

Diagnostic accuracy of spiral CT Scan for colorectal carcinoma taking histopathology after surgery as gold standard

Kawita Satiwan, Sumera Tabassum, Shahbaz Haider, Tariq Mehmood

Abstract:

Introduction: Colorectal cancer (CRC) is cancer that takes its origin in the large intestine (colon) or the rectum (end of the colon). CT, MRI and transrectal ultrasound are relatively new modalities for evaluation of CRC.

Objective: To determine the diagnostic accuracy of spiral CT scan for colorectal carcinoma taking histopathology as gold standard.

Material and Methods: Cross sectional study was carried out in Department of Radiology, Jinnah Post graduate Medical Centre, Karachi from May 03, 2017 to December, 02 2017. A total of 66 patients of CRC meeting the inclusion criteria as defined in operational definition were enrolled in the study. Spiral CT was performed using Toshiba spiral CT scanner machine, having 16 slice capabilities. Images were reviewed by consultant having more than 5 years of experience. Patients histopathological report was taken from the laboratory.

Results: Mean (\pm SD) age was 58.4 \pm 9.1 years with Male: Female = 1.6: 1. Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography for colorectal carcinoma were 96.7%, 80%, 98.3% and 66.7% respectively. Diagnostic accuracy of spiral computed tomography came out to be 95.5%.

Conclusion: The results of study suggested that spiral computed tomography can be used as first choice diagnostic test and has potential to replace the lengthy tiresome colonoscopic procedure in the investigation of colorectal carcinoma.

Keywords: Colorectal carcinoma, spiral CT, bleeding per rectum, diagnostic accuracy, colonoscopy

Introduction:

Carcinoma of rectum and colon is one of the most prevalent malignancies worldwide. In Pakistan it was found 25.4% and 20.1% of gastrointestinal carcinomas in males and females respectively. In the United States, it ranks second to lung cancer as a cause of cancer death.¹

In recent years it has been noted that colorectal cancer is no longer a disease of only developed countries, as approximately 36% of new cases of colorectal cancer in the year 2000 were reported outside industrialized countries.²

Colorectal cancer is usually diagnosed with colonoscopy and biopsy or after barium enema and colonoscopy. CT, MRI and transrectal ultra-

sound (TRUS) have been making its place in diagnosis of many diseases. CT particularly Spiral CT, has several advantages: it can be performed rapidly and relatively easily.³ Its availability is increasing gradually. Sensitivity and the specificity of CT in the diagnosis of colorectal cancer has been found to be high.⁴

The rationale of the study is to “assess Sensitivity and the specificity of spiral CT in the diagnosis of colorectal cancer, as it is a non-invasive, less time consuming and relatively easy modality for the diagnosis of colorectal carcinoma in our Pakistani setup and its prospectus to replace the lengthy tiresome colonoscopic procedure. CT modality has the additional advantage of

Received

Date: 7th February, 2020

Accepted

Date: 23rd January, 2021

JPMC, Karachi

K Satiwan,
S Tabassum
S Haider
T Mehmood

Correspondence:

Dr. Sumera Tabassum,
Assistnat Professor,
Department of Radiology,
JPMC, Karachi
Address: Bungalow A3 \ C3
Doctors Colony: JPMC
Karachi Cantt
Cell No: +92 300-2270978
Cell No: +92 334-3445303
email: Sumert57f@yahoo.
com

diagnosing invasion into adjacent organs or abscess formation and metastasis. Simultaneous information of these complications will lead to instant decision making for management/surgery of this debilitating disease that may favor better prognosis.

Objective of this study was “to determine the diagnostic accuracy of spiral CT scan for colorectal carcinoma taking histopathology after surgery as gold standard”.

Colorectal carcinoma will be most likely if we have any one of the following findings on Spiral CT scan.

- An eccentric focal mass with irregular segmental or circumferential wall
- Wall thickness ranges 0.7-4.5 cm
- Extension of wall ranges 1.0-10.0 cm

Histological appearance of colorectal carcinoma: Presence of any of the following findings

- Transitional cell tumor
- Squamous cell tumors
- Tumors that secrete mucin or hormone

Material and Methods:

This Cross sectional Study was conducted in Department of Radiology, Jinnah Post graduate Medical Centre, Karachi from May 03, 2017 to December, 02 2017. Ethical approval was obtained from Ethical Review Board (ERB) of institution. Non Probability Consecutive sampling technique was used for sampling.

Patients of age 40-70 years of either gender with complaints suggestive of CRC i.e. having two or more of the signs and symptoms among abdominal pain, altered bowel habits (constipation, diarrhea, bloating), weight loss (reduction of $\geq 20\%$ from base line), history of bleeding per rectum, decreased appetite, palpable abdominal mass on examination or Iron deficiency anemia of unknown origin with duration of symptoms ≥ 6 months.

Patients already diagnosed and on radiotherapy or chemotherapy, or patients already operated for colorectal carcinoma and patients contrain-

dicated for CT radiation were excluded from the study.

Patients so selected were enrolled in the study by the principle investigator (PI). Informed consent was taken from patient or next of kin for inclusion in the study after explaining the pros and cons. Spiral CT was performed using Toshiba spiral CT scanner machine, having 16 slice capabilities. Images were taken from dome of diaphragm to pubic symphysis in craniocaudal direction. Images were reviewed by consultant having more than 5 years of experience. Patient's histopathological report was collected from the laboratory with the patient's permission. This information as well as data regarding age, gender was entered in purpose built proforma.

Data was entered and analyzed on SPSS version 15. Mean \pm SD was calculated for age of the patients and duration of symptoms. Frequency and percentages were calculated for gender, abdominal pain, altered bowel habits, weight loss, bleeding per rectum and palpable mass. Sensitivity, specificity, PPV and NPV were calculated for spiral CT scan taking histopathology as gold standard. Stratification of age, gender, duration of signs and symptoms was done to control effect modifiers.

Results:

During the study period 66 clinically suspected cases for colorectal carcinoma were included in this study. Out of 66 cases, 41 (62.1%) were male and 25 (37.9%) were female (Male: Female = 1.6: 1)

Mean \pm SD age of patients was 58.4 \pm 9.1 years (Min – Max = 41 – 70), majority of patients had age between 56 – 70 years, 41 (62.1%).

Bleeding per rectum was the most common symptom of colorectal carcinoma found in 60 (90.1%) with mean duration 6.9 \pm 1.6 months followed by complaints of abdominal pain in 56 (84.8%) with mean duration 8.8 \pm 2.6 months, alteration in bowel habits is 33 (50%) with mean duration 0.9 \pm 0.3 months and Weight loss in 33 (50%) with mean duration 4.6 \pm 1.4 months.

Table 1: Diagnostic accuracy of spiral computed tomography for colorectal carcinoma by taking histopathology as gold standard (n = 66)

Spiral CT	Histopathology		Results
	Positive	Negative	
Positive	59 (TP)	1 (FP)	PPV = 98.3%
Negative	2 (FN)	4 (TN)	NPV = 66.7%
Results	Sensitivity 96.7%	Specificity 80.0%	Diagnostic accuracy 95.5%

CT = Computed Tomography, TP = True Positive, FP = False Positive, FN = False Negative, TN = True negative, NPV = Negative Predictive Value, PPV = Positive Predictive Value

Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were calculated by taking histopathology as gold standard. Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were 96.7%, 80%, 98.3% and 66.7% respectively. Diagnostic accuracy of spiral computed tomography was found to be 95.5% as shown in table-1

In male sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were 100%, 75%, 97.4% and 100% respectively while in female Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were 91.7%, 100%, 100% and 33.3% respectively.

In age between 41 – 55 years sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were 100%, 66.7%, 95.7% and 100% respectively while in age group of 56 – 70 years Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were 94.9%, 100%, 100% and 50% respectively.

Discussion:

Colorectal cancer (CRC) is a fatal disease; pre-malignant adenomas if detected and removed may prevent the cancer. Similarly early detection of localized cancer and resection may prevent CRC-related morbidity. CRC is uncommon before age 40; above this age the incidence rises at the rate of 3.7/1,000 per year till the age of 80. "Average risk for the lifetime incidence for adults is 5 percent".⁵ 90 percent of cases occur after the age of 50. Worldwide, CRC is the sec-

ond most commonly diagnosed cancer in women and third most common in men, accounting for over 600,000 deaths in 2008.⁶ In the United States (US), CRC is the second leading cause of cancer death and accounts for approximately 9 percent of cancer deaths overall.⁷ Approximately one in three people who develop CRC die of this disease. In Pakistan it constitutes 25.4% and 20.1% of gastrointestinal malignancies in males and females respectively.¹ Medical literature abounds with evidence that early detection and aggressive management of these lesions can significantly improve patient survival.

Colorectal cancer have been usually diagnosed by barium studies and colonoscopy followed by biopsy. Although these techniques provide superb visualization of the mucosa, they cannot determine the depth of mural invasion by the tumor or the extent of metastatic disease. In patients with colorectal cancer, accurate assessment of tumour extent within and beyond the bowel wall, the presence or absence of lymphadenopathy and distant metastases is significantly important.⁸

Pre-operative imaging aims to accurately assess tumour extent to individualize patient therapy, facilitate evaluation of treatment results, assess risk of disease recurrence and determine prognosis.⁸ With the development of high-resolution scanners, technical refinements in obtaining better quality studies, and the accumulated clinical experience leading to better interpretation, the role, indications, and accuracy of CT of the colon have dramatically enlarged and improved.^{9,10}

In this study 66 clinically suspected patients of colorectal carcinoma were included with Male: Female was 1.6: 1 and Mean \pm SD age of patients was 58.4 \pm 9.1 years (Min – Max = 41 – 70). Similar mean age was reported by Ashraf K et al.⁸ Bleeding per rectum was the most common presenting symptom of colorectal carcinoma found in 90.1% followed by complains of abdominal pain in 84.8%, Altered bowel habits in 50% and weight loss in 50%. In a local study "53% presented with rectal bleeding either alone or in combination with other symptoms, 41%

presented with altered bowel habits".¹¹ Another study reported the clinical presentation "in majority of cases was of abdominal pain (32%) and altered bowel habits (30%)". The other symptoms include weight loss and bleeding per rectum in 22% patients each.⁸

Sensitivity, specificity, positive predictive value and negative predictive value of spiral computed tomography were calculated by taking histopathology as gold standard. Sensitivity, specificity, positive predictive value and negative predictive value of trans-vaginal ultrasound were 96.7%, 80%, 98.3% and 66.7% respectively. Diagnostic accuracy of spiral computed tomography was 95.5%. A study from UK "reported the sensitivity of CT in the diagnosis of colorectal cancer was found to be 100% and the specificity was 84%".⁴ Ashraf K et al.⁸ reported "48 out of the 52 primary malignant lesions were detected on the spiral CT yielding a sensitivity of 92%". Balthazar et al.¹² found "an accuracy of 58% in 90 patients". Freeny et al.¹³ examined 103 patients and reported "sensitivity of 61% and a specificity of 81% for local tumor extension". Gazelle et al.¹⁴ correctly "assessed 23 of 30 tumors using water as intraluminal contrast". The best-published results however, are for Hundt et al.¹⁵ "with an accuracy of 81%". A retrospective review "of pre-operative CT using an early generation scanner showed a sensitivity of 84% in detecting histologically proven cancers".¹² Two studies from one centre specifically applied the use of CT to the elderly. Barium Enema was used as the gold standard in one study,¹⁶ which found that "CT had a sensitivity of 100% and specificity of 86% in detecting cancer", very similar to this study. CT alone was performed in a second study from the same centre, in that study 3 of 8 patients having abnormal colon findings on CT were confidently diagnosed as having carcinoma which was later confirmed on other investigations.¹⁷ Another study, using ultrafast CT with IV contrast medium, demonstrated cancer in 89% of cases.¹⁸ In another study, CT has a sensitivity of 95.2% and an accuracy of 76.6% in evaluating the local invasion. However, the specificity is only 40.9%.¹⁹ Harvey et al.²⁰ reported that its sensitivity is 100% and specificity is 33%. Zhou

et al.¹⁰ reported that its sensitivity is 92.9% and specificity is 50.0%.

Conclusion:

Spiral CT pneumocolon is a quick and non-invasive method for detecting colorectal carcinoma. In addition reliable pre-operative determination of the extent of spread of a colorectal carcinoma not only indicates the expected prognosis but also assists management. For obtaining reliable results from CT scan, preparation of the patients, especially complete distention of the colon using water or air as contrast agent, is the most important step. Otherwise, collapse of the colon and feces can easily be misinterpreted as tumor. Many studies have shown that water enema spiral CT is a useful modality for pre-operative staging of patients with colorectal carcinoma.^{14,15,21}

The results of study suggested that spiral computed tomography can be used as first choice diagnostic test and has potential to replace the lengthy tiresome colonoscopic procedure in the investigation of colo-rectal carcinoma

Conflict of interest: none

Funding source: none

Role and contribution of authors:

Dr Kawita Satiwan, Conceived and designed the study, included the patients. Contributed to drafting and revising of article, contributed to final approval.

Dr Sumera Tabassum, included the patients, evaluated the Spiral CT scan findings, contributed to drafting and revising of article, contributed to critical appraisal of findings with literature, contributed to final approval.

Prof. Shahbaz Haider, Contributed to study design, analysis and interpretation of the data statistically, critical appraisal of findings and statistical conclusions, manuscript writing and critical revising the article and final approval of manuscript.

Prof. Tariq Mehmood, contributed to study design, critical appraisal of findings, final approval of manuscript.

References:

- Mehdi I. Frequency of Gastrointestinal Tumors at a Teaching Hospital in Karachi. *J Pak Med Assoc.* 1998;48:14-17.
- Boyle P, Leon ME. Epidemiology of colorectal cancer. *Br Med Bull.* 2002;64:1-25.
- Zeman RK, Brink JA. Technical Principles. In: *Helical/Spiral CT, A practice approach.* New York:McGraw Hill;1995. p. 1-26.
- Loftus WK, Metreweli C, Sung JJ, Yang WT, Leung VK, Set PA. Ultrasound, CT and colonoscopy of colonic cancer. *Br J Radiol.* 1999;72:144-8
- SEER Stat Fact Sheet; colon and rectum. National Cancer Institute. Available at:<http://seer.cancer.gov/statfacts/html/colorect.html> (Accessed on October 10, 2011).
- Jemal A, Bray F, Center MM. Global cancer statistics. *CA Cancer J Clin* 2011;61:69
- Siegel R, Ward E, Brawley O, Jemal A. Cancer statistics, 2011: the impact of eliminating socioeconomic and racial disparities on premature cancer deaths. *CA Cancer J Clin* 2011;61:212.
- Ashraf K, Ashraf O, Haider Z, Rafique Z. Colorectal carcinoma, preoperative evaluation by spiral computed tomography. *J Pak Med Assoc.* 2006;56:149-53.
- Dobos N, Rubesin SE. Radiologic imaging modalities in the diagnosis and management of colorectal cancer. *Hematol Oncol Clin North Am* 2002;16:875-95
- Zhou C, Li J, Zhao X. Spiral CT in the preoperative staging of colorectal carcinoma-radiologic-pathologic correlation. *Zhonghua Zhongliu Zazhi* 2002;24:274-7
- Anwar N, Badar F, Yusuf MA. Profile of Patients with Colorectal Cancer at a Tertiary Care Cancer Hospital in Pakistan. *Ann NY Acad Sci.*2008;1138:199-203.
- Balthazar EJ, Megibow AJ, Hulnick D, Naidich DP. Carcinoma of the colon: detection and preoperative staging by CT. *AJR Am J Roentgenol* 1988; 150:301-6.
- Freeny PC, Marks WM, Ryan JA, Bolen JW. Colorectal carcinoma evaluation with CT: preoperative staging and detection of postoperative recurrence. *Radiology* 1986;158:347-53
- Gazelle GS, Gaa J, Saini S, Shellito P. Staging of colon carcinoma using water enema CT. *J Comput Assist Tomogr* 1995;19:87-91
- Hundt W, Braunschweig R, Reiser M. Evaluation of spiral CT in staging of colon and rectum carcinoma. *Eur Radiol* 1999;9:78-84
- Day JJ, Freeman AH, Coni NK, Dixon AK. Barium enema or computed tomography for the frail elderly patient? *Clin Radiol* 1993;48:48-51.
- Fink M, Freeman AH, Dixon AK, Coni NK. Computed tomography of the colon in elderly people. *Br Med J* 1994;308:1018.
- Okizuka H, Sugimura K, Shinozaki N, Watanabe K. Colorectal carcinoma: evaluation with ultrafast CT. *Clin Imaging* 1995;19:247-51.
- Sun CH, Li ZP, Meng QF, Yu SP, Xu DS. Assessment of spiral CT pneumocolon in preoperative colorectal carcinoma. *World J Gastroenterol* 2005;11:3866-70
- Harvey CJ, Amin Z, Hare CM, Gillams AR, Novelli MR, Boulos PB et al. Helical CT pneumocolon to assess colonic tumors: radiologic-pathologic correlation. *Am J Roentgenol* 1998;170:1439-43
- Gossios KJ, Tsianos EV, Kontogiannis DS. Water as contrast medium for computed tomography study of colonic wall lesions. *Gastrointest Radiol* 1992;17:125-8