Original Research Article

A comparative study between abdominal plain radiography and ultrasonography in non-traumatic acute abdominal emergencies in tertiary care hospital

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ABSTRACT

Background: Acute abdomen is a loose term frequently used to describe the acute abdominal pain in a subgroup of patients who are seriously ill developing suddenly, over a period of several hours or few days.
Methods: It was a prospective comparative study between abdominal plain radiography and ultrasonography in non-traumatic acute abdominal emergencies in Tertiary Care Hospital.
Results: All the included patients (140) were imaged with abdominal X-rays series (AAS) and Ultrasonography (US) by different blinded radiologists without conveying results to either. Final diagnosis was made on the basis of clinical findings / laboratory or biochemical findings /radiological evaluation /therapeutic response / operative findings / histopathological examination. The entire data was collected, recorded and statistically analyzed as per objectives. GIT system was most commonly involved, in 75/140 cases (53.57%). Most common diagnoses were acute appendicitis, KUB calculus disease and acute cholecystitis seen in 32/140 (22.86%), 24/140 (17.14%) and 21 (15%) cases respectively. US supersedes Provisional clinical diagnosis and Radiographic evaluation in diagnosing acute abdominal conditions with Sensitivity, Positive Predictive Value, False positive rate, False Negative rate and Diagnostic Accuracy as 90.71, 100, 0 ,9.28 and 90.71 percent respectively.
Conclusions: We concluded that Plain X rays can be used as screening modality in the diagnosis of acute abdominal emergencies; however ultrasound examination is cheaper, non-invasive, quick, reliable and highly accurate modality in diagnosing the exact cause of pain and its origin in a patient presenting with an acute abdomen and thus helps the physician or surgeon to plan the timely management.

Keywords: Acute abdomen, Non traumatic, Plain radiography, Ultrasound

INTRODUCTION

Acute abdomen is a loose term frequently used to describe the acute abdominal pain in a subgroup of patients who are seriously ill and have abdominal tenderness and rigidity. It usually refers to presence of severe abdominal pain developing suddenly, over a period of several hours.[1] However conditions that present with clinical features of short duration (few days, usually 3-5) which might indicate a progressive intra-abdominal condition that is threatening to patient's life or capable of causing severe morbidity are also sometimes included in

acute abdomen.[2] Some of these processes can be life-threatening and several of these require rapid diagnosis with timely medical or surgical intervention to avoid significant morbidity and mortality.[3] Acute abdomen does not invariably signify the need for surgical intervention. A good history, thorough clinical examination, laboratory investigations and imaging studies are necessary in order to arrive at a correct diagnosis, so that appropriate management can be done. The spectrum of non-traumatic acute abdomen is broad and varies according to referral and demographic patterns. Studies have shown that abdominal radiographs are not much sensitive and specific in the evaluation of patients presenting with non-traumatic acute abdominal pain.[4]

US have been largely used in clinical practice and in protocol of investigation of non-traumatic acute abdomen pain. US are easily available, lack radiation and have revolutionized the diagnosis of many acute intra-abdominal conditions.[5] Inappropriate use of ultrasound in the assessment of acute abdominal pain can lead to an increase in the workload of the personnel involved, prolonged inpatient stay, possible delay in treatment, and increased hospital costs.[6]

Though CT scan has been shown to increase the referring physician's level of certainty in the diagnosis, reduce hospital admission rates, and help in guiding the therapeutic strategy, including surgical intervention, it is more expensive, has radiation hazards, not widely available especially in rural settings, non-portable and require certain prerequisites especially the contrast enhanced CT.[7,8] Magnetic resonance (MR) imaging and diagnostic laparoscopy are also available, but they are used far less frequently for initial diagnostic workup.

The primary aim of this study was to prospectively analyze and compare the roles of abdominal plain radiography and ultrasonography in non-traumatic acute abdominal emergencies in tertiary care hospital.

Aims and objectives

Primary aim was to analyze and compare the diagnostic yields of abdominal X-rays and Ultrasonography and secondary aims were to analyze the spectrum, to correlate the clinical and radiological diagnoses and In Non-traumatic acute abdominal emergencies of tertiary care hospital.

METHODS

This was a prospective study conducted in two months (July and August 2015) on patients of non-traumatic acute abdominal emergencies referred to the department of Radio-Diagnosis from the outpatient and emergency departments of BPS Government Medical College for Women, Khanpur Kalan, Sonepat, Haryana, India.

100 patients were proposed in the study protocol; however more patients were taken to make data more reliable and authentic. Initially a total of 160 patients were selected for the study; however statistical analysis was done for 140 patients only, as 20 patients were lost to the follow up. The Institutional Ethical Committee (IEC) approval was taken prior to start of the study.

Inclusion criteria

All the patients attending Emergency and Out Patient Departments with non-traumatic acute abdominal emergencies with provisional clinical diagnosis referred to Department of Radiology and Imaging for further evaluation were included for the study.

Exclusion criteria

- Already radiologically diagnosed patients
- Patients with abdominal trauma
- Patients with suspected or confirmed pregnancy

All the procedures were done with patient's prior written informed consent and confidentiality was taken care of in all the cases. All the included patients were imaged with abdominal X-rays series (AAS) of upright chest, abdominal erect and supine at X-ray machine model no: FUZIFILM DIGITAL RADIOGRAPHY DR-XD 200. Plain x-rays were evaluated by one blinded radiologist with clinical history of abdominal pain only. No other details of the patient were given.

Similarly ultrasonography was done by another blinded radiologist with same patient details at USG machine model no: PHILIPS HD11XE with curvilinear, linear and TVS probes as per case need with reports given in emergency itself. The reports of radiographs and ultrasonography were not conveyed to the respective radiologist. Special investigations like intravenous urography, contrast studies of gastrointestinal tract, CT scan of abdomen were conducted /obtained whenever advised by the concerned physician or if the patients got it done from outside; however imaging details are not included in the study.

Final diagnosis was made on the basis of clinical evaluation /laboratory or biochemical findings /radiological work up/therapeutic response /operative findings / histopathological examination. The entire data was collected as per Clinical Case Sheet and was statistically analyzed as per our objectives.

RESULTS

Most of the patients (33/140) were in age group of 11-20 Years with mean age as 33.92±17.40 years (Table 1). Male to female ratio is 1.12 with 74 males and 66 females (Figure 1).

Table 1: Age group.

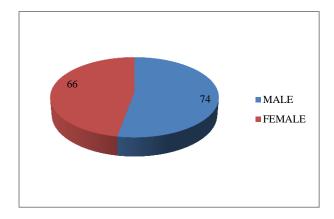| Age group (in years)	No. of cases
0-10	8
11-20	33
21-30	22
31-40	30
41-50	24
51-60	14
61-70	6
71-80	3

Figure 1: Sex ratio.

Most common clinical complaint of patients was abdominal pain (localized or diffuse) present in 100% cases (140/140) followed by vomiting, abdominal distention, fever and diarrhoea seen in 17.14% (24/140), 6.4% (9/140), 2.9% (4/140) and 0.7% (1/140) cases respectively (Table 2).

Table 2: Presenting complaints.

Associated complaints	No. of cases	% of cases
Vomiting	24	17.14
Abdominal distension	9	6.43
Fever	4	2.86
Diarrhoea	1	0.71

89/140 (63.57%) cases were sent with the provisional clinical diagnosis and 51/140 (36.43%) cases had no provisional clinical diagnosis / non- specific diagnosis. Most common provisional clinical diagnosis was acute appendicitis given in 36/140 patients i.e. 25.71% cases. Second and third common clinical diagnoses were KUB system calculus disease and acute cholecystitis given in 20/140 patients (14.29% cases) and 17/140 (12.14% cases) respectively (Table 3).

Radiographic evaluation

100/140 (71.43%) patients showed normal or non-specific findings. 40/140 patients (28.57%) showed findings specific to a particular diagnosis. Most cases diagnosed on X-rays were of KUB calculus disease and small bowel obstruction seen in 22/140 (15.71%) and 13/140 (9.29%) cases respectively (Table 4).

Table 3: Provisional clinical diagnosis.

Clinical diagnosis	No. of cases	% of cases (out of 140)
No clinical diagnosis given	51	36.43
Clinical diagnosis given	89	63.57
KUB system calculus disease	20	14.29
ureteric colic	10	7.14
Renal colic	10	7.14
Acute appendicitis	36	25.71
Acute pancreatitis	6	4.29
Acute gastroenteritis	1	0.71
Sub-acute intestinal obstruction	3	2.14
Peritonitis	3	2.14
Acid peptic disease	2	1.43
Acute cholecystitis	17	12.14
Torsion of ovarian cyst	1	0.71

Table 4: Radiographic evaluation.

Provisional diagnosis given by X-ray findings	No. of cases	% of cases (out of 140)
Normal radiographs / nonspecific findings	100	71.43
Provisional diagnosis given	40	28.57
KUB system calculus disease	22	15.71
Renal calculus	8	5.71
Calculus at pelvi-ureteric junction	2	1.43
Ureteric calculus	5	3.57
Calculus at uretero-vesical junction	7	5.00
Emphysematous pyelonephritis	1	0.71
Small bowel obstruction	13	9.29
Chronic constipation with large bowel dilatation	2	1.43
Bowel perforation with likely peritonitis	2	1.43

Ultrasonographic evaluation

Diagnosis was given in 127/140 (90.71%) cases and in rest of the 13/140 (9.29%) cases, USG was inconclusive. Most common diagnoses given were acute appendicitis, KUB calculus disease with proximal system dilatation and acute cholecystitis seen in 30/140 (21.43%), 24/140(17.14%) and 21/140 (15%) cases respectively. No false positive case was seen.

However, there were 13 false negative cases (8 acid peptic diseases, 2 acute appendicitis and 1 each of Acute Pancreatitis, Epiploic Appendagitis and Acute Gastroenteritis) (Table 5). The patients were managed as

per case need with conservative, conservative followed by surgical and emergency surgical management done in

76/140 (54.29%), 11/140 (7.86%) and 53/140 (37.86%) cases respectively (Table 6).

Table 5: Ultrasonographic evaluation

Provisional diagnosis given by USG	No of cases	% of cases
Normal USG	13	9.29
Provisional diagnosis given	127	90.71
KUB System Calculus Disease	24	17.14
Renal Calculus with Proximal Hydronephrosis	8	5.71
Calculus at Pelvi-ureteric Junction with Proximal Hydronephrosis	2	1.43
Ureteric Calculus with Proximal Hydroureteronephrosis	2	1.43
Proximal Hydroureteronephrosis with likely Ureteric Calculus	5	3.57
Calculus at Uretero-vesical Junction with Proximal Hydroureteronephrosis	7	5.00
Ureteric Stricture	1	0.71
Emphysematous Pyelonephritis	1	0.71
Acute Cholecystitis	21	15.00
Acute Cholecystitis with Cholelithiaisis	17	12.14
Acalculus Acute Cholecystitis (without cholelithiaisis)	3	2.14
Acute Cholecystitis with Perforation of Gall Bladder and Biliary Peritonitis	1	0.71
CBD Pathology	3	2.14
Choledocholithiasis	2	1.43
Choledochocoele with secondary Acalculus Cholecystitis	1	0.71
Acute Appendicitis	30	21.43
Acute Appendicitis	18	12.86
Perforated Acute Appendicitis	12	8.57
Acute Pancreatitis	7	5.00
Early Acute Pancreatitis	6	4.29
Pancreatic Pseudocyst	1	0.71
Mesenteric Lymphadenitis	10	7.14
Small Bowel Obstruction	7	5.00
Chronic Constipation with Acute Abdominal Distension due to Large Bowel Dilatation	1	0.71
Inflammatory Bowel Disease	1	0.71
Intussusception	2	1.43
Omental Infarction	1	0.71
Bowel Tuberculosis	3	2.14
Peritonitis	11	7.86
Non-tubercular peritonitis	10	7.14
Acute Peritonitis without small bowel ileus or obstruction	4	1.43
Acute Peritonitis with small bowel obstruction	5	3.57
Acute Peritonitis with small bowel ileus	1	0.71
Tubercular Peritonitis	1	0.71
Ovarian Hemorrhagic Cyst	2	1.43
Epididydmo-orchitis complex diseases	2	1.43

Table 6: Management.

Management	No. of cases	% of cases
Conservative	76	54.29
Conservative followed by surgical	11	7.86
Emergency surgical	53	37.86

Final diagnosis was made based on Clinical examination, Radiological work up, Biochemical tests, Medical management with follow up, Surgical and Histo-Pathological findings. GIT system was most commonly involved, in 75/140 cases (53.57%). Others systems involved were KUB (26/140, 18.57%), biliary (24/140,

17.14%), peritoneal (11/140, 7.86%) and genital (4/140, 2.86%). Most common three diagnoses were acute appendicitis, KUB calculus disease and acute

cholecystitis seen in 32/140 (22.86%), 24/140 (17.14%) and 21/140 (15%) cases respectively (Table 7).

Table 7: Final diagnosis.

System	Final diagnosis	NO.	%
KUB system		26	18.57
	Calculus Disease	24	17.14
	Renal Calculus with Proximal Hydronephrosis	8	5.71
	Calculus at PU Junction with Proximal Hydronephrosis	2	1.43
	Ureteric Calculus with Proximal Hydroureteronephrosis	7	5.00
	Calculus at UV Junction with Proximal Hydroureteronephrosis	7	5.00
	Ureteric Stricture	1	0.71
	Emphysematous Pyelonephritis	1	0.71
GIT system		75	53.57
	Acute Appendicitis	32	22.86
	Acute appendicitis	20	14.29
	Perforated acute appendicitis	12	8.57
	Acute Pancreatitis	8	5.71
	Early acute pancreatitis	7	5.00
	Pancreatic pseudocyst	1	0.71
	Mesenteric lymphadenitis	10	7.14
	Small bowel obstruction	7	5.00
	Chronic constipation with acute abdominal distension due to large bowel dilatation	1	0.71
	Inflammatory Bowel Disease	1	0.71
	Intussusception	2	1.43
	Acid Peptic Disease	8	5.71
	Epiploic Appendagitis	1	0.71
	Acute Gastroenteritis	1	0.71
	Omental Infarction	1	0.71
	Bowel Tuberculosis	3	2.14
Biliary system		24	17.14
	Acute cholecystitis	21	15.00
	Acute calculus Cholecystitis	17	12.14
	Acute Acalculus Cholecystitis	3	2.14
	Acute Cholecystitis with GB Perforation and Biliary Peritonitis	1	0.78
	CBD pathology	3	2.14
	Choledocholithiasis	2	1.43
	Choledochocoele with Secondary Acalculus Cholecystitis	1	0.71
System	Final diagnosis	NO.	%
Peritoneum		11	7.86
	Peritonitis	11	7.86
	Non-tubercular peritonitis	10	7.14
	Acute Peritonitis without Small bowel obstruction/ileus	4	1.43
	Peritonitis with Small Bowel Obstruction	5	3.57
	Peritonitis with Small Bowel Ileus	1	0.71
	Tubercular Peritonitis	1	0.71
Genital system		4	2.86
	Ovarian hemorrhagic cyst	2	1.43
	Epididymo-orchitis complex disease	2	1.43

Provisional clinical diagnoses, X-ray diagnoses and USG diagnoses were compared and further statistically analyzed as per objectives (Table 15). Statistical analysis reveals that USG is better in diagnosing acute abdominal

conditions than Provisional and Radiographic Diagnosis with Sensitivity, Positive Predictive Value, False Positive Rate, False Negative Rate and Diagnostic Accuracy as 90.71, 100, 0, 9.28 and 90.71 percent respectively.

Table 8: Correlation between provisional diagnosis and final diagnosis.

	Matched/ diseased (%)	Not matched/ no disease (%)
Diagnosed	73 (52.14)	16 (11.43)
Not diagnosed	51 (36.43)	0 (0)

Table 9: Correlation between X-ray and final individual diagnosis.

	Diseased (%)	Not diseased (%)
Positive	38 (27.14)	2 (1.43)
Negative	100 (71.43)	0 (0)

Table 10: Differential case percentages diagnosed on plain radiographs.

Final diagnosis	No. of cases	No. of cases diagnosed by X-ray	% of cases diagnosed by X ray (of total respective cases)
KUB System Calculus Disease	24	22	91.67
Renal Calculus with proximal hydronephrosis	8	8	100
Calculus at Pelvi-ureteric Junction with proximal hydronephrosis	2	2	100
Ureteric Calculus with proximal Hydroureteronephrosis	7	5	71.43
Calculus at Uretero-vesical Junction with proximal Hydroureteronephrosis	7	7	100
Emphysematous Pyelonephritis	1	1	100
Primary Small Bowel Obstruction	7	7	100
Small Bowel Obstruction Secondary to Peritonitis	5	5	100
Chronic Constipation with abdominal distension with Large Bowel Dilatation	1	1	100
Peritonitis without small bowel obstruction	6	2	33.33

Sensitivities, positive predictive values, false positive rates, false negative rates and diagnostic accuracies of Provisional Clinical Diagnosis and Radiographic diagnosis are 58.87, 82.02, 100, 41.12 and 52.14 and 27.53, 95, 100, 72.46 and 27.14 percent respectively.

DISCUSSION

The study was a prospective study conducted in two months on 160 consecutive patients of non-traumatic acute abdominal emergencies referred to the department of Radiology and Imaging from the Outpatient and Emergency departments of BPS Government Medical College for Women, Khanpur Kalan Sonepat for diagnostic radiological work up. 20/160 patients were excluded as they were lost to follow up. The entire data of 140 patients was collected as per Clinical Case Sheet and further statistically analyzed as per objectives.

Most of the patients (33/140) were in age group of 11-20 Yrs. with mean age as 33.92±17.40 years. Approximate mean age of 37.6 years was seen in study done by Gupta K et al.[1] However in a study by SY Choi et al, there was mean age of 59.7years.[22] Sharma P et al did prospective study titled 'Comparative Study between Plain Radiography and Ultrasound Abdomen in Non-Traumatic Surgical Acute Abdominal Conditions' and showed most of the patients in 31-40 years age group and 37.9±16.7

years as mean age. Karmakar S et al prospective study showed most of the patients in 31-45 year group.[28] Male to female ratio in present study is 1.12 with with 74 males and 66 females. This is comparable to studies done by Choi SY et al, Gupta K et al, Khusheh M. Al et al and Sharma P et al which showed M: F ratio as 1:1, 1: 1.4, 1:09 and 1.4 respectively. M: F ratio was 1.56 in Saurav Karmakar et al prospective study.[1,22,25,28] Most common clinical complaint of patients was abdominal pain (localized or diffuse); present in 100% cases (140 cases) followed by vomiting, abdominal distention, fever and diarrhoea seen in 17.14% (24/140), 6.4% (9/140), 2.9% (4/140) and 0.7% (1/140) cases respectively. Most common symptom as abdominal pain was also seen in study by SY Choi et al.[22] Most common chief complaint was also acute pain abdomen in all the 50 cases (100%) of study of Gupta K et al.[1] Most common chief complaint was acute abdominal pain in 98.1% cases in study by Sharma P et al.[27] Karmakar S et al prospective study had abdominal pain as most common complaint seen in 70 % patients. 51/140 i.e. 36.43% cases in emergency set up were sent with no provisional clinical diagnosis / non-specific diagnosis with 89/140 i.e. 63.57% cases were given the provisional diagnosis.[28] Most common provisional diagnosis was acute appendicitis given in 36/140 patients i.e. 25.71% cases. Second and third common clinical diagnoses were KUB system calculus disease with proximal system dilatation and acute

cholecystitis given in 20/140 patients (14.29% cases) and 17/140 (12.14% cases) respectively. In study of Gupta K et al, on clinical examination; 32 % cases were diagnosed

as acute cholecystitis (much more as compared to our study) and 26% cases as of acute appendicitis (comparable to our study).[1]

Table 11: Differential case percentages not diagnosed on plain radiographs.

Final diagnosis		No. of cases	No. of cases not diagnosed by X-ray	% Of cases not diagnosed by X-ray
KUB System Calculus Disease		24	2	8.33
	Ureteric Calculus with proximal Hydroureteronephrosis	7	2	28.57
Ureteric Stricture		1	1	100
Acute Cholecystitis		21	21	100
	Acute calculus Cholecystitis	17	17	100
	Acute Acalculus Cholecystitis	3	3	100
	Acute Cholecystitis with Perforation of Gall Bladder and Biliary Peritonitis	1	1	100
CBD pathology		3	3	100
	Choledocholithiasis	2	2	100
	Choledochocoele with Secondary Acalculus Cholecystitis	1	1	100
Acute Appendicitis		32	32	100
	Acute Appendicitis	20	20	100
	Perforated Acute Appendicitis	12	12	100
Acute Pancreatitis		8	8	100
	Early Acute Pancreatitis	7	7	100
	Pancreatic Pseudocyst	1	1	100
Mesenteric Lymphadenitis		10	10	100
Inflammatory Bowel Disease		1	1	100
Intussusception		2	2	100
Acid Peptic Disease		8	8	100
Epiploic Appendagitis		1	1	100
Acute Gastroenteritis		1	1	100
Omental Infarction		1	1	100
Bowel Tuberculosis		3	3	100
Peritonitis		11	4	36.36
	Acute Peritonitis without Small Bowel obstruction/ileus	4	2	50
	Peritonitis with Small Bowel Ileus	1	1	100
	Tubercular Peritonitis	1	1	100
Ovarian Hemorrhagic Cyst		2	2	100
Epididymo-orchitis complex disease		2	2	100

In study by Sharma P et al, based on the clinical examination, 22.2% n cases were diagnosed as acute appendicitis, 18.5% as urolithiasis, 14.8% as acute cholecystitis, 9.2% as acute pancreatitis, 7.4% as acute intestinal obstruction, and 5.5% as peritonitis due to bowel perforation which is comparable as in our study. Radiographic evaluation of all cases were done with abdominal three X-rays series.[27] 100/140/ (71.43%) patients showed normal or non-specific findings. Radiologists reported 35.9% films as normal in a study by Choi SY et al. 66.66% radiographs were normal or with nonspecific findings in Sharma P et al.[27] 40/140 patients (28.57%) showed findings specific to a particular

diagnosis. Most cases diagnosed on X-rays were of KUB calculus disease and small bowel obstruction seen in 22 (15.71%) and 13 (9.29%) cases respectively. Though the total percentages of these two categories are relatively low; but the respective percentages (of the diagnoses itself) are high i.e. 22/24 (91.67%) and 12/12 (100%) for KUB calculus and small bowel obstruction (without or with peritonitis) respectively signifies its role in these two conditions. Choi SY et al did a study titled ''A study on the use of abdominal X-ray in an emergency department'' and showed intestinal obstruction as most common diagnosed condition.[22] In study done by Gupta K et al, on plain X ray film series of abdomen, 4% as G.I.T

obstruction and 10% as renal lithiasis.[1] M. Al Khusheh et al did a study titled 'The role of abdominal X-rays in the investigation of suspected acute appendicitis' and 109 patients were included in the study. 35 Patients had AXR prior to surgery. 28 patient's AXR were reported as normal (80%).

Table 12: Differential case percentages diagnosed on USG.

Final diagnosis		No. of total cases	No. of cases diagnosed by USG	% (of total respective cases)
Renal System Calculus Disease		24	24	100
	Renal Calculus with proximal hydronephrosis	8	8	100
	Calculus at PU Junction with proximal hydronephrosis	2	2	100
	Ureteric Calculus with proximal Hydroureteronephrosis	7	7	100
	Calculus at UV Junction with proximal Hydroureteronephrosis	7	7	100
Ureteric Stricture		1	1	100
Emphysematous Pyelonephritis		1	1	100
Acute Cholecystitis		21	21	100
	Acute Calculus Cholecystitis	17	17	100
	Acalculus Acute Cholecystitis	3	3	100
	Acute Cholecystitis with GB Perforation and Biliary Peritonitis	1	1	100
CBD pathology		3	3	100
	Choledocholithiasis	2	2	100
	Choledochocoele with Secondary Acalculus Cholecystitis	1	1	100
Acute Appendicitis		32	30	93.75
	Acute Appendicitis	20	18	90.00
	Perforated Acute Appendicitis	12	12	100
Acute Pancreatitis		8	7	87.50
	Early Acute Pancreatitis	7	6	85.71
	Pancreatic Pseudocyst	1	1	100
Mesenteric Lymphadenitis		10	10	100
Small Bowel Obstruction		7	7	100
Chronic Constipation with Acute Abdominal Distension due to Large Bowel Dilatation		1	1	100
Inflammatory Bowel Disease		1	1	100
Intussusception		2	2	100
Omental Infarction		1	1	100
Bowel Tuberculosis		3	3	100
Peritonitis		11	11	100
	Acute Peritonitis without Small bowel obstruction/ileus	4	4	100
	Peritonitis with Small Bowel Obstruction	5	5	100
	Peritonitis with Small Bowel Ileus	1	1	100
	Tubercular Peritonitis	1	1	100
Ovarian Hemorrhagic Cyst		2	2	100
Epididymo-orchitis complex disease		2	2	100

7 (20%) patients had abnormal AXR. Of the 20% of patients who had abnormal x-rays, the x-ray findings were very non-specific, and none could be said to give a clear indication that the patient was likely to have appendicitis. In fact, within the formal reports of these abnormal x-rays, none of the consultant radiologists mentioned appendicitis as a possible cause for the abnormalities they reported. Hence they stated insignificant use of abdominal x-rays to investigate suspected acute appendicitis and had little impact on the clinician's decision to take the patients to theatre.[25] In present study also we found no role of Plain Radiography

in management of acute appendicitis. None of our 32 patients of acute appendicitis showed specific findings on X-rays evaluation. Gans SL et al did a review titled 'Plain abdominal radiography in acute abdominal pain; past, present, and future' and found diagnostic accuracy of X-rays as 49%. Several studies have demonstrated a high percentage of plain abdominal radiographs without abnormal or specific findings.

Table 13: Correlation between USG and final diagnosis.

	Diseased (%)	Not diseased (%)
Positive	127 (90.71)	0 (0)
Negative	13 (9.29)	0 (0)

Table 14: Differential case percentages not diagnosed on USG.

Final diagnosis	No. of cases	No. of cases not diagnosed by USG	% of total respective cases
Acute appendicitis	32	2	6.25
Acute pancreatitis	8	1	12.5
Acid peptic disease	8	8	100
Acute gastroenteritis	1	1	100
Epiploic appendagitis	1	1	100

Two studies demonstrated that 77% and 78% of all requested plain abdominal radiographs showed no abnormal findings. Whether plain abdominal radiography contributes to therapeutic decision-making or disposition remains questionable. Particularly in the case of a negative result, the additional value of plain abdominal radiographs is disputed. It is for this reason that several studies suggest ordering plain abdominal radiographs for specific indications only, in order to reduce the number of unnecessary requests. Specific indications for ordering plain radiography include suspicion of perforated viscus, urinary tract stones, bowel obstruction, and ingested foreign body.[26] 2 of total 24 KUB calculus disease could not be identified on X-rays (could be radiolucent calculi {seen on IVP as filling defects}, both were ureteric calculi). Only 2 out of 6 cases of peritonitis without bowel obstruction showed gas under diaphragm. Rest 4 cases revealed no significant findings. Two of the positive cases given on X-rays came out to be different diagnosis making them false positive (one was diagnosed as chronic constipation and large bowel dilatation: diagnosed to have cholelithiaisis with acute on chronic cholecystitis, another was given as small bowel dilatation with suspicious air fluid levels; later diagnosed as Choledocholithiasis with acute cholecystitis.

On US evaluation, diagnosis was given in 127/140 (90.71%) cases and in rest of the 13/140 (9.29%) cases, US was inconclusive. Most common diagnoses given were acute appendicitis (30/32, 93.75%), KUB calculus disease with proximal system dilatation (24/24, 100%) and acute cholecystitis (21/21, 100%) seen in 30/140 21.43%), 24/140 (17.14%) and 21/140 (15%) cases respectively. No false positive case was seen. However, there were 13 false negative cases (8 acid peptic diseases, 2 acute appendicitis cases and 1 each of Acute Pancreatitis, Epiploic Appendagitis and Acute Gastroenteritis). These cases were diagnosed as follows {(a) Acid Peptic disease: Clinical, Laboratory and Endoscopic findings (b) Acute Appendicitis: Post Operatively (c) Acute Pancreatitis: Laboratory findings (d) Epiploic Appendagitis: CECT Abdomen (e) Acute Gastroenteritis: Laboratory findings)}.

Table 15: Comparative analysis of provisional clinical diagnosis, X ray diagnosis and USG diagnosis.

	Sensitivity	Positive predictive value	False positive rate	False negative rate	Diagnostic accuracy
Provisional clinical diagnosis	58.87	82.02	100	41.12	52.14
X ray diagnosis	27.53	95	100	72.46	27.14
USG diagnosis	90.71	100	0	9.28	90.71

Ultrasonography also diagnosed 100% cases of peritonitis (11/11), mesenteric lymphadenitis (10/10), small bowel obstruction (7/7), CBD pathology and bowel tuberculosis (3/3 each), intussusception, epididydmo-orchitis and acute ovarian hemorrhagic cysts (2/2 each) and 87.5 % of acute pancreatitis (7/8), signifies its role in these conditions. Sharma P et al prospective study revealed 16.6% as urolithiasis, 14.8% as acute cholecystitis, 12.9% as acute appendicitis, 9.2% as bowel perforation, 7.4% as acute pancreatitis.[27] In study done by Gupta K et al, on ultrasound, 26% cases were diagnosed as acute cholecystitis, 18% as acute pancreatitis, 14% as acute appendicitis, 4% as torsion ovary/cyst, 10% as ureteric calculi, and 2% as intestinal obstruction.[1] They claimed Ultrasound as highly accurate in diagnosing the exact cause of acute abdomen with high overall predictive accuracy of 98.3% and sensitivity of 90%. They further concluded that Plain X ray film can be used as screening modality in the diagnosis of acute abdominal emergencies as it is universally available, more cheaper and was 100% diagnostic in GIT perforation, obstruction and renal lithiasis. Ultrasound examination is cheaper,

non-invasive, quick, reliable and highly accurate modality in diagnosing the exact cause of pain and its origin in a patient presenting with an acute abdomen and thus helps the physician or surgeon to plan the timely management.

As per present study we agreed that plain X rays have significant roles in diagnosing KUB calculus disease and small bowel obstruction cases (though still USG has more role in these conditions, diagnosed 100% cases), in most the non-traumatic acute abdominal emergencies conventional radiography can be used as screening modality with USG remains the superior diagnostic modality diagnosing most of the acute abdominal emergencies with significant accuracy. The patients were managed as per case need with conservative, conservative followed by surgical and emergency surgical management given in 76 (54.29%), 11 (7.86%) and 53 (37.86%) cases respectively. Karmakar S et al prospective study 85 showed that 72% patients required emergency operations, either in the form of laparotomy or appendicectomy.[28]

Final diagnosis was made based on Clinical examination, Radiological work up, Biochemical tests, Medical management with follow up, Surgical and Histo-Pathological findings. GIT system was most commonly involved, in 75/140 cases (53.57%). Others systems involved were KUB (26/140, 18.57%), biliary (24/140, 17.14%), peritoneal (11/140, 7.86%) and genital (4/140, 2.86%). Most common three diagnoses were acute appendicitis, KUB calculus disease and acute cholecystitis seen in 32/140 (22.86%), 24/140 (17.14%) and 21 (15%) cases respectively. Most of the cases (35.18%) were of gut pathology in Sharma P et al prospective study.[27]

Provisional diagnoses, X-ray diagnoses and USG diagnoses were compared and further statistical evaluation was done. Statistical analysis (Table 15) reveals that USG is better in diagnosing acute abdominal conditions than Provisional and Radiographic Diagnosis with sensitivity, positive predictive value, false positive rate, false negative rate and diagnostic accuracy percentages as 90.71, 100, 0, 9.28 and 90.71 percent respectively.

Sensitivities, positive predictive values, false positive rates, false negative rates and diagnostic accuracies of provisional clinical diagnosis and radiographic diagnosis are 58.87, 82.02, 100, 41.12 and 52.14 and 27.53, 95, 100, 72.46 and 27.14 percent respectively.. The overall diagnostic accuracy of clinical examination in acute abdomen is 71% as per Saurav Karmakar et al study.[28]

Similar diagnostic values of plain X-rays are seen in present study (27.14) and study done by SY Choi et al (28.10%) done on the "Use of abdominal X-ray in an emergency department".[22] Gupta K et al conducted research study titled 'Comparative Study of Plain Film

Abdomen and Ultrasound in Non-Traumatic Acute Abdomen' during 2000-2001 including 50 patients. Ultrasound's predictive accuracy was 98.3% and sensitivity (90%), plain X-ray films predictive accuracy was 4.1% and sensitivity (60%) whereas clinical diagnosis accuracy was 70.9% and sensitivity as 83.3%. Sharma P et al prospective study stated that sensitivity of ultrasound (78.7%) was higher than plain X ray (23.4%) in the diagnosis of acute abdomen.

At last they concluded AAS is a less sensitive technique in the evaluation of non-traumatic acute abdomen. It should be used together with ultrasound abdomen in order to arrive at a correct diagnosis.[27] In their study Karmakar S et al study found that among 45 cases of laparotomy other than appendicectomy, 39 cases were accurately diagnosed by x-ray (86.66%), 36 cases (80%) by USG and by combining the two sensitivity rose up to 91%.[28] So they stated that x-ray has also an important role in diagnosing acute abdomen.[28]

CONCLUSION

In present study we studied the demographic and clinical data of Non-Traumatic Acute Abdominal Emergencies as well as did the comparative analysis of sensitivity, positive Predictivity and Diagnostic Accuracy of provisional clinical diagnosis, radiographic and ultrasonographic evaluation. Most important point to consider in managing acute abdomen in emergency department is to correctly identify the cases that need urgent operative intervention so that timely decision can be taken as per protocol in patient's maximum favour.

From present study it is evident that overall diagnostic accuracy of clinical examination, radiographic and ultrasonographic evaluation in Non –Traumatic Acute Abdomen is 52.14%, 27.40% and 91.70 % and USG supersedes the clinical and radiographic diagnosis in terms of sensitivity, positive Predictivity and Diagnostic Accuracy.

Ultrasound is highly accurate in diagnosing the exact cause of Non –Traumatic acute abdomen with high overall Positive Predictivity and Diagnostic Accuracy of 100 and 90.71% respectively. Whereas plain X ray abdomen was highly predictive and sensitive in KUB calculus disease and small bowel obstruction, it is still very insignificant in cases of acute appendicitis, acute cholecystitis, acute pancreatitis, mesenteric lymphadenitis and other most of the GIT & genital causes.

It can thus be concluded that though Plain Radiography can be used as screening modality in the diagnosis of acute abdominal emergencies as it is universally available, cheaper and shows high diagnostic accuracy in few selected cases; Ultrasonography is cheaper, non-invasive, quick, reliable and highly accurate modality in diagnosing the exact cause of pain and its origin in a

patient presenting with an acute abdomen and thus helps the physician or surgeon to plan the timely management.

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