ORIGINAL ARTICLE

PRE-OPERATIVE LOCO-REGIONAL STAGING OF COLO-RECTAL CARCINOMA BY USING CONTRAST ENHANCED COMPUTED TOMOGRAPHY CORRELATION WITH HISTOPATHOLOGY

Imtiaz Ali,[1] Raisa Altaf,[1] Ashok Kumar,[1] Saleha Anwar,[1] Navaira Ali,[2] Rabia Ali[3]

[1] Department of Radiology, Liaquat National Hospital and Medical College Karachi, Pakistan.
[2] Department of Oncology, Liaquat National Hospital and Medical College Karachi, Pakistan.
[3] Department of Histopathology, Liaquat National Hospital and Medical College Karachi, Pakistan.

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ABSTRACT

OBJECTIVE: To determine the correlation of contrast enhanced computed tomography in TNM staging system of colo-rectal carcinoma with histopathology in preoperative patients for establishing the treatment and predicting the prognosis. **INTRODUCTION:** Colorectal carcinoma most common malignancy of gastrointestinal tract. It is more common in male than female with mean age of 51.54 years incidence increased in aging population. Most common location of tumor is rectum, recto-sigmoid junction and sigmoid colon. **METHODS:** Total 50 patients were included in our study. All patients were underwent the contrast enhanced multi-detector CT scan with rectal contrast, Colonoscopy, biopsy and histopathology. All patients were also underwent the CT chest and bone scan turn out to be negative for distant metastasis that is stage IV disease. Data was retrospectively reached through the electronical medical record. We have evaluate the accuracy of Multi-detector CT scan in comparison with histopathology. **RESULTS:** Total number of 50 patients were included with age range from 01-85 years. Mean age of patient was 51.54 years. Majority of patients 18 (36%) were between 46-60 years of age. Out of these 50 patients, 32 (64%) were male and 18 (36%) were female. On conclusion 39 (78%) were diagnosed as same stage on multi-detector CT scan in association with histopathology and 11 (22%) were not corresponding to the stage of colorectal carcinoma on histopathology. **CONCLUSION:** Multi-detector CT scan with rectal oral and IV contrast has good accuracy in diagnosis of colorectal carcinoma beyond the bowel wall with loco-regional extension. It has good accuracy in diagnosis of T3 and T4 that is stage II and III, however low accuracy to evaluate the T1 and T2 that is Stage I.

Keywords: Colorectal carcinoma, TNM staging, computed tomography, histopathology.

Background & Introduction

Colorectal carcinoma (CRC) is a most common malignancy of gastrointestinal tract.[1,2] Worldwide it is 3rd most common in women and 4th most common in men carcinoma and prevalent type of malignancy.[1,3,4] It can cause the significant morbidity and mortality and frequent cause of cancer related death globally.[5,6] The incidence of colorectal carcinoma is increasing in young population due changing in habits of lifestyle and westernization of diet.[2] Signs and symptoms of CRC usually depend on the site of malignancy and metastasis however common symptoms includes unexplained weight loss, abdominal pain, loss of appetite, change in bowel habits, and bleeding per rectum.[2] Rectal carcinoma

Correspondence : Dr. Raisa Altaf
Department of Radiology,
Liaquat National Hospital and Medical College,
Karachi, Pakistan.
Email: raisaaltaf88@gmail.com

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is usually associated with poor prognosis due to local recurrence, extension of tumor into the pre-rectal soft tissue and distant metastasis.[6]

Pre-operative staging of CRC by using different imaging modalities is important for establishing the treatment plan and prognosis of the patient.[1,2] Various imaging modalities such as transrectal endoscopic ultrasonography, MRI, and contrast enhanced CT scan are extensively used for staging of rectal carcinoma.[5] Multi-detector CT scan with IV, and rectal contrast is investigation of choice for diagnosis of clinically advanced disease in abdomen, retroperitoneum and decision making tool in pre-operative local staging of colon cancer.[2,6,7,8] It is more readily, and universally available, cost effective and quicker than MRI.[2,9] Because of limited soft tissue contrast its accuracy for T staging or detecting extra-luminal extension is ranges from 60% to 80%.[6] While CT is more sensitive for evaluating depth of tumor invasion through the wall, extramural extension and loco-regional lymph nodes metastasis than combined PET/CT.[7,10] CT scan with advanced technology and picture archiving computer data system software is more accurate staging tool and predicting the disease prognosis.[9] Multi-detector CT scan using water enema or air insufflation, its accuracy has been increased in pre-operative staging and post-operative follow-up of patients.[2] Magnetic resonance imaging (MRI) has better soft tissue contrast and it can evaluate the layer structure of bowel wall. In cases of rectal carcinoma it can provide confined details of bowel and regional extension but usefulness of MRI for loco-regional staging of colorectal carcinoma is not yet established.[1,6] Within the limitation of CT scan, it is still useful for planning surgery, radiotherapy in pre-operative patients.[11] However no any imaging investigation available for 100% and accurate staging of colorectal carcinoma in pre-operative patients.[2] TNM staging of colorectal carcinoma by CT scan shown in (Tab.1).[11]

Staging of colorectal carcinoma with TNM staging System

Stage	TNM	Definition
0	Tis N0 M0	
I	T1 N0 M0 T2 N0 M0	Limited to bowel wall
II	T3 N0 M0 T4 N0 M0	Extension into the serosa or mesenteric fat
III	Any T N1 M0 Any T N2 M0	Lymph node metastasis
IV	Any T Any N M0	Distant metastasis

Table 1

The aim this study is to evaluate the correlation of high resolution multi-detector CT scan with IV and rectal contrast in staging of colorectal carcinoma as compared with histopathological staging.

Study design:

An observational retrospective cross-sectional Study.

Place of study:

Department of radiology, oncology and histopathology, at Liaquat National Hospital and Medical College, Karachi, Sindh.

Study period:

Last 1 year of duration from 1st January 2021 to 30th December 2021.

Sample Size:

All patients diagnosed as colo-rectal carcinoma and classified into the staging according to the TNM staging system CT scan of whole abdomen with IV and rectal contrast and underwent colonoscopy with biopsy, histopathology and CT chest and bone scan from 1st January 2021 to 30th December 2021 were included in this study.

Sample Selection:

Inclusion criteria:

1: Patients diagnosed as colorectal oncontrast enhanced CT scan and underwent the colonoscopy, biopsy, histopathology CT chest and bone scan.

Exclusion criteria:

01: Already diagnosed case of colorectal carcinoma with widespread metastasis.

02: Post-operative cases like colostomy with diagnosed case of colorectal carcinoma.

03: Post-radiotherapy and chemotherapy follow-up cases of colorectal carcinoma.

04: Patient with known previous malignancy other than the colorectal carcinoma.

05: Patient with known history of contrast media allergy and pregnant lady.

Methodology

The cross-sectional study was conducted at Department of Radiology, Liaquat National Hospital and Medical College from 1st January 2021 to 30th December 2021 with permission from Ethical Board Committee.

Patient with colorectal carcinoma diagnosed and classified according to the TNM staging system on multi-detector CT scan with IV and rectal contrast were included in this study. The data of patients were retrospectively reached through the electronic medical record of tertiary care hospital.

All patients underwent the contrast enhanced multi-detector CT scan with rectal contrast on Siemens Brilliance-128 CT scanner (S.No: YM8U022287) made in Germany with KV 120 and MA 100. Omnipaque (Iohexol) was administrated to all patients. The dose of intra-venous contrast media was calculated according to the weight of the patient. Oral and rectal contrast were also administrated to elaborate the details of large bowel pathology. Volumetric 1mm thickness images were analyzed by the experienced radiologist working independently in department of radiology for diagnosis and TNM staging of colon cancer. After CT staging patient were underwent the colonoscopy and biopsy. The specimens were reported by competent histopathologist. All patients were underwent the CT scan chest and bone scan and turn out to be negative for distant metastasis that is stage IV diseas. All information was documented on performas. After collection of data, it was analyzed by using Statistical Package of Social Science (SPSS) version 18. Descriptive statistics were used to analyze demographic data, these data included gender, location of colorectal carcinoma, tumor extension, and involvement of lymph nodes in term of percentage, while age in term of percentage, mean and standard deviation.

Results

Total number of 50 patients were included with age range from 01-85 years. Mean age of patient was 51.54 years. Majority of patients 18 (36%) were between 46-60 years of age (Tab.2).

Percentage of patient according to the age distribution.

Age (Years)	Frequency	Percentage
1 - 15	1	2
16 - 30	5	10
31 - 45	12	24
46 - 60	18	36
61 - 75	11	22
76 - 85	2	4
>85	1	2

Mean = 51.54, SD=16.65

Table 2

Out of these 50 patients, 32 (64%) were male and 18 (36%) were female (Tab.3).

Percentage of patients according to the gender (N=50)

	Frequency	Percentage
Male	32	64
Female	18	36
Total	50	100

Table 3

According to exact location of colorectal carcinoma in term of number and percentage were 15 (30%) in rectum, 13 (26%) in sigmoid colon, 10 (20%) in recto-sigmoid colon, 4 (8%) in ascending colon, 3 (6%) in cecum, 2 (4%) in hepatic flexure, 2(4%) in transverse colon, 1 (2%) in splenic flexure (Tab.4).

Percentage of patient s colorectal carcinoma according the exact anatomical location.

Location of Ca Colon	Frequency	Percentage
Cecum	3	6
Ascending colon	4	8
Hepatic flexure	2	4
Transverse Colon	2	4
Splenic Flexure	1	2
Sigmoid Colon	13	26
Recto-Sigmoid Colon	10	20
Rectum	15	30
Total Patients	50	100

Table 4

All patients were diagnosed and Classified according to the TNM staging system with multi-detector CT scan with IV and rectal contrast out of which 15

(30%) were stage II and 35 (70%) were stage III (Tab.5).

Staging By CT scan

	Frequency	Percentage
Stage II	15	30
Stage III	35	70
Total	50	100

Table 5

According to the histopathological TNM staging, the patients diagnosed as stage II 15 (30%) on CT scan, classified as in number and percentage on histopathology were 3( ) stage I, 9 (62.2%) stage II, and 3 (9.1%) stage III and patient diagnosed as stage III 35 (70%) on CT scan classified as in number and percentage on histopathology were 30 (90.09%) stage III, 4 (30.8%) stage II and 1 () stage 0 (Tab.6).

Stage by Histopathology

			Stage-0	Stage-I	Stage-II	Stage-III	Total
Stage by CT scan	Stage II	Count % within stage by histo	0	3	9	3	15
			0.0%	100.0%	69.2%	9.1%	30.0%
	Stage III	Count % within stage by histo	1	0	4	30	35
			100.0%	0.0%	30.8%	90.9%	70.0%
Total		Count % within stage by histo	1	3	13	33	50
			100.0%	100.0%	100.0%	100.0%	100.0%

Table 6

From all these patients 33 (66%) were stage III, 13 (26%) were Stage II, 3 (6%) were stage I, and 1 (2%) were stage 0 (Tab.7).

Staging by Histopathology

	Frequency	Percentage
Stage 0	1	2
Stage I	3	6
Stage II	13	26
Stage III	33	66
Total	50	100

Table 7

On conclusion 39 (78%) were diagnosed as same stage on CT scan in association with histopathology and 11 (22%) were not corresponding to the stage of colorectal carcinoma on CT scan with histopathology (Tab.8).

Accuracy of CT scan in Correlation with Histopathology

	Frequency	Percentage
Yes	39	78
No	11	22
Total	50	100

Table 8

Discussion

In patients with colorectal carcinoma, preoperative loco-regional staging is very important to establishing the optimal treatment plan and predicting the prognosis.[1,5,6,12] In few cases of loco-regional staging of colon cancer cannot change the treatment plan as resection of tumor is essential because of persistent rectal bleeding and intestinal obstruction.[3] Definitive and accurate pre-operative loco-regional is very essential to identify the various risk factor and relationship of tumor with adjacent organ for recurrence.[5] These risk factors are depth of tumor invasion through the bowel wall, regional or distant lymph nodes metastasis, and distant organ metastasis.[12] Tumor with early stage I and II treated with surgery and tumor with advanced stage III and IV involving the CRM needs chemotherapy, radiotherapy and or surgery.[5,14,15] Study 15 demonstrated that 5 years survival rate for the colorectal carcinoma for early stage is 90.3% and it drops to 70.4% when disease involved the lymph nodes and adjacent anatomical organs.

Therefore, accurate preoperative staging to distinguish early-stage CRCs from advanced-stage CRCs is essential for treatment planning strategy.[3,4]

Different imaging modalities such as trans-rectal-endoscopic ultrasonography, MRI, and contrast enhanced CT scan are used for staging of colorectal carcinoma.[5,15] PET/CT is also important for evaluation of widespread distant metastasis, however it is very expensive, time consuming and not readily available in every setup.[15] Endoscopic ultrasound is used to diagnose the depth of tumor invasion in cases of rectal carcinoma and it is more diagnostic for layered involvement of bowel wall but it is operator dependent,

require experience, and not readily available in every setup of hospital.[1] MRI is more accurate in diagnosis and detection of lesion rather than local staging of colorectal carcinoma.[1] Main challenging of MRI in diagnosis of colon cancer is motion artifacts caused by the intestinal movement and breathing.[6] Multi-detector CT scan is modality of choice for loco-regional staging of colon cancer, metastasis in pre-operative patients and valuable for surgical planning.[1,7,8] It has higher sensitivity in detection of tumor beyond the large bowel wall however diagnosis definitively made with colonoscopy with biopsy and histopathology.[11] Recommended slice thickness for abdominal CT for staging is 5mm with reformat 3mm.[3] We have done 1mm slice thickness for better evaluation of colon cancer and staging. On CT scan, Colorectal Carcinoma appears as soft tissue mass or circumferential wall thickening and luminal narrowing, extra-luminal extension considered as loco-regional infiltration can appears as soft tissue mass, peri-colonic fat infiltration or loss of fat planes between the bowel wall and adjacent organs.[11] CT scan has high accuracy to identify the locally advanced colorectal carcinoma with extra-luminal extension T3 and T4 that is Stage II and Stage III.[8,11] It cannot able to distinguish the various muscular layer of bowel wall and has low accuracy than MRI and EUS.[2,3,6] therefore it has very low sensitivity and limited value to diagnosed the T1 and T2 that is Stage I disease.[6] CT scan cannot easily recognized the depth of tumor invasion beyond the bowel wall this accuracy can be increased by using rectal contrast.[11] we have also used the rectal contrast in our study for better evaluation. There is also some limitation of CT scan in detection of metastatic lymph nodes, because some small lymph may be metastatic and some enlarged lymph nodes may tumor free therefore low accuracy for identification for metastatic lymph nodes.[1,11,14,15] The aim our study to determine the accuracy of Multi-detector CT scan for staging of colorectal carcinoma. The result showed that CT scan is more accurate when tumor extension beyond the rectal wall, with accuracy of 78% for stage II and III disease in correlation with histopathology and 22% were not corresponding to the histopathology. Multiple studies are published in literatures and attempted to elaborate the accuracy of colorectal carcinoma in preoperative patient on CT scan to predicting the tumor invasion and loco-regional lymph nodes metastasis, however conclusion of those literatures were varied.[1] Study 12 demonstrated the sensitivity of 61% and specificity of 81% for detection of loco-regional colorectal carcinoma. Study 13 demonstrated the sensitivity of 60% and specificity of 67% for detection of loco-regional colorectal carcinoma. The result of our retrospective study analysis in highly organized tertiary care organized hospital showed that, Multi-detector CT scan is more diagnostic in evaluation of T3 and T4 that is stage II and stage III disease and less diagnostic in evaluation of T1 and T2 stage that is stage I disease.

Conclusion

Multi-detector CT scan with IV and rectal contrast has good accuracy in diagnosis of colorectal carcinoma beyond the bowel wall with loco-regional extension. It has good accuracy in diagnosis of T3 and T4 that is stage II and III, however low accuracy to evaluate the T1 and T2 that is Stage I.

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