A PROSPECTIVE STUDY TO EVALUATE THE ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN BOWEL LESIONS

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ABSTRACT

Aims and objectives: 1) To study the role of MDCT in the evaluation of clinically suspected bowel pathologies. 2) To study the imaging characteristics of various bowel pathologies and narrow down the differential diagnosis using MDCT. 3) To correlate the imaging findings with operative findings/ cytohistopathology/ clinical outcomes if any. 4) To determine the sensitivity, specificity and accuracy of MDCT in the evaluation of bowel pathologies. **Material and Methods:** 50 patients with suspected bowel pathologies who were referred to the Department of Radiodiagnosis were included in this study. **Results**: The study had 60% males and 40% females This study showed male predominance. All the 50 patients in the study presented with abdominal pain. Weight loss, fever, vomiting and diarrhoea/constipation were the other complaints by the patients. The predominant wall enhancement pattern was homogenous. We observed that mucosa was affected in maximum number of cases. Based on the length of the bowel maximum cases in our study showed focal involvement. The cases in our study showed equal proportion of the large and small bowel involvement. Maximum cases in our study showed moderate mural thickness. Ascites was present in 88% cases in the present study. Necrotic and non-necrotic nodes were observed in 42% and 38% cases respectively. Pulmonary tuberculosis, liver microabscesses, metastases, peritoneal abscess, diverticulae and ovarian malignancy were the associated abnormalities in our study. On MDCT, tuberculosis followed by the malignancy were the maximum number of cases reported. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of tuberculosis was found to be 91.67%, 92.11%, 78.57%, 97.22% and 92.00% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of malignancy found to be 66.67%, 97.56%, 85.71%, 93.02% and 92.00% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of other cases was found to be 100% each. **Conclusion:** The present study confirms the high diagnostic accuracy of MDCT in bowel diseases. MDCT is a powerful diagnostic tool for the study of bowel disorders, including inflammatory disease, neoplasms, and mechanical obstruction. MDCT enterography is a dedicated technique that allows proper visualization of the entire bowel wall to detect abnormal mural thickening and analyse its type, length, and pattern of enhancement.

Keywords: MDCT, bowel lesions

INTRODUCTION

Diagnosis of intestinal disease often requires tests to visualize the anatomy and pathology of the gastrointestinal (GI) tract. Till date, endoscopy has remained the main technique for the diagnosis of such diseases because it allows a direct visualisation of the mucosa and the possibility of taking samples for histological analysis. Moreover, in recent years, improvements in endoscopic techniques have also made it possible to use endoscopy for interventions in some diseases of the GI tract. However, endoscopy has some limitations due to its invasiveness and the difficulty of examining the small bowel, and it does not allow the visualisation of extra-intestinal structures that may be involved.[1]

Over the years, conventional radiological methods have played an important role in the diagnosis of gastrointestinal diseases. In recent decades, the introduction and improvement of noninvasive cross-sectional imaging methods such as ultrasound (US), computed tomography (CT), and positron emission tomography (PET) and magnetic resonance imaging (MRI) have changed the diagnostic approach to the GI tract.[2] The high resolution of imaging data, ability to acquire 3D images and enhancement of tissues have improved the diagnostic classification of tissue pathology and performance in terms of sensitivity, specificity and accuracy, depending on the specific method and equipment used, the section of the GI tract investigated, the patient's constitution and preparation, and the type of pathology being studied.[3]

Radiologists have played an important role in evaluation of patients with bowel pathology. Colon series and later enteroclysis were the mainstay of radiological diagnosis of many intestinal diseases due to the limited resolution and

speed of CT. There have been continuous improvements in CT technology over the past 2 decades expanding the role of CT to evaluate the gastrointestinal tract. Many conditions such as intestinal obstruction and ischemia, which can usually be imaged with 2 modalities (small bowel series or angiography), are now routinely imaged with CT. Advances in MDCT and improvements in 3D imaging systems have greatly improved the ability to examine the bowel and mesenteric artery.[4] Bowel lesions include a diverse group of lesions: infective, inflammatory, vascular, neoplastic and obstructive lesions. Common lesions are infectious enteritis/colitis, ulcerative colitis, Crohn's disease, ischaemic colitis, diverticular disease, benign and malignant tumors. MDCT helps us in the evaluation and diagnosis of these lesions.

MATERIALS AND METHOD
A prospective study was conducted on 50 patients with suspected bowel pathology at Department of Radiodiagnosis and Imaging, government medical college amritsar.

IMAGING TECHNIQUE
Multi Detector Computed Tomography imaging was performed on PHILIPS MACHINE 64 slice MDCT machine. Imaging technique was plain CT followed by oral and IV contrast. The contrast used was Omnipaque. Omnipaque is iohexol which is a non-ionic, water soluble radiographic contrast medium. Images were acquired following contrast in arterial, venous and delayed phases. Multi planar reformation and 3D reconstruction was done wherever necessary.

RESULTS
The mean age of the study participants was 38.24 ± 19.03 years in the present study. Bassiouny RH et al[5] observed mean age of participants to be 40.26 ± 14.52 years, which is in accordance with our study. We observed that majority of participants (40%) belonged to age group 41 to 60 years, followed by 30% participants in age group 21-40 years, 24% participants were below 20 years of age . In study by Sheikh MT et al also fewer cases (only 8.3%) were below 20 years of age.

In the present study, there were 60% males and 40% females. This study showed male predilection, which is in accordance with the findings of Sheikh MT et al. There were 55% males and 45% females in their study. In study by Bassiouny RH et al[5], there were 58% males and 42% females.

All the participants in the study presented with abdominal pain. Weight loss, fever, vomiting and diarrhoea/constipation was reported by 46%, 44%, 42% and 22% participants respectively. In study by Bassiouny RH et al also, all the participants presented with abdominal pain. Fever, constipation, diarrhoea and vomiting was observed in 15%, 24%, 26% and 41% participants in their study..The predominant wall enhancement pattern was homogenous as observed in 36% cases in this study, which is in accordance with findings of Megally HI et al and Bhalothia S et al.[7]We observed that mucosa and sub-mucosa were affected in 38% and 4% cases respectively. Serosa and all layers were affected in 14% cases each. Megally HI et al[8] also reported that mucosa and/or the sub-mucosa were most commonly involved layers.34% cases showed focal involvement (<5 cm) and 24% cases showed involvement of segment (5-20 cm) in this study. On the contrary, Bhalothia S et al[7] reported that 50% cases were segmental in their study.The cases in the present study showed equal proportion of large bowel and small bowel involvement (32% each). Ileo-caecal junction and appendix were the affected sites in 16% and 12% cases respectively. Monib AM et al observed ileum, rectum/colon, caecum and jejunum to be involved in 62.5%, 25%, 10% and 2.5% cases respectively. Mild, moderate and severe mural thickness was reported in 8%, 42% and 20% cases respectively. Moderate and mild wall thickening was predominantly noted in non-malignant conditions (85%) and marked wall thickening was noted in malignant pathologies mainly (77.77%) in study by Bhalothia S et al.[7]Necrotic and non-necrotic nodes were observed in 42% and 38% cases respectively. Nodes were not observed in remaining 20% cases. Associated enlarged mesenteric lymph nodes were found in 31.8% cases in study by Megally HI et al.[8]24% cases of tuberculosis and 18% cases of malignancy were confirmed by clinical, histopathological and surgical diagnosis in our study. Large bowel obstruction and small bowel obstruction was reported in 10% and 12% cases respectively. There were 8% cases each of appendicitis and Crohn's disease. Diverticulitis was reported in 6% cases. There were 4% cases each of mesenteric ischaemia and haemorrhagic cyst. Intussception, mid-gut volvulus and metastasis were seen in 2% cases each. Intestinal TB was also the most common etiology constituting 27.90% of the cases in study by Bhalothia S et al.[7]In the present study, concordance between MDCT diagnosis and final diagnosis was seen in 88% cases. A study was done by Mangini M et al[9] to evaluate the role of MDCT in the differential diagnosis of non-traumatic acute bowel disease and a total concordance between the MDCT findings and discharge diagnosis (based on surgical findings and histological examinations) in their study was found in 47/57 cases (82.4%); partial discordance was seen in 10 of 57 cases (17.5%) and discordance in 0 of 57 (0%) cases. In study by Bassiouny RH et al[10], MDCT correctly made the diagnosis in 66 of 73 patients (true positive), 7 cases were missed by CT findings (false negative cases) and one case of ileus was falsely diagnosed as small bowel obstruction with an overall sensitivity of 90%, specificity of 93%, PPV of 98%, NPV of 71%. Ramaswamy S et al[11] evaluated the role of MDCT in evaluating small bowel disorders, through a prospective study on 60 patients and concluded by their study that MDCT had an accuracy of 88.3% in diagnosing small bowel pathologies.In study by Jyothi TD[12], all the 26 malignant lesions were correctly diagnosed on MDCT. 13 of the 14 benign lesions were

correctly diagnosed on CT, except one case with an inflammatory lesion of the colon which was diagnosed as a malignancy on CT.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of tuberculosis was found to be 91.67%, 92.11%, 78.57%, 97.22% and 92.00% respectively. In study by Khan A et al[13], MDCT was 93.8% sensitive and only 65% specific in the diagnosis of gastro-intestinal tuberculosis. The positive and negative predictive values were 81.1% and 86.7%, respectively. The diagnostic accuracy of MDCT was calculated as 82.7% in their study.

In the present study, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of malignancy found to be 66.67%, 97.56%, 85.71%, 93.02% and 92.00% respectively. In study by Sheikh MT et al[14], sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT in diagnosing appendicitis was 100%. MDCT was accurate in 98.2% cases for differentiating between benign and malignant etiology in study done by Bhatt CJ et al.[15]Bayoumi D et al[16] studied 53 patients of pathologically proven malignant localized small intestinal tumors, who underwent multidetector CT enterography and concluded that MDCT is a non-invasive and accurate method in the evaluation of focal and localized small intestinal malignant lesions.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of appendicitis/appendicular lump was found to be 100%, 95.65%, 66.67%, 100% and 96.00% respectively in this study. In study by Sheikh MT et al[14], sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT in diagnosing appendicitis was 100%.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of other cases including small bowel obstruction, large bowel obstruction, Crohn's disease, mesenteric ischaemia, intussusception, diverticulitis mid-gut volvulus and metastasis was found to be 100% each.

Elsayed EE et al[17] studied the usefulness of multidetector computed tomography (MDCT) in the evaluation of intestinal obstruction and their results showed a very high sensitivity and specificity of 100%. Fedrele et al[18] stated that MDCT can combine the advantages of volume challenge in detecting and grading partial obstruction with the ability of CT to demonstrate the cause of obstruction and any pertinent extra-intestinal manifestations, including vascular impairment. It demonstrates signs of threatened bowel viability and can exclude other causes of an acute abdomen making it particularly valuable in the acute clinical setting. Our study also showed high diagnostic performance in diagnosis of both small bowel obstruction and large bowel obstruction. The study by Bassiouny RH et al[10] also showed high diagnostic performance in identifying the presence of SBO with and without strangulation. The administration of enteric contrast material in SBO patients significantly accentuates the ability of CT to identify the transition zone and accordingly the location of an obstruction. However, it increases the risk of aggravated or acute obstructions.The present study confirms the high diagnostic accuracy of MDCT in bowel diseases. Increased speed and resolution of multidetector row computed tomography (MDCT) have made CT the modality of choice for the examination of small bowel disease. It allows visualization of the entire small bowel and elimination of artefacts related to respiratory motion within a single breath-hold. It also has the advantage of being noninvasive, able to obtain multiphase images after a single intravenous injection increasing diagnostic potentials as well as its strong image processing ability.
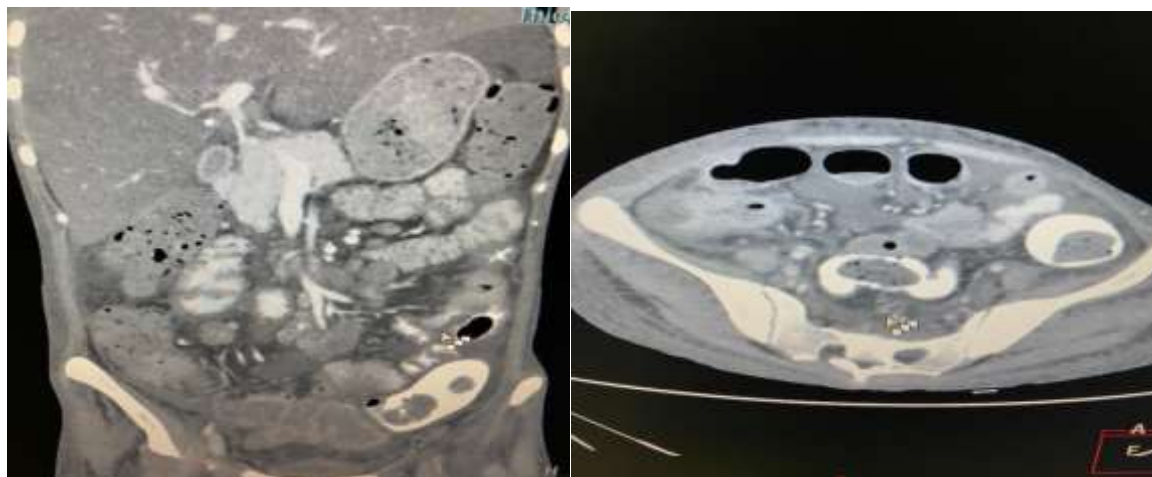
TABLE NO. 1: DIAGNOSTIC ACCURACY OF MDCT

DIAGNOSIS	TRUE POSITIVE	FALSE POSITIVE	TRUE NEGATIVE	FALSE NEGATIVE	SENSITIVITY (%)	SPECIFICITY (%)	POSITIVE PREDICTIVE VALUE (%)	NEGATIVE PREDICTIVE VALUE (%)	ACCURACY (%)	YOUDEN'S INDEX
TB	11	3	35	1	91.67	92.11	78.57	97.22	92.00	83.77
MALIGNANCY	6	1	40	3	66.67	97.56	85.71	93.02	92.00	64.23
APPENDICITIS/ APPENDICULAR LUMP	4	2	44	0	100.00	95.65	66.67	100.00	96.00	95.65
INTUSSCEPTION	1	0	49	0	100.00	100.00	100.00	100.00	100.00	100.00
CROHN'S DISEASE	4	0	46	0	100.00	100.00	100.00	100.00	100.00	100.00
MESENTRIC ISCHAEMIA	2	0	48	0	100.00	100.00	100.00	100.00	100.00	100.00
SMALL BOWEL OBSTRUCTION	6	0	44	0	100.00	100.00	100.00	100.00	100.00	100.00

LARGE BOWEL OBSTRUCTION	5	0	45	0	100.00	100.00	100.00	100.00	100.00	100.00
MID_GUT VOLVULUS	1	0	49	0	100.00	100.00	100.00	100.00	100.00	100.00
DIVERTICULITIS	3	0	47	0	100.00	100.00	100.00	100.00	100.00	100.00
METASTASIS	1	0	49	0	100.00	100.00	100.00	100.00	100.00	100.00

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of tuberculosis was found to be 91.67%, 92.11%, 78.57%, 97.22% and 92.00% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of malignancy found to be 66.67%, 97.56%, 85.71%, 93.02% and 92.00% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of appendicitis/appendicular lump was found to be 100%, 95.65%, 66.67%, 100% and 96.00% respectively. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT on diagnosis of other cases was found to be 100% each.

CASE: Ileocaecal tuberculosis

We had an 18 year old male patient who came for the contrast enhanced MDCT abdomen. He presented with the complaints of abdominal pain, weight loss and low-grade fever. On CECT we observed the following:

There was circumferential moderate thickness of the ileocaecal junction up to 8mm, ascites and necrotic lymphadenopathy. The additional findings of tree in bud pattern indicative of pulmonary tuberculosis were observed in the bilateral lung fields.

Conclusion and summary:

The present study confirms the high diagnostic accuracy of MDCT in bowel diseases. MDCT is a powerful diagnostic tool for the study of bowel disorders, including inflammatory disease, neoplasms, and mechanical obstruction. MDCT enterography is a dedicated technique that allows proper visualization of the entire bowel wall to detect abnormal mural thickening and analyse its type, length, and pattern of enhancement. Apart from wall pathologies, complications/associated findings related to vessels and mesentery and lymph nodes can be evaluated in single setting, which is important in narrowing down the differential diagnosis.

It offers the additional benefit of assessing abdominal and pelvic structures other than the small intestine, allowing alternative diagnoses to guide medical and surgical management. Further studies with larger sample size are required to substantiate the findings of the present study.

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