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Research Article

COMPARATIVE STUDY OF PLAIN XRAY ABDOMEN,USG AND CT DIAGNOSIS OF NON-TAUMATIC ACUTE ABDOMEN

Jain PK[1], Liyakat A[2], Mishra H[3], Arora N[4]*

1. **Professor & Head, Department of Radiology, SGT Medical College, Hospital & Research Institute, Budhera, Gurgaon**
2. **Department of Radiology, Mahatama Gandhi Medical College& Hospital, Jaipur**
3. **Professor & Head Radiology, Mahatama Gandhi Medical College & Hospital, Jaipur**
4. **Associate Professor, SHKM Govt. Medical College, Nalhar, Nuh Mewat**

Corresponding Author: Dr. N. Arora

Abstract :

Acute abdomen is a clinical condition which demands immediate and accurate diagnosis & treatment. This condition relates to infection & inflammation of intra-abdominal organs. Aims of the study are to evaluate the role of XRAY, USG & CT in the diagnosis of non traumatic acute abdomen & to compare which imaging modality is better in various parameters e.g. Sensitivity, Specificity, Cost effectiveness & time consumption. It was revealed that CT although most sensitive in most of the causes, was time consuming, costly, and exposing the patient to radiation so it could be reserved in doubtful findings of XRAY & USG procedure or should be performed if some better details were needed for management.

Keywords—Acute Abdomen, Non traumatic, Plain X-ray, USG- Ultrasonography, CT – Computed tomography

INTRODUCTION

The acute abdomen refers to presence of severe abdominal pain. It may take few minutes to several hours to develop such pain & the condition demands immediate accurate diagnosis and treatment. This is the most frequent condition for which the patient visits the emergency department.

Plain XRAY abdomen is the first procedure followed by USG and if required by CT. To reduce the morbidity and mortality accurate diagnosis is needed. Various imaging modalities play a vital role to reach an accurate diagnosis.

There are many causes of acute abdomen-

-Causes of generalized abdominal pain – Intestinal obstruction, bowel ischaemia, perforation & gastro enteritis.

-Causes of upper abdominal pain – Acute cholecystitis, acute pancreatitis, liver abscess, subphrenicabscess, ulcer perforation.

-Causes of lower abdominal pain – Acute appendicitis, urolithiasis & gynecological causes.

Plain radiography is the first and foremost investigation performed in acute abdomen emergency. This is by far the best method of imaging the condition of intestinal obstruction, perforation, urolithiasis and intra abdominal foreign body but CT is the most sensitive for these conditions particularly in intestinal obstruction & perforation.

Availability of CT has made it the modality of choice for the majority of patients of acute abdomen being sensitive for diseases like pancreatitis, appendicitis, diverticulitis and gynecological condition.

USG has become the modality of choice nowadays in certain conditions like acute cholecystitis, Urolithiasis & Gynecological conditions like torsion and rupture ectopic, due to being cheaper, free from ionization and least time consuming.

AIMS & OBJECTIVES

1. To evaluate & compare the role of X-ray, USG & CT Scan in cases of acute abdomen for accurate diagnosis.
2. To co-relate findings of all the three modalities to reach the final diagnosis.
3. To evaluate & determine the best modality in regard to sensitivity, specificity, cost effectiveness & time consumption

MATERIALS AND METHODS

The permission to conduct study was taken from Institutional ethical committee. A prospective study of 200 cases of Non-Traumatic acute abdomen presenting at emergency department was done from November 2009 to November 2010 in order to diagnose the cause & compare plain X ray, USG & CT findings. Patients with traumatic abdomen, pregnant women with Intra-uterine pregnancy& pediatrics were not taken into account.

Plain x-rays were evaluated by a blinded (DS) radiologist. The images were interpreted with only the knowledge that patients presented with abdominal pain. Ultrasound & CT scan were done by a blinded radiologist (PS).

Investigation was performed by using X ray machine of 300 mA & 500 mA, USG machine with convex probe (3.5 – 5 MHz), linear probe (7.5 – 10 MHz) & transvaginal probe (7.5 – 10 MHz) & 4 single slice spiral CT.

Final diagnosis was made on the basis of operative findings/therapeutic response/ histopathological/laboratory findings. These data were analysed manually to meet the objectives of the study

OBSERVATIONS & RESULT

Diagnosis of patient was made using X rays, USG & CT & sensitivities of these imaging modalities were compared.

URINARY TRACT PATHOLOGY

Total 56 patients(28%) had urinary cause for abdominal pain. Out of 56 patients,42 patients(75%) had calculi in kidneys.9 patients(16%) had ureteric calculi.Four patients had pyonephrosis and 1 patient had renal abscess.Among the renal calculi,34 patients had calculi in calyceal system and 8 patients had calculi in renal pelvis. In some cases, calculi were seen in both renal pelvis and calyceal system but division into calyceal and renal pelvic calculi in the observation table was made depending where predominantly calculi were located.

1A.**X RAY** FINDINGS IN RENAL CALCULI ON BASIS OF SIZE

RENAL CALCULI		LOCATION	
SIZE	TOTAL PATIENTS	CALYX	PELVIS
3-5 mm	7	7	
>5-9 mm	18	15	3
> 9mm	10	5	5
Seen by X- ray	35	27	8
Sensitivity of X-rays (%)	83.33		

1B.**USG** FINDINGS IN RENAL CALCULI ON BASIS OF SIZE

RENAL CALCULI		LOCATION		HYDRONEPHROSIS
SIZE	TOTAL PATIENTS	CALYX	PELVIS	
3-5mm	9	9		Not seen
> 5 – 9mm	19	16	3	Seen in 10 cases
>9mm	10	5	5	Seen in 9 cases
Seen by USG	38	30	8	
Sensitivity of USG(%)	90.48			

1C. **CT** FINDINGS IN RENAL CALCULI ON BASIS OF SIZE

RENAL CALCULI		LOCATION		HYDRONEPHROSIS
SIZE	TOTAL PATIENTS	CALYX	PELVIS	
3-5mm	13	13		Not seen
>5-9mm	18	15	3	Seen in 10 cases
>9mm	10	5	5	Seen in 10 cases
Seen by CT	41	33	8	
Sensitivity of CT(%)	97.61			

1D.**IMAGING** FINDINGS IN URETERAL & UVJ CALCULI

	PROXIMAL URETER	MIDDLE URETER	DISTAL URETER	UVJ	TOTAL	SENSITIVITY (%)
X-ray	0	1	2	6	9	100
USG	0	0	2	6	8	88.89
CT	0	1	2	6	9	100

Three cases presented with ureteral calculi.2 cases presented with distal ureteric calculi & one cases presented with mid-ureteric calculus. All three cases were detected by X Ray & CT.Mid ureteric calculus was missed by USG.4 cases of pyonephrosis & 1 case of renal abscess were diagnosed by USG & confirmed by CT.

2. HEPATOBILIARY PATHOLOGY

2A.NUMBER OF PATIENTS OF HEPATOBILIARY PATHOLOGY

CAUSE	X RAY	USG	CT
CALCULUS CHOLECYSTITIS	0	42	33
A)GALL STONES	0	41	39
B)THICK GB WALL	0	4	3
ACALCULUS CHOLECYSTITIS	0	1	1
CHOLEDOCHOLITHIASIS	0	1	1
GB PERFORATION(SEALED)	0	1	1
MUCOCELE GB	0	1	1
LIVER ABSCESS	0	4	4

53 patients (26.5%) had hepatobiliary cause of abdominal pain.Out of these 42 patients (79.25%) had calculus cholecystitis.4 patients (7.5%) each were of acalculus cholecystitis and liver abscess.1 patient each presented with choledocholithiasis,mucocele of Gall bladder and sealed GB perforation.X ray played no role in diagnosis of gall stones and common bile duct stones as maximum gall stones are made up of cholesterol so they are radiolucent.GB wall thickness ranged from 3.5-7mrn.Thick GB wall was not identified on USG in 1 patient.CT detected only 33 Gall stones out of 42.Cholecystitis was not seen by USG in 4 patients.1 case of CBD stone was seen by USG & CT.1 case of mucocele GB was seen by USG & CT.1 case of sealed GB perforation was not diagnosed by X ray and ultrasound but irregularity in GB fundal wall was detected by CT and perforation was confirmed postoperatively.

2B.SENSITIVITY

IMAGING MODALITY	SENSITIVITY(%)	SENSITIVITY(%)	SENSITIVITY(%)
	CHOLECYSTITIS	GALL STONES	LIVER ABSCESS
X RAYS	0	0	0
USG	97.82	100	100
CT	91.30	78.57	100

3.GASTEROINTESTINAL PATHOLOGY

3A. 1.NUMBER OF PATIENTS OF GASTEROINTESTINAL OBSTRUCTION

	OBSTRUCTION	Patients	X RAY	USG	CT
1	GASTRIC OUTLET OBSTRUCTION	1	1	1	1
2	ILEAL OBSTRUCTION	14	12	11	13
3	JEJUNAL OBSTRUCTION	3	3	3	3
4	OBSTRUCTED HERNIA	2	2	2	2
5	LARGE BOWEL OBSTRUCTION	11	11	10	11
	TOTAL PATIENTS	31	29	27	30
	SENSITIVITY(%)		93.55	87.09	96.77

Total patients were 52 having gastrointestinal cause of acute abdominal pain.Out of these, 31(59.6%) had features of gastrointestinal obstruction,8 patients(15.38%) had perforation and 13 patients(25%) had acute appendicitis.

Among gastrointestinal causes of acute abdomen,maximum cases presented with GIT obstruction-31 cases(59.51%),followed by acute appendicitis 13 cases(25%),followed by perforation 8(15.38%).

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3B NUMBER OF PATIENTS OF GIT PERFORATION

	PERFORATION	Patients	X RAY	USG	CT
1	PEPTIC	2	2	2	2
2	INTESTINAL	5	5	4	5
3	APPENDICULAR (SEALED)	1	0	0	0
	TOTAL PATIENTS	8	7	6	7
	SENSITIVITY(%)		87.5	75	87.5

PERFORATION-(Table 3B) 8 cases presented with GIT perforation .1 case of appendicular perforation diagnosed postoperatively was not detected by either X ray,USG or CT because perforation was sealed by the time patient presented to the hospital.

3C. ACUTE APPENDICITIS

CAUSE	TOTAL PATIENTS	X RAY	USG	CT
ACUTE APPENDICITIS	13	0	11	12
SENSITIVITY(%)		0	84.62	92.30

X Ray was not able to diagnose any case of Acute Appendicitis while USG with 84.62 & CT with 92.30 sensitivity diagnose acute appendicitis.

3D ACUTE PANCREATITIS

CAUSE	TOTAL PATIENTS	X RAY	USG	CT
ACUTE PANCREATITIS	14	6	12	13
SENSITIVITY(%)		42.86	85.71	92.86

Out of 14 cases only 6 cases were diagnose by X ray while CT was most sensitive to diagnose acute pancreatitis.

4.GYNECOLOGICAL PATHOLOGY

CAUSE	X Ray	USG	CT
SIMPLE OVARIAN CYST	0	8	8
HEMORRHAGIC OVARIAN CYST	0	3	3
ENDOMETRIOSIS	0	1	1
TUBO-OVARIAN ABSCESS	0	4	4
ECTOPIC PREGNANCY	0	2	Not done
SENSITIVITY(%)	0	100	100

GYNECOLOGICAL PATHOLOGY-(Table 4) 18 females presented with acute pelvic pain.8 cases presented with simple ovarian cyst,3 cases showed hemorrhagic ovarian cysts, one case showed findings of endometriosis,4 cases presented with tubo-ovarian abscesses & 2 cases presented with ruptured ectopic pregnancy.X rays were normal in all cases.CT was not performed in cases of ectopic pregnancy.

DISCUSSION

AII cases with calculi of size >9 mm were detected by X Ray, USG & CT with 100% sensitivity. Zagoria et a1[20] found that 79% of renal calculi greater than 5 mm & 95% calculi with CT attenuation greater than 300 HU were seen on plain radiographs .Out of 42 renal calculi,41 were seen by CT(sensitivity 97.61%).Sensitivity of X Ray & USG in detection of renal calculi were 83.33% & 90.48% respectively. As compared to our study,Smith[16] reported sensitivity of 97%,specificity of 96% & accuracy of 97% for CT in urolithiasis

Sensitivity of USG & CT in diagnosis of gall stones was 100% & 78.57 % respectively.For liver abscesses,sensitivity of USG and CT were 100%.Barakos[4] reported sensitivity of 79.1% for CT for gall stone detection.Edward Bluth[8] found USG 95% sensitive for gall stone detection,CT-80% & X rays 15 % sensitive.William Scruggs et al[19] found USG to be 88% sensitive for gall stone detection.

Overall sensitivity of USG & CT in diagnosis of acute cholecystitis was 97.82% &91.30 %.Benett[5,6] reported sensitivity of 91.7% for acute cholecystitis detection. Bingener J et al[7]

found USG to be 60% sensitive for acute cholecystitis. Van Randen found sensitivity of both USG & CT to be 73% for cholecystitis detection.

Out of 31 cases of obstruction,14 cases presented with ileal obstruction.Two cases were missed on X ray, as it takes 3-5 hours for bowel loops to dilate & present with air-fluid levels.Four cases of obstruction were missed on USG,Two cases presented very early after onset of symptoms and in other 2 cases, severe gaseous distension was present so dilated bowel loops were not visible on USG.One case was missed on CT which presented too early after onset of obstruction.Sensitivity of X Ray,USG & CT in diagnosis of intestinal obstruction was 93.55%,87.09% & 96.77%.CT was most sensitive for detection of site of obstruction

As compared to our study,Suri, Sudhakar etal[18] in their study found sensitivity of X ray, USG &CT in diagnosis of obstruction to be 77%,83% & 93% respectively. Gore[11] found CT to be 90-96% sensitive for bowel obstruction. K.Gupta, Bhandari, Chander[14] found X ray to be 100% diagnostic for obstruction. Frances Hampson & Shaw[9] reported 98% sensitivity of CT for small bowel obstruction.

Sensitivity of X ray,USG & CT in diagnosis of perforation was 87.5%,75% & 87.5% respectively.K Gupta et al[14] reported 100% sensitivity of X rays for perforation but perforation site was not sealed in their cases.Gore et all' found CT most sensitive for diagnosis & location of site of perforation.

X rays were not useful in diagnosis of acute appendicitis.11 out of 13 cases were detected by USG.(Sensitivity 84.62%).CT diagnosed 12 cases out of 13(Sensitivity 92.30%).Funaki[10] reported 97% sensitivity of CT for acute appendicitis.Gore[ll] reported sensitivity of CT-90-100% for diagnosis of acute appendicitis. Van Randeni found 94% sensitivity of CT for acute appendicitis

14 patients had pancreatic pathology.5 patients had acute pancreatitis and 9 patients had acute on chronic pancreatitis with pseudocyst formation Colon cut off sign on X Ray was seen in 6 patients.12 were detected by USG-85.71% sensitivity .13 cases were seen by CT with sensitivity 92.86%.1 case was missed by CT as it presented with mild pancreatitis which was confirmed at exploratory laparotomy.As compared to our study,Pandey[15] reported sensitivity of USG to be 89.6% for severe acute pancreatitis.Julia Meyerle et al[13] found sensitivity of CT to be 78% for pancreatitis detection. According to Balthazar[3],CT showed early overall detection rate of 90% with close to 100%sensitivity after 4 days for pancreatic gland necrosis.

Plain X ray did not contribute to the diagnosis of any case with gynaecological pathologies. Both USG & CT were equally sensitive in diagnosis of gynecological causes of acute abdomen,follow up was needed & carried out using USG,so USG was found to be more useful for gynecological causes of acute pelvic pain as also reported by Andrew Potter[2] in their study.

One case of subphrenic abscess presented with pain in right hypochondrium. Air-fluid level was seen under right dome of diaphragm on X ray.USG showed mixed attenuation lesion with internal echoes under right dome of diaphragm. CT confirmed the diagnosis & also showed air bubbles within the abscess. Three cases of psoas abscess were detected by USG & confirmed by CT.Two cases of mesenteric cyst were suspected on USG & confirmed by CT. One case of aortic aneurysm was detected by USG & confirmed by CT. Our results matched the results of the study of Suri, Sudhakar et al[18],Smith[15,17],K.Gupta,Bhandari et al[14] & Harish K Gupta[12]

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