Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/2qfxpj44

EPIDEMIOLOGICAL AND CLINICOPATHOLOGICAL PROFILE AND TREATMENT OUTCOME OF COLON CANCER IN A TERTIARY CARE CENTRE A RETROSPECTIVE ANALYSIS

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ABSTRACT

Background: Colon cancer is an emerging health concern in India, with limited data on its epidemiological and clinicopathological characteristics. This study aimed to analyze the demographic profile, clinical features, pathological findings, and treatment outcomes of colon cancer patients managed at a tertiary care center.

Methods: A retrospective observational study was conducted on 43 patients diagnosed with colon cancer. Demographic, clinical, histopathological, and treatment-related data were collected from hospital records. Statistical analysis was performed using SPSS version 26.0, and variables were compared using appropriate tests, with $p < 0.05$ considered significant.

Results: The mean age of patients was 51.5 years, with most cases occurring in the 41–60 year age group. Males constituted 55.8% of the cohort. Family history of malignancy was rare (2.3%). The ascending colon/hepatic flexure and sigmoid colon were the most frequent sites of involvement. Abdominal pain was the predominant symptom (95.3%), followed by altered bowel habits (53.5%), weight loss (48.8%), and anemia (30.2%). Adenocarcinoma was the most common histological subtype (93%). More than half of the patients (51.2%) presented with stage IV disease, with frequent metastases to the peritoneum (59.1%), lymph nodes (54.5%), and liver (22.7%). Mean baseline CEA was 130.7 ng/mL, with extreme elevations in a subset of patients. Treatment intent was nearly equally divided between curative (48.8%) and palliative (51.2%).

Conclusion: Colon cancer in this cohort primarily affected middle-aged adults, was mostly sporadic, and commonly presented at advanced stages with a high metastatic burden. These findings highlight the urgent need for early detection, routine screening, and integration of molecular profiling to improve outcomes in Indian patients.

Keywords: Colon cancer, epidemiology, clinicopathology, carcinoembryonic antigen.

INTRODUCTION

Colorectal cancer (CRC) is an emerging public health concern in India, with hospital- and population-based registries indicating a steady rise in incidence over the past few decades. Traditionally considered a disease of the elderly, recent trends show an alarming increase in CRC among younger populations, including adolescents and young adults (AYAs) [1,2]. According to projections from Indian cancer registries, nearly 178,617 new AYA cancer cases are expected by 2025, with colorectal and pancreatic cancers being among the most concerning malignancies in this group [3]. The presence of modifiable behavioral risk factors such as dietary changes, physical inactivity, obesity, and substance use further increases the likelihood of future disease burden in the Indian context.

The challenges faced by AYAs with CRC in India are multifaceted. Beyond the biological aggressiveness of tumors, this age group often experiences delays in diagnosis due to lack of awareness, under-recognition of symptoms, and limited accessibility to specialized oncology services. As a result, CRC in Indian AYAs is frequently diagnosed at advanced stages, compromising treatment outcomes [4,5]. This underscores the need to break the prevailing assumption that colorectal cancer is predominantly a disease of older adults.

Evidence from international studies highlights that the incidence of CRC is rising most rapidly in the 20–29 year age group, with a reported annual percentage change (APC) of 2.4% since the 1980s [6]. In India, similar trends are becoming evident, with a shift toward distal colon and rectal involvement, suggesting distinct biological and clinical behavior in younger patients [7]. However, despite the growing burden, survival outcomes for AYA CRC patients remain unsatisfactory. This is particularly true in low- and middle-income settings like India, where healthcare systems are stratified into pediatric and adult oncology services, often leaving AYAs underserved [8].

A comprehensive review has further pointed out the lack of detailed clinicopathological data from low- and middle-income countries, including India, which limits the development of effective region-specific guidelines for early detection, treatment, and long-term follow-up [8]. In this context, tertiary care centers in India play a critical role, as they act as referral hubs catering to diverse patient populations and provide valuable opportunities to study disease characteristics and outcomes.

Against this backdrop, the present retrospective study aims to evaluate the epidemiological and clinicopathological profile of colon cancer and its treatment outcomes in a tertiary care centre in India, thereby bridging existing knowledge gaps and contributing evidence to guide early detection strategies and improve therapeutic outcomes for Indian patients.

MATERIAL AND METHOD

This retrospective observational study was conducted at Sri Aurobindo Institute of Medical Sciences, Indore in India . A total of 43 patients diagnosed with colon cancer between January 2023 and December 2024 were included, identified through the hospital-based cancer registry, pathology archives, and clinical records.

Patients of all ages and both sexes with histologically confirmed primary colon cancer and complete demographic, clinical, pathological, and treatment details were included. Exclusion criteria were rectal cancers, recurrent disease, and incomplete medical records.

Data collection was performed using case sheets, histopathology reports, and oncology department records. Demographic details included age, gender, and family history of malignancy. Clinical presentation was recorded in terms of abdominal pain, altered bowel habits, weight loss, anemia, obstruction, vomiting, and bleeding per rectum. Tumor characteristics were documented with respect

to anatomical subsite, including cecum, ascending colon, hepatic flexure, transverse colon, splenic flexure, descending colon, and sigmoid colon. Laboratory investigations focused on carcinoembryonic antigen (CEA) levels, classified into normal, mild, moderate, high, and very high categories. Histopathological evaluation categorized tumors as adenocarcinoma, signet ring carcinoma, or other types. Staging was performed using the TNM classification and grouped into stage II, III, or IV. Microsatellite instability (MSI) testing, where available, was also noted.
Treatment-related data included treatment intent (curative or palliative), lymph node dissection (<12 or >12 nodes), and metastatic status. Sites of metastasis such as liver, peritoneum/omentum, non-regional lymph nodes, bone, and ovary were documented. The primary outcome measured was the distribution of patients receiving curative versus palliative treatment, while secondary outcomes included stage distribution, metastatic patterns, and correlation of clinical and pathological features with tumor laterality (right versus left colon).

Statistical Analysis

Data were compiled in Microsoft Excel and analyzed using IBM SPSS Statistics version 26. Continuous variables (age, CEA) were expressed as mean, median, standard deviation, and range, and compared using the independent t-test. Categorical variables (gender, stage, histopathology, metastasis) were presented as frequencies and percentages, and analyzed with chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

RESULTS

Among 43 colon cancer patients, the mean age was 51.5 years, with over 60% in the 41–60 year age group, and a slight male predominance (55.8%). Only one patient (2.3%) reported a family history of malignancy, indicating that most cases were sporadic. The ascending colon/hepatic flexure (30.2%) and sigmoid colon (30.3%) were the most frequent tumor sites, followed by the cecum (23.3%). Abdominal pain was the predominant presenting complaint (95.3%), with altered bowel habits (53.5%), weight loss (48.8%), and anemia (30.2%) also common, while vomiting, bleeding per rectum, and obstruction were less frequent. These findings suggest colon cancer in this cohort mainly affected middle-aged adults, with sporadic occurrence and typical presentations dominated by abdominal and bowel-related symptoms [Table 1].

Table 1: Distribution Based on Demographic and Disease Related parameters

Age Group	**Frequency**	**Percent N=43**
21-30 Years	2	4.7
31-40 Years	4	9.3
41-50 Years	15	34.9
51-60 Years	12	27.9
61-70 Years	7	16.3
71-80 Years	3	7.0
Mean Age	51.51±12.52	
Gender	**Frequency**	**Percent N=43**
Female	19	44.2
Male	24	55.8
Family history of malignancy	**Frequency**	**Percent N=43**
No	42	97.7
Yes	1	2.3
Distribution of disease	**Frequency**	**Percent N=43**
Ascending colon and hepatic flexure	13	30.2
Cecum	10	23.3
Descending colon	4	9.3

Sigmoid colon	13	30.3
Transverse colon and splenic flexure	3	7.0
Chief Complaints	**Frequency**	**Percent N=43**
Pain Abdomen	41	95.3
Anemia	13	30.2
Obstruction	7	16.3
Altered bowel habit	23	53.5
Weight Loss	21	48.8
Bleeding Per Rectum	8	18.6
Vomiting	11	25.6

The mean age of patients was 51.5 years (±12.5), with a median of 51 years and a range of 21–79 years, indicating that colon cancer predominantly affected middle-aged adults but was also seen in younger and elderly patients. Carcinoembryonic antigen (CEA) levels varied widely, with a mean of 130.7 ng/mL, a median of 16 ng/mL, and a range of 0–2522 ng/mL. While most patients exhibited modest CEA elevations, a minority demonstrated extremely high values, reflecting advanced or aggressive disease biology [Table 2].

Table 2: Descriptive Statistics of Age And CEA

Statistics	**Age (Years)**	**CEA (**ng/mL)
Mean	51.51	130.69
Median	51.00	16.00
Std. Deviation	12.519	409.175
Range	21-79	0-2522

Histopathological evaluation demonstrated that most patients in this cohort had adenocarcinoma (93%), with only a few cases of signet ring carcinoma (2.3%) or other rare histological variants (4.7%). More than half (51.2%) presented with stage IV disease, while 23.3% and 25.6% were in stages II and III, respectively, highlighting the predominance of advanced disease at diagnosis. Microsatellite instability (MSI) testing was performed in less than one-third of patients, and all tested were MSI-proficient, reflecting limited molecular profiling. Baseline carcinoembryonic antigen (CEA) levels varied widely. While most patients (44.2%) had moderately elevated levels (10–100 ng/mL), smaller subsets showed normal (23.3%), mild (16.3%), or markedly high values (14.0%), with one patient exceeding 1000 ng/mL. The mean CEA was 130.7 ng/mL with a large standard deviation, indicating that although moderate elevations were most common, extreme values in a minority suggested aggressive or advanced disease biology [Table 3].

Table 3: Distribution Based on Clinical Findings

Histopath	**Frequency**	**Percent N=43**
Adenocarcinoma	40	93.0
signet ring	1	2.3
Other	2	4.7
Stage	**Frequency**	**Percent N=43**
II	10	23.3
III	11	25.6
IV	22	51.2
MSI	**Frequency**	**Percent N=43**
Not done	30	69.8
Proficient	13	30.2

CEA	Frequency	Percent N=43
0-3	10	23.3
3.01-10	7	16.3
10.01-100	19	44.2
100.01-1000	6	14.0
>1000	1	2.3
Mean CEA	130.69 ± 409.17	

In this cohort, 51.2% of patients presented with metastatic disease, most commonly involving the omentum and peritoneum (59.1%) and non-regional lymph nodes (54.5%), followed by the liver (22.7%), bone (9.1%), and a rare case of bilateral ovarian metastasis (4.5%). Lymph node dissection exceeded 12 nodes in 27.9% of patients, while 20.9% had fewer than 12 nodes examined. Treatment intent was almost equally divided between curative (48.8%) and palliative (51.2%), reflecting the advanced stage at diagnosis and substantial metastatic burden, particularly in the peritoneal cavity and lymph nodes [Table 4].

Table 4: Distribution Based on Metastatic Outcomes

Metastatic Status	Frequency	Percent N=43
Non-Metastatic	21	48.8
Metastatic	22	51.2
Metastatic-site	**Frequency**	**Percent N=22**
Liver	5	22.7
Bone	2	9.1
Omental and peritoneum	13	59.1
Non regional Lymph node	12	54.5
Bilateral ovary	1	4.5
Ln Dissected	**Frequency**	**Percent N=43**
<12	9	20.9
>12	12	27.9
Metastatic	22	51.2
Intent	**Frequency**	**Percent N=43**
Curative	21	48.8
Palliative	22	51.2

When comparing right-sided (n=26) and left-sided (n=17) colon cancer, no statistically significant differences were observed across demographic, clinical, or pathological variables, as all p-values were >0.05. The mean age was slightly lower in right-sided cases (50.19 ± 11.42 years) compared to left-sided cases (53.53 ± 14.16 years), but this difference was not significant (p=0.399). Similarly, mean CEA levels were comparable between groups (133.78 ng/mL vs. 125.97 ng/mL; p=0.952). Gender distribution, stage at diagnosis, metastatic status, CEA categories, and histopathological types also showed no significant variation between the two groups. Overall, the findings indicate a broadly similar clinical and pathological profile irrespective of tumor laterality in this cohort.

Table 5: Comparison of Different Parameters Among Side Involved

Parameter	Group	Side		P Value
		Right Side N=26	Left Side N=17	
Age		50.19 ± 11.416	53.53 ± 14.16	0.399 Non=Sig
CEA		133.78 ± 494.13	125.97 ± 240.73	0.952 Non-Sig
Gender	Female	10	9	0.350, Non-Sig
		38.5%	52.9%	
	Male	16	8	
		61.5%	47.1%	
Stage	II	7	3	0.688, Non-sig
		26.9%	17.6%	
	III	7	4	
		26.9%	23.5%	
	IV	12	10	
		46.2%	58.8%	
Metastatic Status	Non-Metastatic	14	7	0.416, Non-Sig
		53.8%	41.2%	
	Metastatic	12	10	
		46.2%	58.8%	
CEA	0-3	9	1	0.201, Non-Sig
		34.6%	5.9%	
	3.01-10	4	3	
		15.4%	17.6%	
	10.01-100	9	10	
		34.6%	58.8%	
	100.01-1000	3	3	
		11.5%	17.6%	
	>1000	1	0	
		3.8%	0.0%	
Histopath	Adenocarcinoma	23	17	0.348, Non-Sig
		88.5%	100.0%	
	Signet ring	1	0	
		3.8%	0.0%	
	Other	2	0	
		7.7%	0.0%	

DISCUSSION

Colon cancer is increasingly recognized as a major health burden in India, and the findings from this study provide important insights into its epidemiological and clinicopathological profile in a tertiary care setting. The mean age of patients in our cohort was 51.5 years, with the majority belonging to the 41–60 year age group, which is younger compared to Western populations where the median age at diagnosis is around 68 years in men and 72 years in women [9]. This shift toward younger age at presentation has been observed in several Indian studies as well, suggesting possible differences in environmental exposures, lifestyle factors, and healthcare-seeking behavior [10].

A slight male predominance was observed (male:female ratio 1.2:1), consistent with previous reports from India and globally [11,12]. The low proportion of patients with a positive family history (2.3%) highlights that most cases in our setting are sporadic rather than hereditary. In contrast, studies from Western countries have reported a stronger influence of hereditary syndromes such as Lynch syndrome and familial adenomatous polyposis, though they still account for less than 5% of all colorectal cancers [13].

The anatomical distribution of tumors in this study revealed a predominance in the ascending colon, hepatic flexure, and sigmoid colon, each accounting for about 30% of cases. This pattern differs slightly from Western cohorts where left-sided cancers, especially in the sigmoid colon and rectum, are more common [14]. Recent global data, however, indicate a rising proportion of right-sided colon cancers, particularly among older adults [15]. Right-sided tumors are often associated with more advanced stage at diagnosis, larger tumor burden, and poorer prognosis [16], which aligns with our observation of late-stage presentation.

Abdominal pain was the most common presenting complaint in our cohort (95.3%), followed by altered bowel habits, weight loss, and anemia. These findings are comparable to studies from India and other low- and middle-income countries, where vague abdominal symptoms dominate the clinical picture and contribute to delayed diagnosis [17,18]. In contrast, rectal bleeding and changes in bowel pattern are more commonly reported in Western literature [19]. This difference may reflect variations in tumor location as well as differences in healthcare-seeking behavior and awareness.

Histopathological evaluation demonstrated that adenocarcinoma was the predominant subtype (93%), which is consistent with international evidence showing adenocarcinoma as the most common histological type of colon cancer, accounting for over 95% of cases [20]. Only a small fraction of our patients had signet ring carcinoma (2.3%), a histology associated with aggressive behavior and poorer prognosis [21].

Staging at presentation revealed that over half of our patients (51.2%) were diagnosed with stage IV disease. This finding is alarming but consistent with other Indian studies that report late-stage diagnosis in 40–60% of patients [22,23]. In comparison, population-based studies from high-income countries such as the United States report only about 20% of patients presenting with metastatic disease at diagnosis [24]. This discrepancy underscores the lack of organized screening programs and low awareness in India. The high proportion of metastatic disease in our study, particularly to the peritoneum and non-regional lymph nodes, emphasizes the aggressive nature of disease progression in this cohort.

Carcinoembryonic antigen (CEA) levels demonstrated wide variability, with most patients showing moderate elevation and a minority exhibiting extremely high levels (>1000 ng/mL). Elevated CEA has been consistently associated with advanced stage, metastasis, and poorer survival outcomes [25]. Our findings of markedly elevated CEA in a subset of patients correlate with their advanced stage and metastatic burden, reinforcing its role as a prognostic biomarker.

Microsatellite instability (MSI) testing was performed in less than one-third of patients, with all tested cases being MSI-proficient. While MSI-high tumors are known to be more frequent in younger patients and associated with better prognosis and response to immunotherapy [26], the lack of testing in the majority reflects a gap in molecular profiling in Indian practice. Studies from Western countries report MSI-high status in about 15% of colorectal cancers [27], while Indian data remain limited. Routine incorporation of MSI testing could improve risk stratification and guide treatment strategies.

Treatment intent in our study was almost equally divided between curative and palliative approaches, reflecting the advanced stage at diagnosis in many patients. This pattern mirrors other Indian studies, where late presentation frequently precludes curative resection [28]. Improving screening coverage, raising public awareness, and strengthening referral pathways are crucial to shift this balance toward curative management.

Our findings underscore several key challenges in managing colon cancer in India. First, the younger age at presentation suggests the need to revisit screening guidelines and possibly initiate earlier screening, especially in high-risk groups. Second, the predominance of advanced-stage diagnosis calls for improved awareness programs to encourage timely consultation. Third, the limited use of molecular profiling highlights the need for wider adoption of tests like MSI and KRAS/NRAS mutational analysis, which are increasingly guiding treatment decisions worldwide.

Although this study provided valuable insights into the epidemiological, clinicopathological profile, and treatment outcomes of colon cancer patients in a tertiary care center, it was limited by its retrospective design, relatively small sample size, and incomplete molecular profiling due to limited

availability of resources. Long-term follow-up data were not available for all patients, restricting survival and prognostic analysis. Future prospective, multicentric studies with larger cohorts, comprehensive molecular characterization, and evaluation of treatment response are essential to generate robust evidence and guide optimized management strategies for colon cancer in the Indian setting.

CONCLUSION

This retrospective study highlights the clinicopathological profile and outcomes of colon cancer in an Indian tertiary care setting. The disease predominantly affected middle-aged adults, showed a slight male predominance, and was largely sporadic. The ascending and sigmoid colon were the most frequent subsites, with abdominal pain as the leading symptom. Adenocarcinoma was the commonest histology, and over half of the patients presented with stage IV disease, often with metastases to the peritoneum, lymph nodes, and liver. CEA levels varied widely, with extreme elevations in some patients, underscoring advanced disease and the need for early detection and molecular testing.

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