Indian Journal of Pathology and Oncology 2024;11(4):352–356

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Indian Journal of Pathology and Oncology

Journal homepage: www.ijpo.co.in

Original Research Article

Analysis of clinical and histopathological differences between right and left sided colon cancers

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ARTICLE INFO

Article history:
Received 08-08-2024
Accepted 23-08-2024
Available online 12-12-2024

Keywords:
Right sided colon cancer (RCC)
Left sided colon cancer (LCC)
Histopathological characteristics
Adenocarcinoma
Lymphovascular invasion
Perineural invasion

ABSTRACT

Background: Right-sided colon cancer (RCC) and left-sided colon cancer (LCC) exhibit distinct clinicopathological characteristics, which may influence their diagnosis, treatment, and prognosis. Understanding these differences is crucial for optimizing patient care and outcomes.

Aim and Objective: This study aimed to analyse and compare the clinical and histopathological features of RCC and LCC in a cohort of 80 patients, focusing on demographic characteristics, clinical presentation and tumor pathology.

Materials and Methods: A retrospective analysis was conducted on 80 patients diagnosed with colon cancer, divided equally between RCC (n=40) and LCC (n=40). Data on demographic characteristics, clinical presentation, histologic type, tumor size, histologic grade, tumor stage, lymphovascular invasion, and perineural invasion were collected. Statistical analysis was performed using appropriate tests, with a significance level set at $p < 0.05$.

Results: The mean age of RCC patients was significantly higher than that of LCC patients (68 ± 8 years vs. 64 ± 7 years, p = 0.02). RCC patients more commonly presented with anemia (50% vs. 20%, p = 0.006) and weight loss (40% vs. 15%, p = 0.01), while LCC patients were more likely to report changes in bowel habits (50% vs. 15%, p = 0.001) and rectal bleeding (40% vs. 10%, p = 0.002). Histologic type distribution was similar between RCC and LCC, with adenocarcinoma being the most common subtype in both groups.RCC tumors were larger on average (6.2 ± 1.4 cm vs. 4.5 ± 1.1 cm, p = 0.001) and more likely to be high-grade (40% vs. 20%, p = 0.04).

Conclusion: This study highlights significant differences between RCC and LCC in terms of age, clinical presentation, tumor size, and histologic grade. RCC is associated with older age, larger and higher-grade tumors, and a higher incidence of anemia and weight loss, while LCC more frequently presents with changes in bowel habits and rectal bleeding.

1. Introduction

Colorectal cancer (CRC) is the third most common cancer worldwide.[1] Most colon cancers are sporadic, and approximately 5 percent are due to an inherited genetic mutation which includes Lynch syndrome (Hereditary nonpolyposis colon cancer or HNPCC) and familial adenomatous polyposis (FAP). It takes several years for the transition of normal colonic epithelium into an invasive cancer which requires accumulation of genetic mutations, adenoma formation and subsequent carcinogenesis.[2] The other risk factors include increasing age, family history, inflammatory bowel disease (IBD) and various environmental and lifestyle factors. Following the diagnosis of ulcerative colitis in a patient, the annual incidence of colon cancer is 0.5% in the first 10 to 20 years which increases to 1% per year after that. Crohn disease

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https://doi.org/10.18231/j.ijpo.2024.077

increases the cancer risk if present in the ileocolic region.[3] The various lifestyle factors which increase the risk of colon cancer are alcohol consumption, cigarette smoking, obesity, diets rich in processed red meat, insulin resistance, history of prior radiation and immunosuppression.[4] Colon cancers are divided into two groups based on the location of the primary tumor. It is a heterogenous disease, with notable differences between right sided colon cancer (RCC) and left sided colon cancer (LCC). Anatomical and developmental origins, unique carcinogenic causes or a mix of both may account for the differences between these tumor.[5] These variations impact prognosis and treatment strategies and thus, the present study was undertaken to determine the various clinicopathological differences between RCC and LCC.

2. Aim and Objective

This study aimed to analyse and compare the clinical and histopathological features of RCC and LCC in a cohort of 80 patients, focusing on demographic characteristics, clinical presentation and tumor pathology.

3. Materials and Methods

This study was designed as a retrospective cohort analysis to investigate the clinical and histopathological differences between right -sided colon cancers (RCC) and left sided colon cancers (LCC) in 80 cases. The study included 80 patients diagnosed with colon cancer, with 40 RCC and 40 LCC cases. The clinical histories were obtained from the medical records of the patients at American Oncology Institute, Jammu and their respective histopathologic specimens were received in our department of pathology. Various parameters were compared which included demographic information like age at diagnosis and gender, clinical symptoms like anemia, weight loss, changes in bowel habits and rectal bleeding. Various histopathologic features were evaluated like tumor size, histologic type, grade, stage, lymphovascular invasion and perineural invasion.

3.1. Statistical analysis

Data analysis was conducted using SPSS software version 19.0. Descriptive statistics were used to summarize demographic and clinical characteristics. Independent t-tests were used to compare continuous variables (age, tumor size) between RCC and LCC groups. Chi square tests were employed to compare categorical variables (gender, clinical presentation, histologic grade, tumor stage, lymphovascular invasion and perineural invasion). A p- value of less than 0.05 was considered statistically significant.

3.2. Inclusion criteria

Patients aged 18 years or older at the time of diagnosis.

Tumors located in the right colon (caecum, ascending colon, hepatic flexure) or left colon (splenic flexure, descending colon, sigmoid colon).

Patients who have undergone surgical resection for the colon cancer.

3.3. Exclusion criteria

1. History of other malignancies.
2. Incomplete medical records
3. Neoadjuvant chemotherapy

4. Results

This study compares the clinicopathological characteristics of right-sided colon cancer (RCC) and left-sided colon cancer (LCC) in 80 cases. The data was analysed to identify significant differences between the two groups.

Table 1: Demographic characteristics

Characteristic	RCC (n = 40)	LCC (n = 40)	p-value
Age (Mean ± SD)	68 ± 8 years	64 ± 7 years	0.02*
Gender			
Female	24 (60%)	18 (45%)	0.18
Male	16 (40%)	22 (55%)	

*Significant at $p < 0.05$

Age: RCC patients were significantly older than LCC patients ($p = 0.02$).

Gender distribution: No significant difference in gender distribution between RCC and LCC ($p = 0.18$).

Table 2: Clinical presentation

Clinical Feature	RCC (n = 40)	LCC (n = 40)	p-value
Anemia	20 (50%)	8 (20%)	0.006*
Weight Loss	16 (40%)	6 (15%)	0.01*
Changes in Bowel Habits	6 (15%)	20 (50%)	0.001*
Rectal Bleeding	4 (10%)	16 (40%)	0.002*

*Significant at $p < 0.05$

Anemia: More common in RCC (50%) than LCC (20%) ($p = 0.006$).

Weight Loss: More prevalent in RCC (40%) than LCC (15%) ($p = 0.01$).

Changes in Bowel Habits: More common in LCC (50%) than RCC (15%) ($p = 0.001$).

Rectal Bleeding: More frequent in LCC (40%) than RCC (10%) ($p = 0.002$).

4.1. Gross features

4.1.1. Tumor appearance

1. **RCC**: Tumors in RCC often appeared as larger, exophytic masses that can grow into the lumen of the colon, sometimes with ulceration.

2. **LCC**: LCC tumors were more commonly circumferential, leading to a "napkin-ring" or constrictive appearance, which can cause obstruction.

Although the study did not quantify the exact percentage of exophytic versus circumferential appearances, these descriptions are consistent with general findings in colon cancer literature.

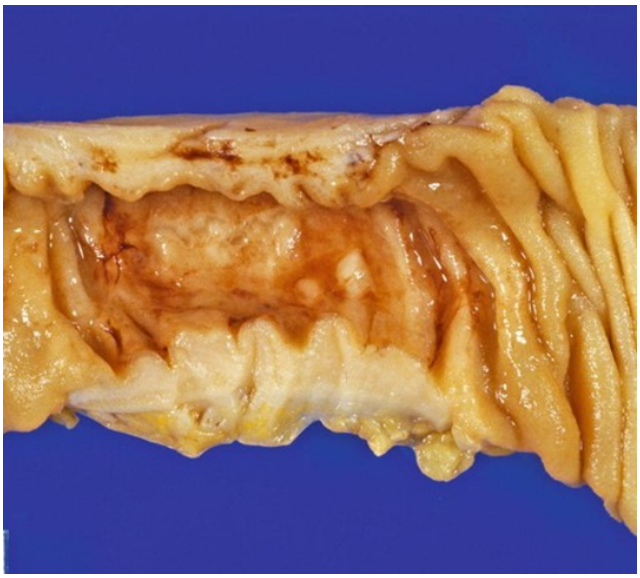

Figure 1: Ulcerated exophytic growth in the ascending colon

Figure 2: Napkin ring constriction due to growth in the descending colon

4.2. Interpretation of histologic type

Adenocarcinoma: This is the most common histologic type in both RCC and LCC. In this study, 75% of RCC cases and 80% of LCC cases were classified as adenocarcinoma, with no significant difference between the two groups (p = 0.78).

Table 3: Distribution of histologic types in RCC and LCC

Histologic Type	RCC (n = 40)	LCC (n = 40)	p-value
Adenocarcinoma	30 (75%)	32 (80%)	0.78
Mucinous Adenocarcinoma	6 (15%)	4 (10%)	0.73
Signet Ring Cell Carcinoma	3 (7.5%)	2 (5%)	0.64
Others	1 (2.5%)	2 (5%)	0.55

Mucinous adenocarcinoma: The incidence of mucinous adenocarcinoma was slightly higher in RCC (15%) compared to LCC (10%), though the difference was not statistically significant (p = 0.73). Mucinous adenocarcinoma is known to be more commonly associated with RCC, and while our study reflects this trend, the sample size may not be sufficient to demonstrate a significant difference.

Signet ring cell carcinoma: This rare and aggressive subtype was observed in 7.5% of RCC cases and 5% of LCC cases, with no significant difference between the groups (p = 0.64). Signet ring cell carcinoma is typically associated with poor prognosis and often presents at a more advanced stage.

Other histologic types: Rare histologic types such as medullary and squamous cell carcinoma were observed in a small number of cases (2.5% in RCC and 5% in LCC). These types are uncommon in colorectal cancer, and the distribution in our study did not show a significant difference (p = 0.55).

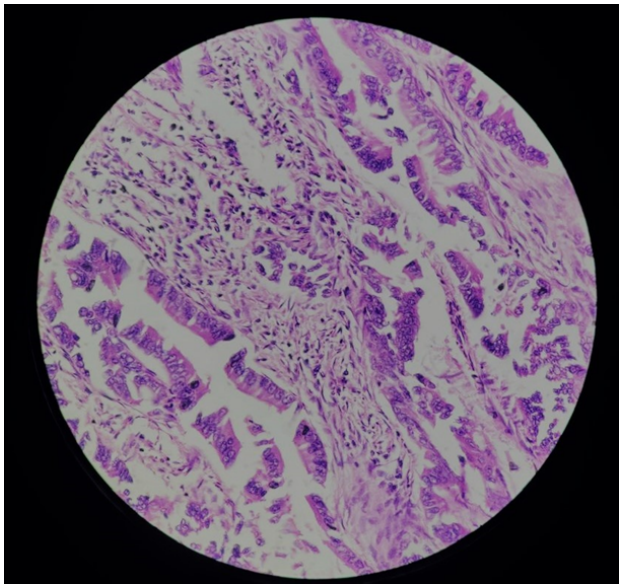

Figure 3: Microphotograph showing low grade adenocarcinoma (H&E X400)

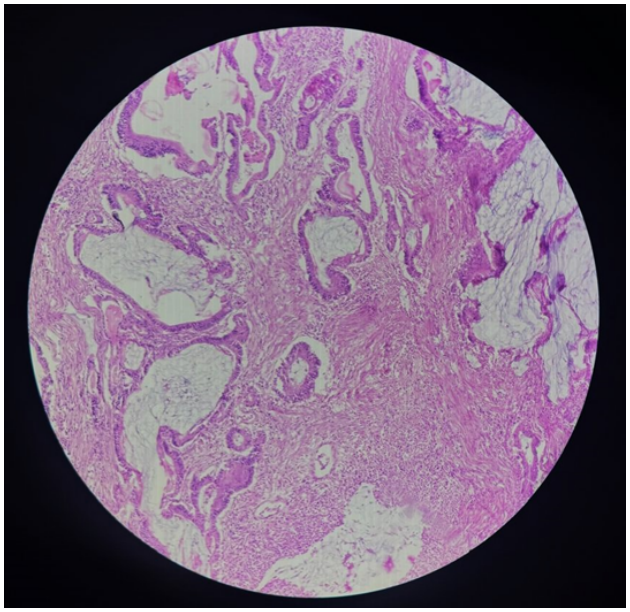

Figure 4: Microphotograph showing mucinous adenocarcinoma (H&E X100)

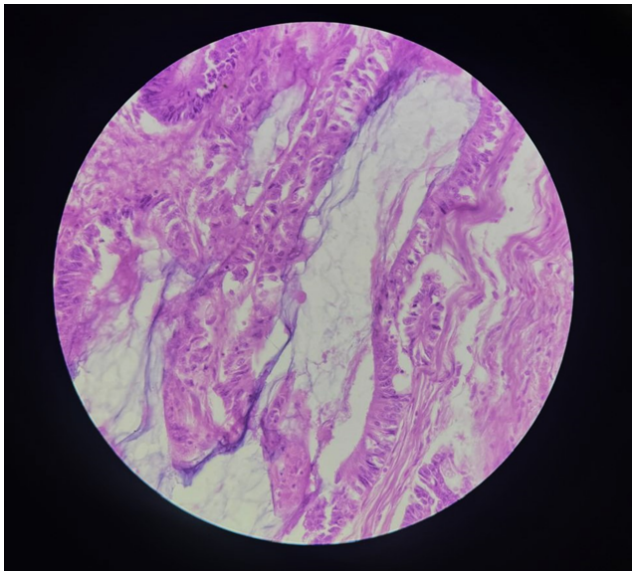

Figure 5: Adenocarcinoma with mucin pools (H&E X400)

These results underscore the importance of recognizing the distinct clinicopathological features of RCC and LCC, which can aid in tailored approaches to screening, diagnosis, and treatment.

5. Discussion

According to Saltzstein et al.,[6] aging was linked to a shift in the anatomic site of colon cancer from the left to the right side. This aligns with present study that has reported older age at diagnosis for RCC (68±8 years) compared to LCC (64±7 years). The youngest patients had tumors in their sigmoid colons, while the oldest patients had tumors in their caecums.[7] This finding is most likely explainable by a delay in the right side of the colon's cancer diagnosis.

Table 4: Other pathological features

Pathological Feature	RCC (n = 40)	LCC (n = 40)	p-value
Tumor Size (Mean ± SD)	6.2 ± 1.4 cm	4.5 ± 1.1 cm	0.001*
High-grade Tumors	16 (40%)	8 (20%)	0.04*
Low-grade Tumors	24 (60%)	32 (80%)	0.04*
Tumor (Stage pT)			
- Stage T1/T2	14 (35%)	22 (55%)	0.08
- Stage T3/T4	26 (65%)	18 (45%)	
Lymphovascular Invasion	8 (20%)	14 (35%)	0.15
Perineural Invasion	6 (15%)	6 (15%)	1.00

*Significant at $p < 0.05$

Tumor size: RCC tumors were significantly larger than LCC tumors (p = 0.001).

Histological grade: Higher percentage of high-grade tumors in RCC (40%) compared to LCC (20%) (p = 0.04). Conversely, more low-grade tumors were found in LCC (80%) compared to RCC (60%) (p = 0.04).

Tumor stage: No significant difference in tumor stage distribution between RCC and LCC (p = 0.08).

Lymphovascular invasion: No significant difference in lymphovascular invasion between RCC and LCC (p = 0.15).

Perineural invasion: No difference in perineural invasion between RCC and LCC (p = 1.00).

In a study by Gonzalez EC et al.,[8] there was more female preponderance than males. Gender distribution did not differ significantly between RCC and LCC in our study, with a slight predominance of females in the RCC group and males in the LCC group. According to Vayrynen J.P. et al.,[9] anemia is commonly seen in RCC patients than in LCC patients, regardless of sex, which may be related to variations in genetic instability. Anemia in CRC is mostly caused by chronic blood loss. RCC patients were more likely to present with anemia (50% vs. 20%, p = 0.006) and weight loss (40% vs. 15%, p = 0.01) in our study as well. LCC patients reported changes in bowel habits (50% vs. 15%, p = 0.001) and rectal bleeding (40% vs. 10%, p = 0.002) in the present study. In a study by Bourakkadi Idrissi M,[10] left-sided colon cancers presented with rectal bleeding more often which was in accordance to our study. However, the changes in bowel habits were mostly observed in patients with RCC.

RCC tumors were significantly larger than LCC tumors (6.2 ± 1.4 cm vs. 4.5 ± 1.1 cm, p = 0.001). The histologic type distribution between RCC and LCC in this study did not show statistically significant differences, though there was a trend toward a higher incidence of mucinous adenocarcinoma in RCC. In a study by Zenger S et al.,[11] right sided colon cancers were diagnosed mostly with mucinous type of cancer while left sided colon cancer was diagnosed as adenocarcinoma. It is more common for the histological patterns (mucinous adenocarcinoma)

seen in right colon cancers to be linked to faults in the mismatch DNA repair pathway.[12] Larger tumor size in RCC has been reported in other studies and may be related to delayed symptom onset and diagnosis in the right colon. Additionally, RCC had a higher proportion of high-grade tumors (40% vs. 20%, p = 0.04) and a lower proportion of low-grade tumors (60% vs. 80%, p = 0.04) compared to LCC. This suggests that RCC may exhibit more aggressive behaviour, which is supported by molecular studies indicating differences in genetic and epigenetic alterations between RCC and LCC. In a study by Hsu Y-L et al.,[13] Patients with right-sided colon cancers had a more advanced Tumor stage and were poorly differentiated tumors. The presence of lymphovascular and perineural invasion was similar in both groups, indicating that these features may not be specific to tumor location but rather to tumor biology

The tumor's anatomical location has a significant impact on its behavior, which in turn influences its molecular and immunological features. It is crucial to comprehend the attributes of these two distinct entities in order to create medicines that work.[14,15]

6. Conclusion

This study underscores the significant clinicopathological differences between RCC and LCC. Recognizing these differences is vital for improving diagnostic accuracy, optimizing treatment strategies, and ultimately enhancing patient outcomes. Future research should focus on elucidating the underlying molecular mechanisms driving these differences and exploring targeted therapeutic approaches.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Kailu A, Raina B, Mahajan C. Analysis of clinical and histopathological differences between right and left sided colon cancers. *Indian J Pathol Oncol* 2024;11(4):352-356.