

Role of Multidetector Computed Tomography in Evaluation of Acute Abdomen

¹Dr.Kurre Pranetha, Postgraduate, Department of Radio- Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

²Dr.Sriramaneni Venkateswar Rao, Professor and Head of Department, Department of Radio-Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

³Dr.Killada Meghana Devi, Postgraduate, Department of Radio- Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

⁴Dr.Batchu Meghala, Postgraduate, Department of Radio- Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

⁵Dr.Kilaparti Kavya, Postgraduate, Department of Radio- Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

Corresponding Author: Dr. Kurre Pranetha, Postgraduate, Department of Radio- Diagnosis, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, 534005, India.

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Abstract

Background: Acute abdomen is defined as an entity with sudden onset of intense abdominal pain necessitating emergency medical / surgical management. In order to reduce the mortality and morbidity rates, an effective and accurate diagnosis should be made in patients who present to the emergency department complaining of sudden onset of intense abdominal pain. The clinician will favour radiological examinations in order to arrive at an appropriate final diagnosis. Multidetector Computed Tomography is a widely

accepted primary investigation of choice in patients presenting with intense abdominal pain and provides a global overview of the gastrointestinal tract, mesenteries, solid organs, peritoneum and retroperitoneal areas.

Aims and objectives

- To evaluate the accuracy of MDCT in the diagnosis of acute abdomen.
- To assess the efficacy of MDCT in differentiating various pathological causes of acute abdomen.
- To evaluate the sensitivity and specificity of MDCT in patients with acute abdomen using intra-operative

surgical findings/ histopathological findings/ clinical findings as reference standards.

Materials and methods: This is a prospective study conducted on 80 patients who were referred to the radio-diagnosis department at Alluri Sitarama Raju Academy of Medical Sciences with clinical symptoms of an acute abdomen using GE Revolution Act CT machine (50 slice). This study is done over a period of 12 months (1st October 2020 to 30th September 2021).

Results: Out of 80 cases studied, common pathologies were appendicitis (23%), bowel obstruction (16%), acute pancreatitis (14%) and bowel perforation (13%). The accuracy rate, sensitivity, specificity and positive and negative predictable values of MDCT were 96.25%, 97.36%, 75% and 98.66% and 60% respectively.

Conclusion: MDCT has high accuracy and sensitivity. In clinically inconclusive cases of acute abdomen, the consultant will favor for MDCT to arrive at an appropriate provisional diagnosis. The results obtained in the study were comparable to pioneer studies conducted worldwide.

Keywords: Acute abdomen, MDCT, appendicitis, pancreatitis, bowel obstruction, perforation, urolithiasis, volvulus, intussusception, aneurysm, cholecystitis, diverticulitis, aortic dissection.

Introduction

Acute abdomen is defined as an entity with sudden onset of intense abdominal pain necessitating emergency medical / surgical management. Most of the patients who come to the emergency department present with sudden onset of intense abdominal pain. It can be due to variety of diagnosis.

After the patients come to the emergency department, they are subjected to medical and physical examinations and further with clinical interpretation and lab

investigations, the clinician will favour in for radiological examinations in order to arrive at an appropriate final diagnosis.

In order to decrease the mortality rate and morbidity rate, an efficient and correct diagnosis should be given for these patients.

This may be challenging because, the clinical examination is tough, and investigations, like plain radiograph of the abdomen and USG examinations are usually inconclusive.

In such cases

1. Multi-Detector Computer Tomography is a widely accepted primary investigation of choice in patients coming with intense abdominal Pain.¹⁻³
2. It is the most rapid, specific, time efficient, objective and informative imaging technique.
3. With the advanced technology of MDCT, multiple images can be acquired in a single tube rotation. The whole abdomen and pelvis can be scanned within a single breath hold at a thickness of sub-millimetre (0.5 to 0.75mm) in the 3D plane.
4. These data sets result in voxels that are both submillimetre in dimension and isotropic, suggesting that reformations in any desired plane will have a spatial resolution similar to that of the axial plane.
5. MDCT provides a global judgment of the gastrointestinal tract, mesenteries, solid organs, peritoneum and retroperitoneal areas.
6. It also gives us clear data for another possible diagnosis, if the working clinical diagnosis is incorrect and has a significant outcome in the treatment of patients with intense abdominal pain.
7. With the introduction of multi planar reconstruction in the workstations, MDCT has led to a great improvement in the management of these patients⁴.

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Materials & Methods

This is a prospective study conducted on 80 patients who were referred to the radio-diagnosis department at Alluri Sitarama Raju Academy of Medical Sciences with clinical symptoms of an acute abdomen using GE Revolution Act CT machine (50 slice).

This study is done over a period of 12 months (1st October 2020 to 30th September 2021).

Source of data

Patients referred from emergency department with history of acute abdomen.

Selection criteria

Inclusion criteria

Patients who are presenting with clinical symptoms of acute abdomen and undergoing MDCT.

Exclusion criteria

- Patients who have contraindication to contrast media in whom contrast study is indicated.
- Patients lost to follow up.

Results

A total of 80 patients referred with clinical symptoms of acute abdomen were studied.

Table1: Frequency and percentage of the various pathologies detected among the study population.

PATHOLOGY	FREQUENCY	PERCENTAGE %
Appendicitis	18	23%
Bowel Obstruction	13	16%
Acute Pancreatitis	11	14%
Perforation	10	13%
Urolithiasis	7	9%
Cholecystitis	4	5%
Bowel Ischemia	2	3%
Aortic Dissection	1	1%
Diverticulitis	2	3%
Aortic Aneurysm	2	3%
Intussusception	3	4%
Volvulus	4	5%
Non-Specific Abdominal Pain	3	4%
Total	80	100%

Figure1: Frequency and percentage of the various pathologies detected among the study population.

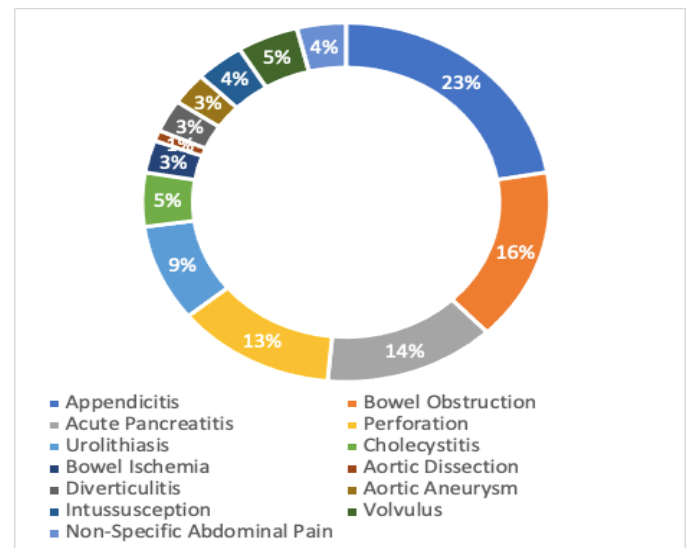


Table 2: Summary of diagnostic efficacy of various pathologies.

STATISTIC	MDCT IN ACUTE ABDOMEN CASES
Sensitivity	97.36%
Specificity	75.00%
Positive Predictive Value	98.66%
Negative Predictive Value	60.00%

Table3: Summary of concordance and accuracy.

	NO OF CASES CONCORDANT WITH FINAL DIAGNOSIS
NO OF PATIENTS	77
PERCENTAGE%	96.25%

Table 4: Surgical management distribution

SURGICAL MANAGEMENT	FREQUENCY
Appendicitis	18
Bowel Obstruction	11
Perforation	10
Urolithiasis	7
Bowel Ischemia	2
Volvulus	4
Aortic Dissection	1
Intussusception	3
Cholecystitis	4
Acute Pancreatitis	2
Aortic Aneurysm	1
Non-Specific Abdominal Pain	3
Total	66

Figure 2: Surgical management distribution

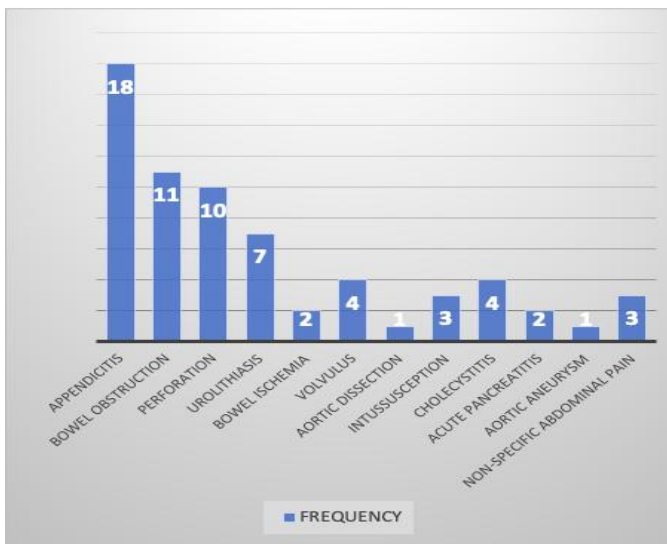
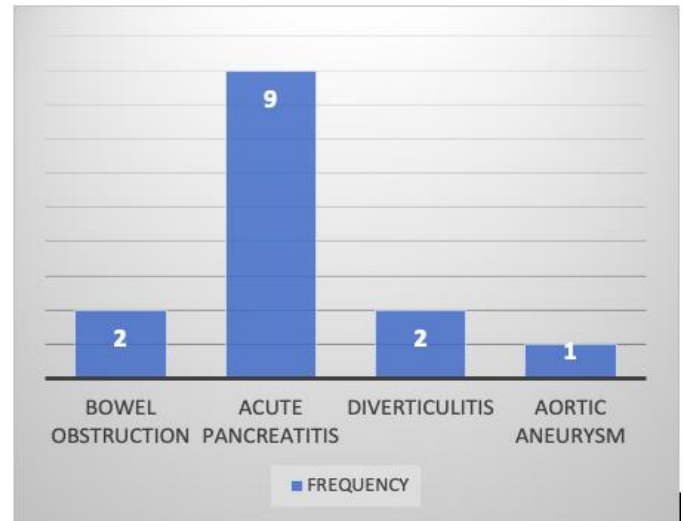


Table 5: Conservative management distribution

CONSERVATIVE MANAGEMENT	FREQUENCY
Bowel Obstruction	2
Acute Pancreatitis	9
Diverticulitis	2
Aortic Aneurysm	1
Total	14

Figure 3: Conservative management distribution



The common pathologies were appendicitis (23%), bowel obstruction (16%), acute pancreatitis (14%) and bowel perforation (13%), among which appendicitis is the most common cause.

The accuracy rate, sensitivity, specificity and positive and negative predictable values of MDCT were 96.25%, 97.36%, 75% and 98.66% and 60% respectively.

One out of 18 acute appendicitis cases was discordant with intraoperative surgical findings and was diagnosed to be ileocecal tuberculosis and confirmed by histopathological examination.

Out of 10 bowel perforation cases, 2 false negative cases were reported by CT, which on surgical exploration the presence of sealed perforations were identified.

In 3 out of the 80 cases no significant abnormalities were detected by MDCT and this was proved by diagnostic laparoscopy also.

Figure4: Axial and coronal images show thickened appendix (16mm) with increased wall thickness (8mm). There is focal defect in enhancing appendiceal wall with intramural air foci – Suggestive of appendicular perforation.

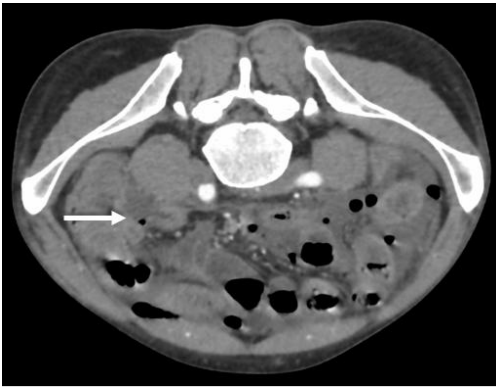


Figure 5: Axial and coronal images show rotation of stomach around the short axis from lesser to greater curvature with displacement of antrum above the gastro-esophageal junction – Suggestive of gastric outlet obstruction secondary to mesenteroaxial volvulus.

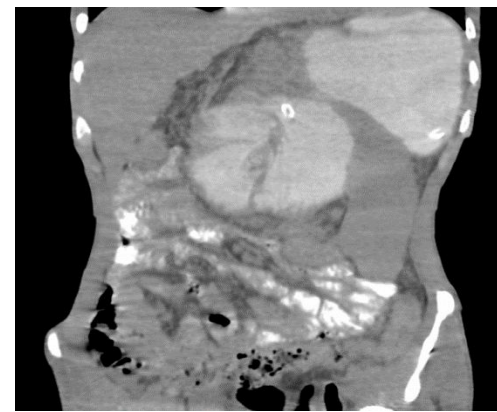
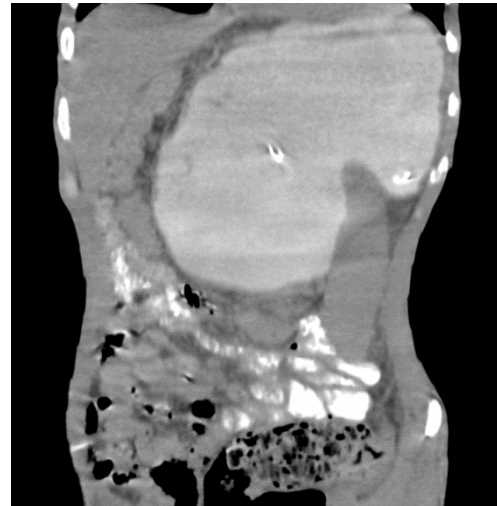
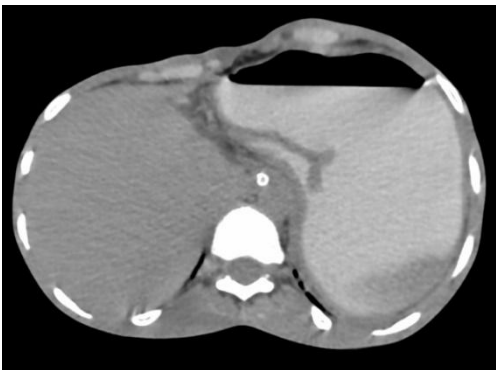


Figure 6: Axial and coronal images show twisting of sigmoid colon with mesentery and mesenteric vessels (whirl sign) with upstream dilated air-filled loops of descending colon, transverse colon, ascending colon and ileum - Suggestive of sigmoid volvulus.





Figure 7: Axial image shows acute pancreatitis with pseudocyst



Figure 10: Coronal image shows right hydronephrosis secondary to vesicoureteric junction calculus.



Figure 8: Axial image shows acute necrotizing pancreatitis with acute necrotic collections



Figure 9: Coronal image shows bilateral proximal ureteric calculi with moderate hydronephrosis.



Discussion

The cutting edge new MDCT over the years from single detector CT has clinical advancement in the management of acute abdomen cases.

- The reduced scanning time leads to improved output and reduces artefacts by improved acquisition in fraction of second is critical in evaluation of sick patients.
- The large volumetric data obtained in the axial plane allows reformations into required plane even in micrometre pathologies.

- Dedicated contrast injection techniques and image reconstruction precisely localizes blood vessel pathologies.
- The advanced reformation techniques save time in critically ill patients by increasing the computing speed and facilitating faster radiological interpretation.

Monica Mangini et al⁵ compared the role of MDCT findings with intraoperative surgical findings and histopathological results in 57 pain abdomen subjects. She found that 47 out of 57 cases were totally concordant with MDCT and final discharge diagnosis depending on the intraoperative surgical findings and histopathological results. 10 out of 57 cases were partially discordant and none of the cases were completely discordant. The MDCT sensitivity for this study was 82.4%.

Conclusion

MDCT has high sensitivity and accuracy rate in detecting various pathologies in cases of inconclusive situations. MDCT is recommended when the clinical examination is tough, and investigations, like plain radiograph of abdomen and USG examinations are inconclusive. MDCT is a widely accepted primary investigation of choice in patients coming with intense abdominal pain.

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