**International Journal of Medical Science and Clinical Inventions 4(2): 2684-2688, 2017**
**DOI:10.18535/ijmsci/ v4i2.09** **ICV 2015: 52.82**
**e-ISSN: 2348-991X , p-ISSN: 2454-9576**


**Research Article**

# Comparative study of Sensitivity of Ultrasonography and Multiple Detector Computed Tomography in diagnosing various causes of Non Traumatic Acute Abdomen

***Dr. Aakriti Kapoor[1], Dr. Lalit Krishna Gothecha[2]***

[1]Junior resident ,Department of Radiodiagnosis and Imaging,NIMS Medical College, Shobha Nagar, Jaipur
[2]Assistant Professor, Department of Radiodiagnosis and Imaging,NIMS Medical College, Shobha Nagar, Jaipur

**ABSTRACT:**

An observational prospective study was performed on 240 patients, presenting with non traumatic acute abdomen, using USG (WIPRO P3 and GE Voluson 730 Pro) and MDCT (Siemens somatom emotion 16) . Pre-designed proforma were used to collect all the relevant information which included patient data, clinical finding, provisional clinical diagnosis, laboratory reports, USG and MDCT findings and final diagnosis following surgery/histopathologically or biochemically. The diagnosis made by USG and MDCT were compared with final diagnosis and their sensitivities in diagnosing different causes of non traumatic acute abdomen were calculated and compared with each other. MDCT proved to be a superior modality in terms of sensitivity for all patients of acute abdomen except in cases of hepatobiliary& gynaecological pathologies. In gynaecological pathologies there was not much statistical difference between sensitivities of USG and MDCT and for hepatobiliary causes USG proved to be a superior modality.

**Key Words**: USG, MDCT, non-traumatic, acute, abdomen

## INTRODUCTION

Acute abdomen pertains to severe abdominal pain developing suddenly or over a period of several hours and constitutes a significant percentage of emergency admissions. A long list of differential diagnosis is encompassed within it, which poses one of the greatest challenges to a clinician[1].

A wide spectrum of conditions, ranging from a benign and self-limiting disease to a surgical emergency, can cause acute abdomen[2]. Thus indicated management may vary from emergency surgery to reassurance of the patient. Misdiagnosis may easily result in delayed necessary treatment or result in unnecessary surgery. Due to this reason a thorough and logical approach to the diagnosis of abdominal pain is necessary. Imaging modalities such as ultrasonography and multiple detector computed tomography play an important role in diagnosing these conditions.

In the past various studies have been performed to compare the efficiency of various imaging modalities in diagnosing different cause of acute abdomen. Gore et al in 2000, in their study on, role of helical CT in evaluation of acute abdomen, found CT to be 90-100% sensitive for acute appendicitis, 90-96% sensitive for bowel obstruction & showed high sensitivity for other causes of acute abdomen.[3]

According to a comparative study of plain film abdomen and USG by Gupta et al in 2005, USG was found highly accurate in diagnosing the exact cause of acute abdomen with overall predictive accuracy of 98.3% and sensitivity of 90% as compared to 41% and 60% respectively for plain X-Ray abdomen[1]

According to a comparative study of USG and CT for non traumatic acute abdomen by Adrienne Van Randen et al in 2011, on 1021 patients, the sensitivity of CT was 94% for diagnosis of appendicitis & diverticulitis was 81%. USG on the other hand showed significantly less sensitivity of 76% for appendicitis and 61% for diverticulitis. For cholecystitis sensitivity of both was 73%. CT missed fewer cases than ultrasound but both could detect common diagnosis causing acute abdomen.[4]

Gupta et al in their study on role of ultrasound in acute non traumatic abdominal emergencies in 2015 found that the sensitivity and specificity of ultrasound in diagnosing acute appendicitis, perforation of a hollow viscus, intestinal obstruction and acute pancreatitis was around 86. 1% and 83.3%, 86.3% and 80%, 93.7% and 80%, 70% and 75% respectively. They found that in diagnosing hepatobiliary conditions ultrasonography is highly sensitive and specific and in diagnosing other conditions such as acute appendicitis, perforation, intestinal obstruction, acute pancreatitis and ureteric colic, ultrasonography have good overall sensitivity and specificity. Thus Ultrasonography should be a part of routine surgical investigations as it guides in timely intervention in surgical cases.[5]

Hence as acute abdomen is a common cause of patient admission in emergency department and imaging plays a vital role in establishing the diagnosis and planning of management of these patients , this study was done to determine sensitivity of ultrasonography and multiple detector computed tomography in various causes of non traumatic acute abdominen to determine which entity is better in specific conditions ,so that quicker and more accurate diagnosis is made ,which will in turn aid in better management of patients.

## MATERIALS AND METHODS

This observational prospective study was conducted in the Department of Radiodiagnosis & Imaging, NIMS Medical College & Hospital, Jaipur from 1st February 2015 to 31st July 2016. 240 patients presenting with non traumatic acute abdomen were included and were evaluated using USG (WIPRO P3 and GE Voluson 730 Pro) and MDCT (Siemens somatom emotion 16) . Pre-designed proforma were used to collect all the relevant information which included patient data, clinical finding, provisional clinical diagnosis, laboratory reports, USG and MDCT findings and final diagnosis following surgery/histopathologically or biochemically. The diagnosis made by USG and MDCT were compared with final diagnosis and their sensitivities in diagnosing different causes of non traumatic acute abdomen were calculated and compared with each other.

Inclusion criteria**:**

Patients of all ages and sexes presenting with non-traumatic abdominal pain of more than 2 hours & less than 5 days duration.

Exclusion criteria:

- Abdominal trauma
- Pregnant women
- Patient with compromised vital signs.
-

## RESULTS AND DISCUSSION

**TABLE I : AGE DISTRIBUTION OF PATIENTS**

| AGE GROUP (YEARS) | NUMBER OF PATIENTS | (%) |
|---|---|---|
| **0 - 10 yrs** | 12 | 5.0% |
| **11 - 20 yrs** | 29 | 12.1% |
| **21 - 30 yrs** | 61 | 25.4% |
| **31 - 40 yrs** | 64 | 26.7% |
| **41 - 50 yrs** | 54 | 22.5% |
| **51 - 60 yrs** | 12 | 5.0% |
| **>60 yrs** | 8 | 3.3% |
| **Total** | 240 | 100.0% |

Maximum patients belonged to 21-40 yrs age group, corresponding to the study of JD Wig et al[6]

**TABLE II : SEX DISTRIBUTION IN PATIENTS OF NON TRAUMATIC ACUTE ABDOMEN**

| GENDER OF PATIENT | NUMBER OF PATIENTS | (%) |
|---|---|---|
| **FEMALE** | 108 | 45.0% |
| **MALE** | 132 | 55.0% |
| **Total** | 240 | 100% |

Males were more than female which corresponds with the study of JD Wig et al[6]

**TABLE III : CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| CAUSE OF ACUTE ABDOMEN | FREQUENCY | % |
|---|---|---|
| | | |
| **Urinary tract pathologies** | 55 | 22.9% |
| **Gastrointestinal pathologies** | 49 | 20.4% |
| **Non specific abdominal pain** | 46 | 19.2% |
| **Hepatobiliary pathologies** | 38 | 15.8% |
| **Pancreatitis** | 18 | 7.5% |
| **Gynaecological pathologies** | 20 | 8.3% |
| **Miscellaneous** | 14 | 5.8% |
| **Total** | 240 | 100.0% |

Commonest cause of acute abdomen came out to be urolithiasis, which could be attributed to the topography and warm climate of Rajasthan where the study took place.

**TABLE IVa : URINARY CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| URINARY TRACT PATHOLOGY | NUMBER OF PATIENTS | % |
|---|---|---|
| **1.Urolithiasis** | 52 | 94.5% |
| **A. Renal calculus** | 30 | 54.5% |
| **B. Ureteric calculus** | 22 | 40.0% |
| **2. Pyelonephritis** | 2 | 3.6% |
| **3. Pyelonephrosis** | 1 | 1.8% |
| **Total** | 55 | 100.0% |

**TABLE IVb : STATISTICAL RESULTS OBTAINED IN URINARY CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| **True positive** | **36** | **53** | **<0.001*** |
| **False negative** | **19** | **2** | |
| **Sensitivity** | **65.5%** | **96.4%** | |

*Denotes highly significant association

Sensitivity of MDCT for urinary causes of non traumatic acute abdomen was found to be higher than USG and the difference between them was found to be statistically significant.

Similarly M Hammad Ather et al in 2004 found sensitivity of USG for ureteric calculi to be 46% and Smith in 1996 found sensitivity of MDCT for nephrolithiasis to be 97%.[7,8]

**TABLE Va : GASTROINTESTINAL CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| GASTROINTESTINAL CAUSE | NUMBER OF PATIENTS | % |
|---|---|---|
| ACUTE APPENDICITIS | 30 | 61.2% |
| INTESTINAL OBSTRUCTION | 18 | 36.7% |
| INTESTINAL PERFORATION | 1 | 2.0% |
| TOTAL | 49 | 100.0% |

**TABLE Vb : STATISTICAL RESULTS OBTAINED IN GASTROINTESTINAL CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| True positive | 38 | 47 | 0.015* |
| False negative | 11 | 2 | |
| Sensitivity | 77.6% | 95.9% | |

*Denotes significant association

Sensitivity of MDCT for gastrointestinal causes of non traumatic acute abdomen was found to be higher than USG and the difference between them was found to be statistically significant.

Similarly Pickhardt PJ et al in 2011 found sensitivity of MDCT for acute appendicitis to be 98.5%[9].Jyotindu Debnath et al in 2015 found sensitivity of USG for acute appendicitis to be 81%[10]. Gore et al in 2000 found sensitivity of MDCT for intestinal obstruction to be 90-96%[3]. Kamlesh Gupta et al in 2015 found sensitivity of USG to be 93.7% for intestinal obstruction[13].

**TABLE VIa : HEPATOBILIARY CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| HEPATOBILIARY CAUSES | NUMBER OF PATIENTS | % |
|---|---|---|
| CHOLECYSTITIS | 26 | 68.4% |
| CHOLEDOCHOLITHIASIS | 6 | 15.8% |
| HEPATIC ABSCESS | 6 | 15.8% |
| TOTAL | 38 | 100.0% |

**TABLE VIb : STATISTICAL RESULTS OBTAINED IN HEPATOBILIARY CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| True positive | 35 | 26 | 0.019* |
| False negative | 3 | 12 | |
| Sensitivity | 92.1% | 68.4% | |

* Denotes significant association

Sensitivity of USG for hepatobiliary causes of non traumatic acute abdomen was found to be higher than MDCT and the difference between them was found to be statistically significant. Similarly Adrienne Van Randen et al in 2011 found sensitivity of MDCT for cholecystitis to be 73%[4]. Hamish Hwang in 2014 found sensitivity of USG for cholelithiasis to be 100%[11].

**TABLE VIIa : PANCREATIC CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| PANCREATITS | NUMBER OF PATIENTS | % |
|---|---|---|
| Acute Pancreatitis | 11 | 61.1% |
| Acute on Chronic Pancreatitis with Pseudocyst | 7 | 38.9% |
| Total | 18 | 100.0% |

**TABLE VIIb : STATISTICAL RESULT OBTAINED IN PANCREATIC CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| True positive | 10 | 17 | 0.018* |
| False negative | 8 | 1 | |
| Sensitivity | 55.6% | 94.4% | |

* Denotes significant association

Sensitivity of MDCT for pancreatic causes of non traumatic acute abdomen was found to be higher than USG and the difference between them was found to be statistically significant.

According to Balthazar , CT has a early overall detection rate of 90% with close to 100% sensitivity after 4 days for pancreatic gland necrosis[12]. Kamlesh Gupta et al in 2015 found sensitivity of USG for acute pancreatitis to be 70%[5].

**TABLE VIIIa : GYNAECOLOGICAL CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| GYNAECOLOGICAL CAUSE | NUMBER OF PATIENTS | % |
|---|---|---|
| Pelvic inflammatory disease (PID) | 6 | 30.0% |
| Ovarian cyst(simple & haemorhagic) | 9 | 45.0% |
| Tubo-ovarian abscess | 2 | 10.0% |
| Endometriosis | 2 | 10.0% |
| Haematometra | 1 | 5.0% |
| Total | 20 | 100.0% |

**TABLE VIIIb : STATISTICAL RESULTS OBTAINED IN GYNAECOLOGICAL CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| True positive | 19 | 16 | 0.342* |
| False negative | 4 | 1 | |
| Sensitivity | 95.0% | 80.0% | |

*Denotes no significant association

The sensitivity of USG for gynaecological causes of non traumatic acute abdomen was found to be higher than MDCT, but the difference between them was not statistically significant, hence the two sensitivities were comparable.

In the study of Potter et al in 2008 on USG & CT evaluation of acute pelvic pain, USG was found to be modality of choice for initial imaging[13].

**TABLE IXa : MISCELLANEOUS CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| MISCELLANEOUS CAUSE | NUMBER OF PATIENTS | % |
|---|---|---|
| Mesenteric lymphadenitis | 9 | 69.2% |
| Epiploic appendagitis | 1 | 7.7% |
| Psoas abscess | 3 | 23.1% |
| Total | 13 | 100.0% |

**TABLE IXb : STATISTICAL RESULTS OBTAINED IN MISCELLANEOUS CAUSES OF NON TRAUMATIC ACUTE ABDOMEN**

| | USG | CT | P value |
|---|---|---|---|
| True positive | 9 | 14 | 0.041* |
| False negative | 5 | 0 | |
| Sensitivity | 64.3% | 100.0% | |

* Denotes significant association

Sensitivity of MDCT for miscellaneous causes of non traumatic acute abdomen was found to be higher than USG and the difference between them was found to be statistically significant.

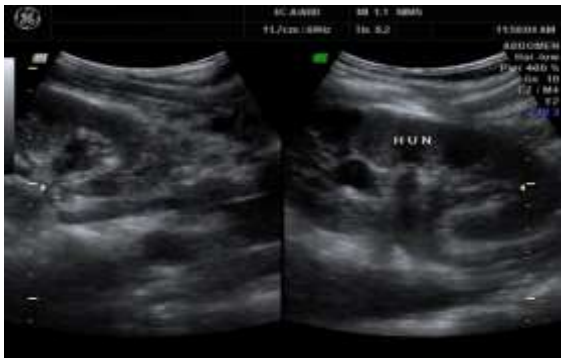

Fig. 1 : USG Abdomen showing right hydronephrosis with proximal hydroureter, distal ureter could not be traced.

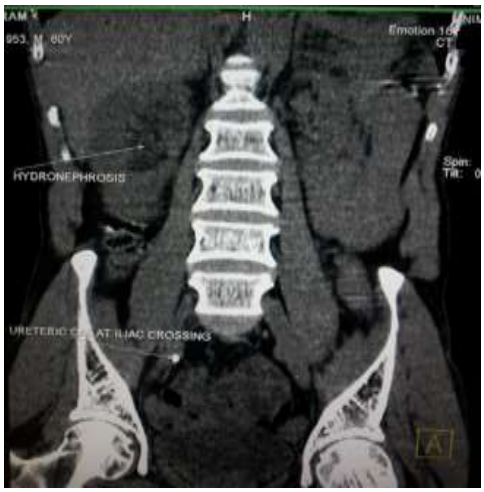


Fig. 2 : NCCT Abdomen of the same patient, showing right hydronephrosis with hydroureter due to calculus at iliac vessels crossing.


Fig. 3 : CT Abdomen shows thickened and distended gall bladder with calculus suggestive of cholecystitis with cholelithiasis

Fig. 4 : USG Abdomen showing thickened ,distended and torturous fallopian tubes with echogenic content suggestive of pyosalpinx.

Fig. 5 : CECT Abdomen of the same patient shows tortuous ,distended fallopian tubes with thickened and enhancing walls suggestive of pyosalpinx.

## CONCLUSION

Our study concluded that MDCT is a superior modality in terms of sensitivity for all patients of non traumatic acute abdomen except in cases of hepatobiliary& gynaecological conditions. In gynaecological pathologies there was not much statistical difference between sensitivities of USG and MDCT and for hepatobiliary causes USG proved to be a superior modality.

However due to advantages of lack of radiation & contrast, low on expenses, portability and good sensitivity for most of the causes of acute abdomen, USG can be used as the initial imaging modality in cases of non traumatic acute abdomen, especially in children and young patients and an investigation of choice in cases of hepatobiliary causes.

MDCT being a superior modality in terms of sensitivity, lack of operator dependency, having the ability of assessing the severity and grading of the disease, and giving exquisite and comprehensive anatomical details, can be used whenever USG is equivocal or gives limited details to the physician or operating surgeon.

## REFERENCES


1. Gupta K, Bhandari RK, Chander R. Comparative study of plain abdomen and ultrasound in non-traumatic acute abdomen. Indian journal of radiology and imaging.2005;15(1): 109-115
2. Mazzei M, Guerrini S, Cioffi Squitieri N, Cagini L, Macarini L, Coppolino F et al. The role of US examination in the management of acute abdomen. Critical Ultrasound Journal. 2013;5(Suppl 1):S6.
3. Gore RM, Miller FH, Pereles FS, Yaghmai V, Berlin JW. Helical CT in evaluation of acute abdomen. Am J Roent. 2000;174(4):901-13.
4. van Randen A, Laméris W, van Es HW, van Heesewijk HP, van Ramshorst B, Ten Hove W et al. A comparison of the accuracy of ultrasound and computed tomography in common diagnoses causing acute abdominal pain. EurRadiol. 2011; 21(7):1535-45.
5. Gupta K, Chander R, Singh A, Singh S, Singh S.Role of ultrasound in acute non traumatic abdominal emergencies.JK science.2015;17(4):172-176.
6. Wig J D, Basur R L. Acute abdomen. J Postgrad Med 1978;24:121-4.
7. Ather M, Jafri A, Sulaiman M. Diagnostic accuracy of ultrasonography compared to unenhanced CT for stone and obstruction in patients with renal failure. BMC Medical Imaging. 2004;4(1).
8. Smith RC, Verga M, McCarthy S, Rosenfield AT. Diagnosis of acute flank pain; value of unenhanced helical CT. AJR Am J Roentgenol. 1996; 166:97-101.
9. Pickhardt PJ, Lawrence EM, Pooler BD, Bruce RJ. Diagnostic performance of multidetector computed tomography for suspected acute appendicitis. Ann Intern Med. 2011; 154(12):789-96.
10. Debnath J, Kumar R, Mathur A, Sharma P, Kumar N, Shridhar N et al. On the Role of Ultrasonography and CT Scan in the Diagnosis of Acute Appendicitis. Indian Journal of Surgery. 2015;77(S2):221-226.
11. Hwang H, Marsh I, Doyle J. Does ultrasonography accurately diagnose acute cholecystitis? Improving diagnostic accuracy based on a review at a regional hospital. Canadian Journal of Surgery. 2014;57(3):162-168.
12. Balthazar EJ. Acute pancreatitis: assessment of severity with clinical & CT evaluation. Radiology. 2002;223(3):603-13.
13. Potter AW, Chandrasekhar CA. US and CT Evaluation of Acute Pelvic Pain of Gynaecological Origin in Non Pregnant Premenopausal Patients. Radiographics. 2008 Oct;28(6):1645-59.