

Diagnostic Accuracy of Pre-operative Staging of Colorectal Carcinoma in Comparison to Post-operative Pathological Staging

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Abstract

Background: Pre-operative staging of primary tumor is critical for planning treatment and it is directly related to prognosis of the patient. Hence, assessing the accuracy of this pre-operative staging is essential.

Aim: To evaluate the accuracy of computed tomography (CT) in pre-operative tumor staging of colorectal malignancies by correlating with post-operative histopathological staging.

Materials and Methods: This is a retrospective correlative study. The medical records of 45 consecutive patients who underwent resection for a colonic carcinoma at Father Muller Medical College, Mangalore, over a period of 13-month from January 2015 to February 2016 were retrospectively reviewed. Pre-operative CT staging was correlated with post-operative histopathological staging.

Results: In the CT staging of malignant lesions, 9 of the 11 cases were correctly staged as T1 and T2 lesions. 16 of the 18 cases were correctly staged as T3 lesions, and all the 7 cases were correctly staged as T4 lesions.

Conclusion: CT proved to be an excellent modality for the staging of colorectal carcinomas which helps in the proper planning of surgery and further management of the patient.

Key words: Colon cancer, Computed tomography staging, Histopathology staging, Pre-operative computed tomography staging, Tumor node metastasis staging

INTRODUCTION

Colorectal cancer is the third most common cancer in men and the second in women worldwide. Population-based time trend studies show a rising trend in the incidence of colorectal carcinoma in India.¹ Pre-operative staging of colon cancers is important to plan the best possible treatment options for the patients, which may include for example, neoadjuvant drug therapy to allow for pre-operative downsizing of the primary tumor.² Consequently,

computed tomography (CT) has become an increasingly routine part of the pre-operative staging of colon cancer. The treatment and prognosis of patients with colorectal carcinoma is dependent on the stage of disease at the time of diagnosis.

Aim

The study aim at evaluating the accuracy of CT in the tumor staging of malignant lesions. The pre-operative CT findings are correlated with post-operative histopathological findings considering histopathological staging as the gold standard.

MATERIALS AND METHODS

This was a hospital-based retrospective correlative study conducted in Father Muller Medical College and hospital,

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Mangalore, between October 2015 and April 2016. 45 consecutive patients who underwent resection for colorectal carcinoma at Father Muller Medical College, Mangalore, were included in the study. Their case sheets were reviewed. Pre-operative CT staging was correlated with post-operative histopathological staging. CT was performed using 16 slice GE Bright Speed CT scanner. 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 get adequate colonic distension. CT acquisitions were performed in the arterial phase (start delay of 25-35 s) and in the portal venous phase (start delay of 50-70 s) with a section width of 5 mm. In CT image analysis, only three T stages ($\leq T2$, T3, or T4), are considered instead of the normal four T stages as reported in the tumor node metastasis (TNM) system. T1 and T2 tumors were combined to represent one T-stage, $\leq T2$. This classification is used to address known limitations of CT in distinguishing T1 and T2 lesions. Specimens were processed after fixing them for 48 h, cutting 6 mm axial slices along the tumor length, and embedding the slices in mega blocks for further fixation and processing. The mega blocks were all embedded in paraffin, mounted on glass, and stained with hematoxylin and eosin for histological assessment. Pathological staging of the specimens was then diagnosed by the pathologist according to the Seventh American Joint Committee on Cancer TNM staging system³ as follows: pT0, no evidence of primary tumor; pT1 is, carcinoma *in situ*, intraepithelial, or invasion of lamina propria; pT1, tumor invades submucosa; pT2, tumor invades muscularis propria; pT3, tumor invades through the muscularis propria into the subserosal, or into non-peritonealized pericolic tissues; and, pT4, tumor directly invades adjacent organs or structures, and/or perforation of the visceral peritoneum.

RESULTS

Of the 11 cases staged as T1 and T2 on histopathology, CT correctly staged 9 cases (81.80%). Overstaging was done in 2 cases. Of the 18 cases staged as T3, CT correctly staged 16 cases (88.90%). Understaging was done in 2 cases. All the 7 cases staged as T4 on histopathology were correctly staged on CT (Table 1).

DISCUSSION

The prognosis of patients with colorectal carcinoma is dependent on the stage of disease at the time of diagnosis. An accurate staging of rectal cancer is necessary to indicate the most appropriate management. An early small colorectal cancer confined to submucosa (T1 stage) can be

Table 1: CT in the staging of malignant lesions

Count	Histopathological staging			Total
	T1 and T2	T3	T4	
CT staging				
T1 and T2				
Count	9	2	0	11
	81.80%	18.20%	0.00%	100.00%
	81.80%	11.10%	0.00%	30.60%
T3				
Count	2	16	0	18
	11.10%	88.90%	0.00%	100.00%
	18.20%	88.90%	0.00%	50.00%
T4				
Count	0	0	7	7
	0.00%	0.00%	100.00%	100.00%
	0.00%	0.00%	100.00%	19.40%
Total				
Count	11	18	7	36
	30.60%	50.00%	19.40%	100.00%
	100.00%	100.00%	100.00%	100.00%

$\chi^2=53.99, P=0.000$ HS. CT: Computed tomography

excised locally, whereas pre-operative chemotherapy and radiation therapy can be recommended for advanced rectal cancer for downstaging. Compared with surgery alone, pre-operative neoadjuvant therapy plus surgery for advanced rectal cancer (T3, T4) results in better survival rates, better local control, and comparable or better toxicity compared with standard post-operative adjuvant regimens. Accurate staging is, therefore, crucial in the selection of patients for trials on the evaluation of neoadjuvant treatment. Filippone *et al.*⁴ did a study on the pre-operative T and N staging of colorectal carcinoma using contrast-enhanced multi-detector row CT colonography. They observed that the overall accuracy of contrast-enhanced multi-detector CT (MDCT) in tumor staging was 73% (30 of 41 patients) when transverse images were evaluated alone. Overall, accuracy improved to 83% (34 of 41 patients) when transverse and multiplanar reconstruction (MPR) images were evaluated in combination. Over and under staging using transverse images occurred in 9 of 41 (22%) patients and 2 of 41 (5%) patients, respectively. With transverse images and MPRs combined, over- and under-staging occurred in 5 of 41 (12%) patients and 2 of 41 (5%) patients, respectively. Horton *et al.*⁵ did a study on the imaging features of colonic malignancy using spiral CT. They observed that CT allows detection of pericolic extension of disease and is more accurate than magnetic resonance imaging in staging the local extent of tumor, particularly for rectal cancers and detection of penetration of the lamina propria. They also observed that CT is better than colonoscopy at demonstrating early, mass like tumor recurrence at the surgical anastomosis due to the often largely extrinsic component of such recurrence.

Freeny *et al.*⁶ evaluated the pre-operative staging and detection of post-operative recurrence in colonic cancers. Compared with the Duke's classification, CT correctly staged only 47.5% of patients: 16.6% were upstaged, and 83.3% were downstaged.

Balthazar *et al.*⁷ did a pre-operative evaluation of 90 proved cases of colon carcinoma to know the detection rate and role of CT in the pre-operative evaluation. In this study, the overall detection rate was 84%; however, the rate varied from 68% in unprepared colons to 95% in clean colons that were adequately distended with air. Their study shows that CT had a sensitivity of 55% for local invasion, 73% for regional nodes, and 79% for liver metastases.

Ng *et al.*⁸ assessed the pathological significance of abnormal pericolic fat shown by CT in the context of colorectal carcinoma. According to their study abnormal pericolic fat had a sensitivity of 79%, specificity of 33%, positive predictive value of 91% in identifying extension of tumor infiltration beyond the muscle coat.

Harvey *et al.*⁹ evaluated the role of spiral CT pneumocolon for assessing colonic neoplasms. According to their study, CT pneumocolon clearly showed the primary tumor in all cases as an enhancing soft tissue mass, and was able to detect local extension and lymphadenopathy as well as assess the liver, peritoneum and remaining abdomen. CT depicted the morphology of the primary tumor more clearly than barium enema, and in one case also detected a 1 cm polyp which was not seen on the barium study because the patient was incontinent of barium and views were limited. There was a good correlation between the CT and pathological findings.

Of the 11 cases staged as T1 and T2 on histopathology, CT correctly staged 9 cases (81.80%) (Figure 1). Over staging was done in 2 cases. Filippone *et al.*⁶ in their study on the staging of colorectal carcinoma using MDCT were able to stage 93% of the lesions as T1 and T2 correctly. In our study, 16 cases (88.90%) were correctly staged as T3 (Figure 2). Under staging was done in 2 cases. Filippone *et al.* were able to correctly stage 90% of the cases as T3 lesions. All cases with T4 lesions were correctly staged in our study (Figure 3). Filippone *et al.* were able to correctly stage 98% of the lesions as T4.

CONCLUSION

CT is proved to have good diagnostic accuracy in pre-operative staging of malignant lesions which helps in the proper planning of surgery and further management of the patient.

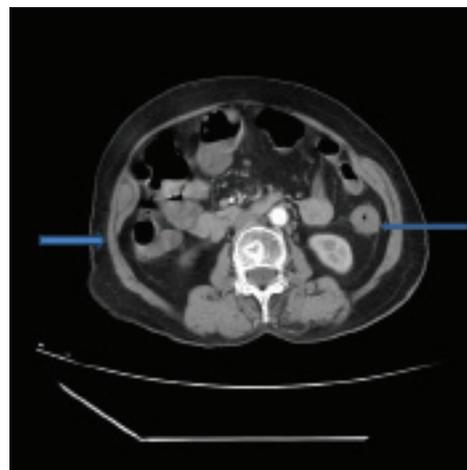


Figure 1: Axial contrast-enhanced computed tomography showing wall thickening of the descending colon (arrows) confined to the wall. No evidence of pericolic fat stranding - T2 tumor staging

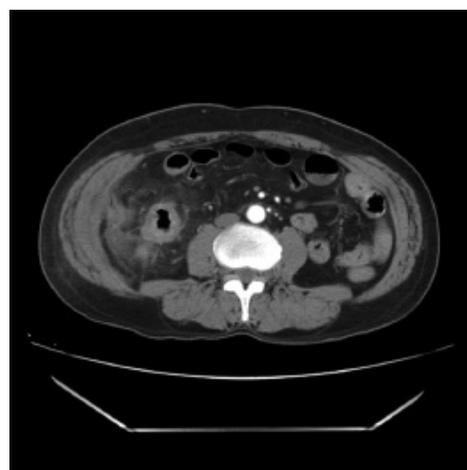


Figure 2: Axial contrast-enhanced computed tomography showing wall thickening of the ascending colon (arrows) with nodular margin and peri colonic fat stranding suggestive of malignancy - T3 tumor staging

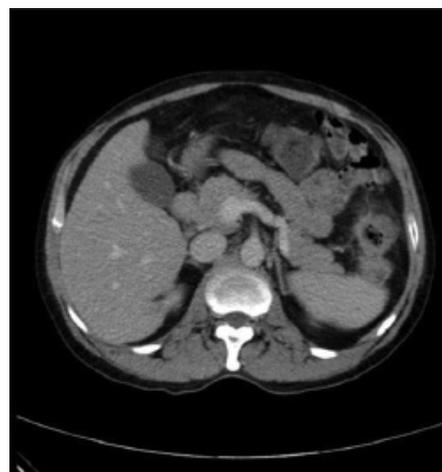


Figure 3: Axial contrast-enhanced computed tomography showing heterogeneously enhancing asymmetric wall thickening involving the descending colon with infiltration of the spleen suggestive of T4 stage

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