Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(10A):3557-3563 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2016.v04i10.002

Original Research Article

Role of Multi Detector Computed Tomography in the Evaluation of Colorectal Pathologies with Histo-Pathological Correlation

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Abstract: The objectives of present study is to study the CT characteristics of benign and malignant lesions of the colon and rectum, to assess the effectiveness of MDCT in differentiating benign and malignant colorectal lesions and to assess the role of MDCT in pre-operative tumor staging of colorectal malignancies. Data was collected from 40 patients with wall thickening involving the colorectal region on CT, referred to the Department of Radio Diagnosis, PDVVPF's Medical College, and Ahmednagar. CT findings are confirmed with histo-pathological diagnosis. CT will be performed using 16 slice GE Light Speed CT scanner. All patients will be placed in the supine position on the CT table, and a rectal tube will be inserted. Room air will be gently insufflated into the colon to get adequate colonic distension. CT acquisitions will be performed in the arterial phase (start delay of 25-35 seconds) and in the portal venous phase (start delay of 50- 70 seconds) with a section width of 5 mm. All the 36 malignant lesions were correctly diagnosed on CT. 8 of the 9 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. In the CT staging of malignant lesions, 9 of the 11 cases were correctly staged as T1&T2 lesions. 16 of the 18 cases were correctly staged as T3 lesions and all the 7 cases were correctly staged as T4 lesions. MDCT proved to be an excellent modality in the diagnosis and differentiation of benign and malignant lesions of the colon and rectum as well as useful in the staging of malignant lesions which helps in proper planning of surgery and further management. Also it provides further information regarding pericolic abnormalities associated with the lesion, presence of lymph nodes, infiltration of adjacent viscera and the presence of distant metastases.
Keywords: MDCT, malignant lesions, lymph nodes.

INTRODUCTION

Technological advances in CT have changed the practice of gastrointestinal radiology. With the development of high resolution scanners, technical refinements in obtaining better quality studies, and the accumulated clinical experience leading to better interpretation. Here the role, indications, and accuracy of CT of the gastrointestinal tract has dramatically enlarged and improved [1]. CT is a highly useful technique in the evaluation of intestinal disease, allowing the evaluation of bowel disease as well as extra-intestinal disease. CT also provides an excellent assessment of the peri-enteric abnormalities that frequently accompany bowel disease (adenopathy, ascites, fat stranding, presence of abscesses and fistulas) and improves specificity in diagnosis [2]. Conventional barium examinations remain superior to CT for evaluating intraluminal and mucosal disease, but CT is far more accurate in evaluating the intramural and extra-intestinal components, including involvement of the mesentery, peritoneal cavity, retroperitoneum, and solid organs. Thickening of the bowel wall is commonly identified abnormality on CT in cases of colorectal lesions. The differential diagnosis for bowel wall thickening is innumerous. Once a bowel wall thickening is detected, its radiologic features are analyzed by using criteria specific to CT imaging. It is important to define the wall thickening as focal, segmental, or diffusely affecting an entire intestinal segment. CT features include degree 2 of thickening of intestinal wall, symmetry of involvement, smooth versus irregular or lobulated inner or outer contour, and pattern of enhancement. Associated findings such as exophytic component, lymphadenopathy, distal metastases, adjacent mesenteric inflammatory response, phlegmon, or abscess are additional important features that are helpful in the differential diagnosis [3].

When confusing or overlapping CT parameters are encountered or uncertainties persist, barium examinations should be liberally used as complementary diagnostic studies. Colorectal cancer is the third most common cancer in men and the second in women worldwide. The prognosis of patients with colorectal carcinoma is dependent on the stage of disease at the time of diagnosis. The depth of wall invasion, presence of lymph node and distant metastases are the major factors that influence prognosis. Accurate preoperative staging is essential for the planning of optimal therapy. The role of conventional CT in patients with colorectal tumors is controversial. Preoperative staging accuracy is not that encouraging and is ranging between 48% and 77% [4]. Hence this study is an attempt to characterize wall thickening in patients with colorectal lesions as either benign or malignant based on the pattern of attenuation, degree of thickening, symmetric versus asymmetric thickening, focal, segmental, or diffuse involvement, and associated peri-enteric abnormalities. The study also aims at evaluating the role of CT in the tumour staging of malignant lesions. The CT findings are finally correlated with histopathological findings.

AIMS AND OBJECTIVES:

1) To study the CT characteristics of benign and malignant lesions of the colon and rectum.
2) To assess the effectiveness of MDCT in differentiating benign and malignant colorectal lesions.
3) To assess the role of MDCT in pre-operative tumour staging of colorectal malignancies.

MATERIALS AND METHODS:

This is a prospective correlative study conducted in the Department of Radio Diagnosis, in our Medical College & Hospital. 40 patients with wall thickening involving the colon and the rectum on CT were included in the study.

In this study, patients with wall thickening involving the colon and rectum on CT were included. A 16 slice GE LIGHT SPEED CT scanner was used for this study. Each patient was given oral preparation for colon-cleaning 12 hours prior to CT examination and was given 1- 1.5L of water to drink shortly before the scan. All patients were placed in the supine position on the CT table, and a rectal tube was inserted. Room air was gently insufflated into the colon to patient tolerance. A standard CT scout image was obtained to assess the degree of colonic distention, which was considered acceptable when all colonic segments including caecum, ascending colon, transverse colon, descending colon, sigmoid colon and rectum were visualized and well distended. Contrast-enhanced multi–detector CT scans were obtained from the diaphragmatic dome to the anal verge with the patient in the supine position after intravenous injection of 80-100 ml of iodinated contrast agent (IOPAMIRO 300; BRACCO) was administered at 3 ml/sec. CT acquisitions were performed in the arterial phase (start delay of 25-35 seconds) and in the portal venous phase (start delay of 50- 70 seconds) with a section width of 5 mm for both arterial and venous phase. Reconstruction of the images with 1.25mm sections was done. All CT data were transferred to a GE workstation for evaluation.

When wall thickening is identified, it is characterized using the following criteria.

- Location
- Attenuation - Homogenous – Uniform attenuation in entire lesion.
- Heterogenous stratified – Target sign (the enhancing mucosa and muscularis propria with the edematous submucosa in between).
- Heterogenous mixed – Mixed areas of hypo / iso / hyper dense attenuation.
- Degree of wall thickening - Mild (2 cms) Symmetric versus asymmetric wall thickening.
- Focal, segmental or diffuse wall thickening.
- Presence of lymph nodes.
- Presence of peri-colonic fat stranding.
- Infiltration of adjacent viscera.ϖ
- Presence of metastasis.
- Staging in cases of suspected malignancy.

Collected data was analyzed by sensitivity, specificity, positive predictive value, negative predictive value, chi square test and by kappa statistics.

INCLUSION CRITERTA o All age groups and both sexes. O Patients with wall thickening involving the colon and rectum. o Patients in whom histopathological findings are available for correlation.

EXCLUSION CRITERIA of Patients with lesions involving the anal canal. o Patients in whom histopathological findings are not available for correlation.

TECHNICAL CONSIDERATIONS IN IMAGING OF LARGE BOWEL (1, 24)

The goal of obtaining a high-resolution study can be accomplished only by a determined attempt to follow several general principles of CT examination:

1. Visualization of the intestinal lumen and its mucosal surface and evaluation of the true thickness of the intestinal wall require the gastrointestinal tract to be empty and clean and its lumen to be opacified and distended. Patient's fast and adequate preparation of the colon is essential, particularly in whom colonic disease is suspected or known to be present. 18

2. Detection of subtle colonic lesions can be enhanced by repeated scans obtained with the patient prone or in left or right lateral decubitus positions, depending on the location of the lesion.
3. The successful acquisition of high-resolution images requires the liberal use of thin (5mm) sections over the area suspected or known to be pathologically involved. This can be done, during the initial scanning, when the location of the lesion is known, or during repeated scanning at the end of the examination, when an abnormality is suspected but is inadequately imaged.

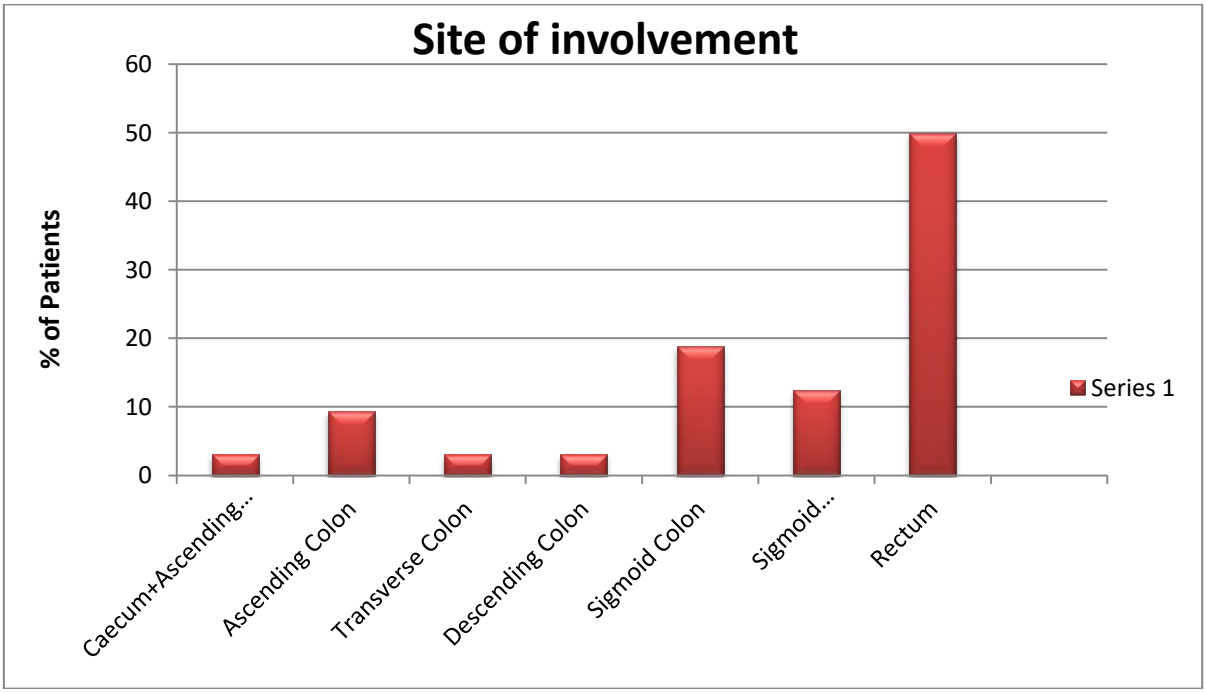
RESULTS & DISCUSSION

The conducted study was a hospital based correlative study in which effectiveness of MDCT in diagnostic evaluation of colorectal lesions. The gold standard method of evaluation that is, comparison of imaging based diagnosis done using MDCT with histopathological diagnosis was studies. In our study, 40 patients were studied with wall thickening involving the region of the colon and rectum. Out of these 40 patients, 22 were males and 18 were females. The age group commonly affected were those in the age group of 61-70 years (25%).

Among the 40 cases, 32 cases were histopathologically proved to be malignant and 8 cases were proved to be benign. Loose stools (37.5%), abdominal pain (37.5%) and vomiting (25%) were the commonest symptoms in patients with inflammatory /infective disease of the colon. Abdominal pain was the commonest symptom in patients with malignant lesions of the colon and rectum. Bleeding per rectum was the second most common symptom in these patients. Most of the patients with benign lesions of the colon had contiguous involvement of the caecum, ascending colon, transverse colon, descending colon and the rectum. Rectum was the commonest site for malignant lesions (50%). This finding was in agreement with the study done by Rajesh *et al.;* [5]. In their study there was involvement of the rectum in 53.71% of the cases.

ATTENUATION OF BOWEL WALL –

Among the 8 benign cases, 7 cases (87.5%) had homogenous attenuation and 1 case (12.5 %) had heterogenous stratified attenuation. Of the 32 malignant cases 31 cases (96.8%) had heterogenous mixed attenuation and 1 case (3.12 %) had homogenous attenuation on CT. 1 case with inflammatory disease of the colon had heterogenous stratified attenuation (target appearance). This showed agreement with studies done by Balthazar et al[1] and Macari et al[6] who told that homogenous attenuation is a feature of benign disease (inflammatory/infective) and heterogenous attenuation is a feature of malignancy (adenocarcinoma). 1 case with inflammatory disease of the colon had heterogenous stratified attenuation (target appearance). This was in agreement with the study done by Jorge Ahuhalli[7]who described that the target sign is a feature of benign disease seen in cases of ischemic colitis, inflammatory colitis and infectious colitis.



Bar diagram showing sites of distribution in histopathologically proven malignant lesions:

Rectum was the most common region to be involved (50%) followed by the sigmoid colon (18.8%). Four lesions showed involvement of both the sigmoid colon and the rectum (12.5%) and one lesion showed involvement of both the caecum and the ascending colon (3.1%).

DEGREE OF BOWEL WALL THICKENING

Mild wall thickening had sensitivity of 87.5%, specificity of 93.8%, and positive predictive value of 77.8 % and negative predictive value of 96.8 % in the diagnosis of benign lesions of the colon. Marked wall thickening had sensitivity of 93.8%, specificity of 87.5 %, and positive predictive value of 96.8 % and negative predictive value of 77.8% in the diagnosis of malignant lesions. This was in agreement with the study done by Balthazar *et al.;* [11] and Macari *et al.;* [4] who described that mild wall thickening is a feature of inflammatory and infective lesions of colon and marked wall thickening is a feature of malignant lesions of colon such as adenocarcinoma.

SYMMETRIC VERSUS ASYMMETRIC WALL THICKENING

Symmetric wall thickening had sensitivity of 87.5 %, specificity of 100%, positive predictive value of 100%, and negative predictive value of 97 %. This is in concordance with the study done by Jorge ahuhalli [7] who described symmetric wall thickening as a feature of benign intestinal lesion. Asymmetric wall thickening had a sensitivity of 100%, specificity of 87.5%, and positive predictive value of 97 % and negative predictive value of 100%. Kumar *et al.;* [8] in their study had found that asymmetric wall thickening is a feature of malignancy which is similar to the pattern of thickening observed in our study.

LENGTH OF INVOLVEMENT OF BOWEL WALL THICKENING

Among the 32 malignant cases, 27 cases (83.33%) had focal involvement of the bowel and 5 cases (16.67%) had segmental involvement of the bowel. Of the 8 benign cases 3 cases (37.5%) had focal involvement of the bowel, 2 cases (25 %) had segmental involvement of the bowel and 3 cases (37.5 %) had diffuse involvement of the bowel. Balthazar *et al.;* [1] and Macari *et al.;* [4] in their study had found that focal involvement of bowel is a feature of malignancy which is in concordance with our study. They also found that diffuse involvement of the bowel is a feature of inflammatory/infective etiology which was again in agreement with our study. However 6 cases of malignancy had segmental involvement of the colon, which according to their study was a feature of benign lesions. Only 37.5 % of the benign cases in our study had segmental involvement of the colon. Hence according our study segmental involvement of the colon is not a reliable indicator in differentiating benign from malignant lesions of the colon

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LYMPH NODES –

Both benign and malignant lesions had multiple enlarged lymph nodes in approximately 78% of the cases. Hence according to our study, presence of enlarged lymph nodes in patients with colonic wall thickening had no role in differentiating benign and malignant lesions of the colon. However Almeida *et al.;* [2] in their study have described that hypo-attenuating bulky lymphadenopathy is a supportive finding in patients with lymphoma of colon. Macari et al[4] have described that low-attenuation lymph nodes with a rim of contrast enhancement or calcified lymph nodes should alert one to the possibility of tuberculosis.

FAT STRANDING

All the benign lesions had evidence of pericolic fat stranding. Pericolic fat stranding was present in 20 cases (60%) of malignancy. Pericolic fat stranding was absent in 12 cases (38%) of malignancy. Filippone *et al.;* [4] in their study have found that pericolic fat stranding adjacent to a malignant lesion is a feature of invasion of pericolic fat and hence is a feature of T3 lesions. However it is not a reliable criterion and may result in over staging of lesions as T3. Pereira *et al.;* [9] had described that pericolic fat stranding is a common finding seen in inflammatory conditions of the colon.

INFILTRATION OF ADJACENT VISCERA

Infiltration of adjacent structures was seen in 5 cases (12.5%) of malignancy. Infiltration of the cervix was seen in 2 cases (40%). Infiltration of the cervix, puborectalis muscle and duodenum was seen in the other 3 cases. Infiltration of adjacent structures is highly suggestive of malignancy.

DISTANT METASTASES

Distant metastasis was seen in 10 malignant cases (31.25%). Liver metastases was seen in 2 cases(20%), lung metastases was seen in 1 case(10%), adrenal metastases in 1 case(10%), bone metastases in 1 case(10%), omental deposits in 2 cases(20%) and peritoneal deposits in 2 cases(20%). Karen *et al.;* [10] in their study have described that liver is the predominant organ to be involved with metastases from colorectal cancer.

ROLE OF MDCT IN DIFFERENTIATING BENIGN AND MALIGNANT LESIONS

Among the 33 lesions identified as malignancy on MDCT, histopathology confirmed malignancy in 32 cases. 1 case diagnosed as malignant on MDCT was confirmed as inflammatory on histopathology. Hence in our study, MDCT had sensitivity of 100%, specificity of 87.5 %, and positive predictive value of 97 % and

negative predictive value of 100% in the diagnosis of malignant lesions. All the cases diagnosed as benign on MDCT were confirmed as benign on histopathology. 1 case diagnosed as malignant on MDCT was confirmed as inflammatory on histopathology. Hence in our study, MDCT had sensitivity of 87.5 %, specificity of 100%, and positive predictive value of 100% and negative predictive value of 97 % in the diagnosis of benign lesions. K= 0.92 (Excellent agreement). Hence MDCT is an excellent modality in differentiating benign and malignant lesions of the colon and rectum.

ROLE OF CT IN STAGING OF MALIGNANT LESIONS

Among the 10 cases staged as T1&T2 on histopathology, MDCT correctly staged 8 cases 79 (81.80%). Over staging was done in 2 cases. This was due to inflammatory reaction at the edge of the tumour which produces a nodular margin. Filippone *et al.;* [4] in their study on staging of colorectal carcinoma using MDCT, were able to stage 93% of the lesions as T1&T2 correctly. In our study 16 cases (88.90%) were correctly staged as T3. Under staging was done in 2 cases. Filippone *et al.;* [4] was able to correctly stage 90% of the cases as T3 lesions. All cases with T4 lesions were correctly staged in our study. Filippone *et al.;* [4] was able to correctly stage 98% of the lesions as T4.

CASES:

Axial CECT showing homogenously enhancing wall thickening involving the transverse colon, this was proved to be a case of adenocarcinoma.

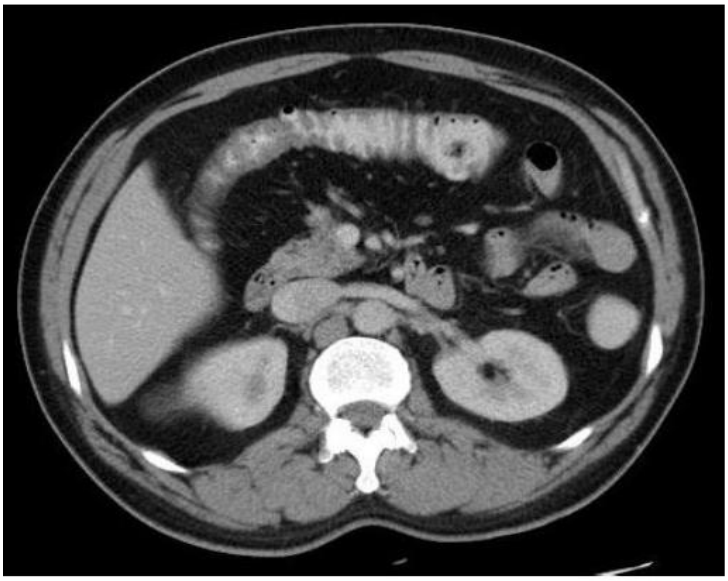

Fig 1: CT- Carcinoma Transverse colon (Homogenous enhancement)

Fig 2 (a): CT- Carcinoma Ascending colon with intussusception

Fig 2(b): CT- Carcinoma Ascending colon with intussusception

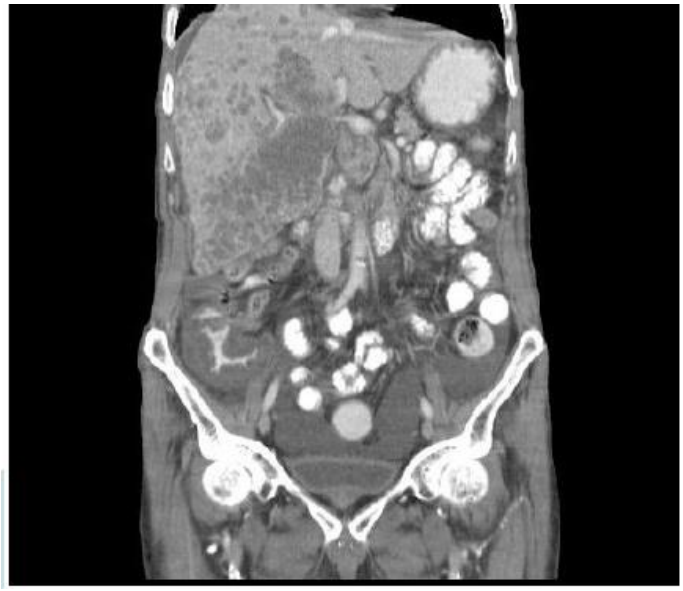

Fig 3 (a): CT- Carcinoma of ascending colon with liver metastasis

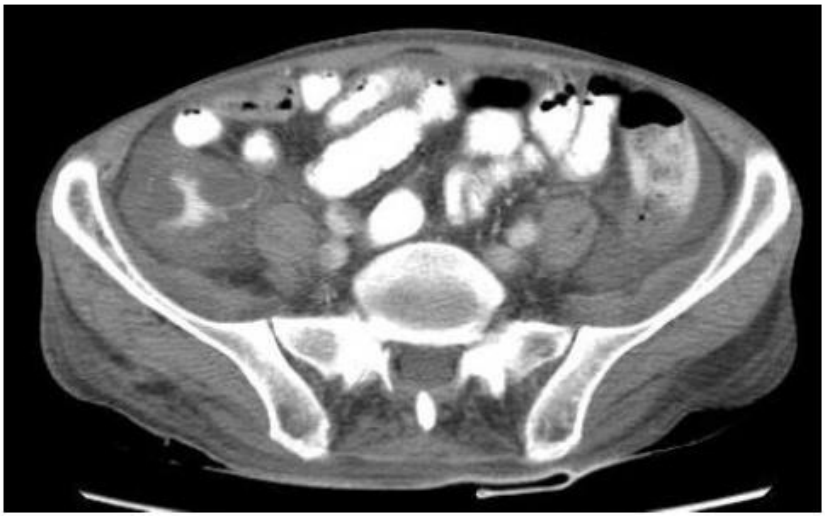

Fig 3 (b): CT- Carcinoma of ascending colon with liver metastasis

Axial and coronal CECT images showing peripherally enhancing hypo dense lesion in the liver suggestive of metastasis in this patient with heterogenous asymmetric wall thickening involving the ascending colon.

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