ORIGINAL ARTICLE http://doi.org/10.3126/njr.v15i1.84163

Diagnostic Role of Contrast Enhanced Computed Tomography (CECT) of Abdomen and Pelvis in Evaluation of Colon Pathologies

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Received: April 9, 2025 **Accepted:** June 15, 2025 **Published:** June 30, 2025

Cite this paper:
Karki P, Shrestha S, Sherpa NT, Gautam D, Luitel S, Khadgi R. Diagnostic Role of Contrast Enhanced Computed Tomography (CECT) of Abdomen and Pelvis in Evaluation of Colon Pathologies. *Nepalese Journal of Radiology* 2025;15(1):16-22. **http://doi.org/10.3126/njr.v15i1.84163**

ABSTRACT

Introduction: Contrast-enhanced computed tomography (CECT) plays an important role in distinguishing benign and malignant colon lesions through cross-sectional evaluation of pericolonic abnormality and features such as wall thickening, post-contrast enhancement, lymphadenopathies, and other associated findings. This can help in the early diagnosis and treatment of colon lesions. Though colonoscopy is the gold standard, it has various limitations and is an invasive procedure.

Methods: A retrospective study was carried out in patients with large bowel symptoms who had undergone CECT from October 2020 to January 2025 at Patan Hospital, Lalitpur, Nepal. Ethical approval was obtained from the institutional review committee of Patan Academy of Health Sciences. CECT diagnosis based on bowel wall thickening and associated features was compared with histopathology diagnosis, and the sensitivity, specificity were calculated.

Results: Among 356 patients, 260 had benign and 96 had malignant lesions. The sensitivity and specificity of CECT in diagnosing malignant colon lesions were 78.1% and 83.1% respectively. Ascending colon (35.41%) and recto sigmoid region (36.4%) were the most common sites for malignancy, while cecum (45.38%) was the common site for benign lesions. CECT features of colon malignancy were asymmetrical wall thickening, focal involvement, heterogeneous enhancement, lymphadenopathy, exophytic component, and intestinal obstruction.

Conclusions: CECT helps in non-invasive evaluation of colon lesions with early detection of malignancy, disease staging and treatment through lesion morphology and pericolonic extent. While colonoscopy and histopathology remain the gold standard for diagnosis.

Keywords: *Caecum; Colonic Neoplasms; Intestinal Obstruction; Lymphadenopathy*

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INTRODUCTION

Colorectal malignancy is the third most common carcinoma globally, which may follow benign conditions like ulcerative colitis. It typically presents between 68 to 72 years of age. CECT plays an important role in evaluating colon pathologies through cross-sectional imaging, revealing pericolonic abnormalities. Approximately 35%-48% patients with rectal bleeding are diagnosed with colorectal carcinoma. Early diagnosis improved the survival rate upto 90% however, due to limited screening, only 39% of colorectal carcinomas are diagnosed in early stages.[1,2,3,4,5,6,]

Colonoscopy, being gold standard for diagnosing colon pathology however has limitations in constipated patients and requires need of bowel preparation and also have risk of bowel perforation and bleeding. CECT, being a noninvasive procedure, helps accurate diagnosis using features of bowel wall thickening, pattern of enhancement, lymphadenopathy, and other associated findings. CECT is 92.0% sensitive and 65.0% specific in diagnosing colon malignancy.[4,7,8]

We aim to establish the diagnostic accuracy of CECT in distinguishing benign and malignant colon pathology for early detection, staging, and treatment of colorectal malignancies.

METHODS

This was a retrospective study of CECT abdomen done in the department of radiology and imaging of Patan Academy of Health Sciences (PAHS), Lalitpur, Nepal. After getting the ethical approval from the institutional review committee of PAHS (Reference number: drs2505132017) retrospective analysis of 356 patients who underwent CECT for large bowel symptoms between October 2020 to January 2025 was done. The CECT reports of the patients were searched and retrieved from the CT section of the radiology department. Histopathology reports of the patients were identified and retrieved from the department of pathology.

The CECT findings of the colon lesions were recorded by two MD radiologists. The CECT final diagnosis was then compared with histopathology findings.

All the patients who had undergone CECT abdomen in the radiology department of Patan Academy of Health Sciences for symptoms such as abdominal pain or per rectal bleeding that were suspected of having large bowel pathologies were included. Patients whose final diagnosis could not be reached due to incomplete data, patients who denied surgery, as a result, histopathology records could not be obtained, and patients whose surgery could not be performed due to various co-morbid conditions were excluded from this study.

The data was entered in MS Excel and imported into the IBM SPSS 20 software for statistical analysis. Descriptive statistics about CT features of benign and malignant colon lesions and the site of involvement of the colon were included; sensitivity and specificity of the CECT in diagnosing malignant colon lesions were calculated.

RESULTS

A total of 356 patients were evaluated using contrast-enhanced computed tomography (CECT), who had undergone histopathology diagnosis. Among these, 96 (26.9%) cases were confirmed to be malignant, while 260 (73.03%) were benign on histopathology.

CECT identified 119 (33.4%) cases as malignant, of which 75 were true positives, 44 were false positives, and 237 (66.5%) cases were diagnosed as benign on CECT, 216 were true negatives, and 21 were false negatives, as confirmed by histopathology.

The distribution of colonic involvement on contrast-enhanced CT scan showed variation between benign and malignant cases.

In benign cases, the caecum was the most frequently affected site, accounting for 45.38% (n=118) of cases. This was followed by the ascending colon (19.23%, n50), and a notable proportion (16.9%, n=44) showed no detectable wall thickening on imaging. Other sites included the sigmoid colon (7.30%, n= 19), rectum (5.76%, n=15), descending colon (3.46%, n=9), and transverse colon (1.92%, n=5).

On the other hand, all the malignant cases showed bowel wall thickening in imaging, most commonly involving the ascending colon (35.41%, n=34) and rectum (20.83%, n=20). The sigmoid colon (15.62%, n=15), transverse colon (10.41%, n=10), caecum (10.41%, n=10), and descending colon (7.29%, n=7) were also involved. (Table 1). In our study, the distribution pattern of the colonic lesion showed a predilection of malignant pathologies toward the ascending colon and rectum, whereas benign conditions more frequently involved the caecum.

Contrast-enhanced computed tomography (CECT) revealed distinct imaging features that helped differentiate between benign and malignant colon pathologies.

Among the 96 malignant cases, the most frequent findings included heterogeneous enhancement (78.1%, n =75) of thickened wall with focal involvement (73.9%, n=71). Asymmetrical wall thickening was observed in 70 (72.9%) of malignant lesions, while surrounding fat stranding was noted in 65 (67.7%). Additional indicators of malignancy included intestinal obstruction (42.7%, n=41), exophytic components (37.5%, n=36), regional and enhancing lymphadenopathy (36.4%, n=35), and peritoneal fluid collection (25%, n=24). Distant metastases were identified in 23 (23.9%) of patients, whereas abscess formation was relatively uncommon (4.1%, n=4). (Table 2).

In contrast, the 260 benign cases predominantly showed symmetrical wall thickening (75%, n =195) and a higher incidence of long segment involvement (47.6%, n=124) and a lesser incidence of heterogeneous enhancement (6.9%, n = 18) compared to malignant cases. Asymmetrical thickening was relatively rare (8%, n=21). Few benign cases (16.9%, n=44) showed no significant wall thickening on imaging. Although regional lymphadenopathy (62.6%, n=163) and surrounding fat stranding (71.1%, n =185) were frequently present, enhancing nodes were rare (9.2%, n=24). Other features, such as peritoneal fluid and abscess formation, were found in 32.6% (n = 85) of benign cases. Intestinal obstruction was much less common, seen in only 6.9% (n = 18) of cases, Table 3

These findings underscore the diagnostic utility of CECT in distinguishing between benign and malignant colon lesions, especially based on wall characteristics, enhancement patterns, and associated lymph node or metastatic features.

Out of 365 cases, CECT identified 119 (33.4%) cases as malignant, of which 75 were true positives, 44 were false positives, and 237 (66.5%) cases were diagnosed as benign on CECT. Two hundred and sixteen were true negatives, and 21 were false negatives, as confirmed by histopathology. According to which, CECT was found to be 78.1% sensitive and 83.1% specific in diagnosing colon malignancy and 83.1% sensitive and 78.1% specific in diagnosing benign colon lesions with a positive predictive value of 63.0% and a negative predictive value of 91.1%. (Table 4)

Table 1: Site of involvement of benign and malignant colon pathologies

Site of involvement	Benign N(%)	Malignant N(%)
No wall thickening	44 (16.9%)	0 (0%)
Caecum	118 (45.38%)	10 (10.41%)
Ascending colon	50 (19.23 %)	34 (35.41%)
Transverse colon	5 (1.92%)	10 (10.41%)
Descending colon	9 (3.46%)	7 (7.29%)
Sigmoid colon	19 (7.30%)	15 (15.62%)
Rectum	15 (5.76%)	20 (20.83%)
Total	260 (100%)	96 (100%)

Table 2: (CECT Findings) CECT findings determining Malignant pathologies

CECT findings of colon lesions	N	Percentage (%)
Malignant lesions:		
Asymmetrical wall thickening	70	72.9
Focal involvement	71	73.9
Long segmental involvement	25	26
Heterogeneous enhancement	75	78.1
Regional lymphnodes	35	36.4
Enhancing lymphnodes	35	36.4
Surrounding fat strandings	65	67.7
Peritoneal fluid collection	24	25
Distant metastasis	23	23.9
Exophytic components	36	37.5
Abscess	4	4.1
Intestinal obstruction	41	42.7

Table 3: (CECT Findings) CECT findings determining benign pathologies

CECT findings of colon lesions	N	%
Benign lesions:		
No wall thickening	44	16.9
Symmetrical wall thickening	195	75
Asymmetrical wall thickening	21	8
Focal involvement	92	35.3
Long segment involvement	124	47.6
Heterogeneous enhancement	18	6.9
Regional lymphnodes	163	62.6
Enhancing lymphnodes	24	9.2
Surrounding fat strandings	185	71.1
Peritoneal fluid collection	85	32.6
Abscess	85	32.6
Intestinal obstruction	18	6.9

Table 4: Accuracy of CECT diagnosis with histopathological proven benign or malignant colon pathologies

Final diagnosis	Histopathology Diagnosis	CECT Diagnosis	Sensitivity	Specificity
Benign lesions	260	237	83.1%	78.1%
Malignant lesions	96	119	78.1%	83.1%

DISCUSSION

In this study involving 356 patients who underwent contrast-enhanced computed tomography (CECT) followed by histopathological confirmation, we observed a diagnostic sensitivity of 78.1% and specificity of 83.1% for malignancy detection using CECT. These findings are consistent with a previous study done by Liu C et al at. 2024, who reported similar sensitivity (around 76%)

and specificity (approximately 87%) for CECT in colorectal cancer diagnosis, reinforcing the modality's value in clinical practice. Similarly, in another study conducted by Dighe S et al. in 2010, they found the sensitivity of CT scan for diagnosing malignant colon pathology to be 86% and specificity to be 78%. In contrast to our study, Tapasvi C et al. conducted a study in 2014, found the sensitivity and specificity of CECT for diagnosing colon lesions to be 97% and 93% respectively.[9,10,11]

The distribution pattern of colonic involvement in our study showed malignant lesions predominantly affecting the ascending colon (35.4%) and rectum (20.8%), while benign lesions more commonly involved the caecum (45.4%). This pattern aligns with observations by Wang X et al. in 2019, who reported a higher prevalence of malignancies in the ascending colon, sigmoid colon, and rectum, possibly due to the biological behavior and epidemiology of colorectal adenocarcinomas, and the least involvement of the cecum. In contrast to our study, Patel et al. in their study in 2018 stated malignant colon lesions were more common in the rectosigmoid region (52.38%), followed by the cecum and ascending colon (26.19%). The predominance of benign lesions in the caecum may relate to common inflammatory or infectious processes in the proximal colon, as noted by Agarwala R et al. in a study conducted in 2019. [12,13,14]

Distinct imaging features differentiated malignant from benign lesions in our study. Malignant pathology frequently showed heterogeneous enhancement (78.1%), focal involvement (73.9%), and asymmetrical wall thickening (72.9%), with associated findings of surrounding fat stranding (67.7%), intestinal obstruction (42.7%), exophytic masses (37.5%), enhancing lymphadenopathy (36.4%), and distant metastases (23.9%). These findings are similar to the study of Chaudhari MK et al. done in 2016, emphasizing the importance of asymmetry, heterogeneous enhancement, intestinal obstruction, and nodal involvement for the diagnosis of malignancy on CECT. Similarly in a study conducted by Macari et al. in 2001 showed that heterogeneous wall and focal involvement of the colon were frequently malignant pathology. However, in contrast to our study the Thoeni RF et al. suggested that asymmetric bowel wall thickening with segmental involvement is seen in granulomatous colitis.[15,16,17]

Benign lesions, in contrast, more commonly demonstrated symmetrical wall thickening (75%), long segment involvement (47.6%), and a higher rate of regional lymphadenopathy (62.6%) and fat stranding (71.1%), but with rare enhancing lymph nodes (3.4%). These characteristics are consistent with a study done by Fernandes et al. in 2014, who reported that benign inflammatory conditions often cause diffuse, symmetrical thickening without aggressive nodal features. The relatively high incidence of lymphadenopathy and fat stranding in benign lesions, however, may limit their specificity in distinguishing benign from malignant pathology. This overlap could be attributed to reactive inflammatory changes that mimic malignancy on imaging.[18]

Notably, intestinal obstruction was much more prevalent in malignant lesions (42.7%) compared to benign cases (6.9%), which is similar to earlier reports by Verheyden C et al. in a study conducted in 2020, which stated that obstruction is a common complication of advanced colorectal cancer and is seen in 60% of colon malignancies. Abscess formation and peritoneal fluid collections were relatively common in benign conditions, reflecting the inflammatory nature of many benign pathologies in our study.[19]

Surrounding fat strandings had no significant role in differentiation between benign and malignant conditions in our study, as it was 71.1% for benign and 67.7% for malignant conditions, which is similar to a study conducted by Filippone A et al. in 2004, in which 60% malignant conditions showed pericolonic fat stranding and all the benign cases 100% showed pericolonic fat strandings.[20]

In contrast to our study Pereira JM et al. suggested that pericolonic fat stranding is common feature of inflammatory pathology.[21]

In our study Both benign and malignant lesions had

multiple enlarged lymph nodes of 66.1% and 72.9% respectively hence enlarged lymphnode alone could not differentiate benign or malignant colonic pathologies however heterogenous enhancement was seen much more in malignant conditions 36.4% in comparision to benign condition which was 9.2% In contrary to our study, Almeida et al. stated hypo-attenuating conglomerate lymphadenopathy favours lymphoma of colon. Similarly, in another Macari et al. described that peripherally enhancing lymphnodes with a central hypodense area or calcified lymph nodes favor abdominal tuberculosis.[16,22]

Differences between our results and some previous studies may stem from variations in sample size, patient demographics, and inclusion criteria. For example, studies with a higher prevalence of inflammatory bowel diseases might report greater overlap in lymphadenopathy and fat stranding between benign and malignant lesions. Additionally, differences in imaging protocols and reader expertise can impact the sensitivity and specificity reported.

CONCLUSION

In summary, our study supports the diagnostic utility of CECT in differentiating benign and malignant colonic lesions based on wall thickening patterns, enhancement characteristics, and associated features such as lymphadenopathy and metastases. While CECT shows high sensitivity and specificity, some overlap in imaging features necessitates cautious interpretation and correlation with clinical and histopathological findings.

CONFLICT OF INTEREST

None

SOURCES OF FUNDING

None

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