S in the diagnosis of acute abdomen. It is most useful in pregnant patients presenting with acute abdomen.^[10]

Regarding the diagnostic accuracy of acute abdomen, this study showed that it was highest in case of bowel obstruction and lowest in other causes of peritonitis. Other study shows, in at least 20% of cases, the decision to operate is uncertain^[18] and the surgeon must make a gamble to open and see^[12] rather than wait and see and structured record forms had been found to improve diagnostic accuracy by 20%.

The total complication rate 97 (28.2%) and the mortality rate 1.74%.

CONCLUSION

It is true that the diagnosis of acute abdomen is based on history, clinical examination and investigation; nevertheless it is rather clinical in most of the cases.

The accuracy of clinical diagnosis was quite significant in acute appendicitis and significant in peritonitis. The rest of surgical conditions contributing to acute abdomen did not show statistically significant diagnostic accuracy. The reason for that lies in the fact that the number of

cases studied for them were inadequate to refute any statistical chance factors.

The pelvic diseases were probably the reason contributing to our observation that highest figures of incorrect diagnosis were found in women of child bearing age.

The key reason for having low incidence of ovarian cysts and ectopic pregnancies in our study is attributed to the hospital protocols that necessitate referring such cases to the gynecologists and obstetricians.

High levels of serum amylase may guide our suspicion toward pancreatitis. A preoperative accurate diagnosis prevents from negative laparotomies.

Recommendation

- 1 To provide the emergency department with a CT-scan abdomen for 24 hours. (CT-scan should be available when we need it).
- 2 Serum amylase should be provided in the emergency unit. (As one of important differentiating investigation determining the cause of acute abdomen).
- 3 To encourage the use of diagnostic laparoscopy (to use in emergency cases).

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