Colorectal Cancer: A Study of Clinicopathological Characteristics and Surgical Interventions

Mohammed Fahad Alhazmi[1], *Rakan Abu Alqam*[1], *Abdullah Alassiri*[1], *Faris Shawli*[1], *Hussain AlTalaq*[1], *Abdulrahman Bahkali*[1], *Mahmood Numan*[1], *Suhail Abdullah Alturkistani*[2,3]

[1]Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

[2]Department of Surgery, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

[3]Gastrointestinal Oncology Unit, King Abdulaziz University Hospital, Jeddah, Saudi Arabia

Correspondence to: Mohammed Fahad Alhazmi; email: hazmi.moha@gmail.com

Received: 20 Aug 2024; Revised: 25 Feb 2025; Accepted: 10 Mar 2025; Available online: ***

Abstract

Background: Colorectal cancer (CRC) is a prominent worldwide health issue, being recognized as the fourth most prevalent malignancy globally. **Objective:** Our research aims to investigate the demographics, characteristics, histological variants, and risk factors associated with CRC patients. **Methods:** A retrospective study was conducted at the King Abdulaziz University Hospital (KAUH). Data were obtained from medical records of patients who underwent procedures and were diagnosed with CRC from 2015 to 2023. **Results:** A total of 204 patients were enrolled in the study, with 52.5% male and 47.5% female. Most (81.8%) of CRC patients were ≥45 years. Abdominal pain (72.1%) was the most common symptom. The most prevalent location for CRC was the sigmoid colon (33.8%). The most common complication was anemia (41.2%). The duration from symptom onset to diagnosis for patients with CRC in the cecum, descending colon, and transverse colon was significantly shorter compared to other sites of the colon. Post-operative complications were found to be more prevalent in patients who underwent an open surgical approach. Most patients (76%) who received palliative therapy were 45 years of age or older. **Conclusion:** The study examines CRC trends at KAUH, focusing on its prevalence in older adults, typical clinical presentations, and diagnostic timelines.

Keywords: Colorectal cancer, Cancer, Clinicopathological characteristics, Retrospective study

Ann Afr Surg. 2025; 22(2): **-**
DOI: http://dx.doi.org/10.4314/aas.v22i2.5

Conflict of interest: None
Funding: None
AI Disclosure Statement: During the preparation of this study, the authors used Wordvice AI to improve grammar and sentence structure. After using this tool, the authors reviewed and edited the content as needed and they take full responsibility for the content of the publication.

Introduction

Colorectal cancer (CRC) is a significant global health concern, characterized by the unregulated growth of cells in the colon or rectum (1). CRC is recognized as the third most frequently diagnosed cancer globally, constituting approximately 9.6% of all documented cancers (1). This alarming prevalence is further

intensified by its position as the second most fatal type of cancer worldwide, following lung cancer, accounting for 9.3% of all cancer-related deaths (1).

Notably, within Saudi Arabia (SA), CRC was identified as the third most frequently diagnosed cancer in the nation in 2018 (2, 3). Both colon and rectal cancers have been identified as among the most prevalent types of cancer, ranking as the most common cancer in Saudi males and the third most common in Saudi females (2, 3). The incidence rate has exhibited a gradual and consistent increase over the years, with CRC rates rising from 9.9% in 2006 to 14.2% in 2018 for males and from 8.8% in 2006 to 11.5% in 2018 for females (3). The impact of CRC is particularly noteworthy among the elderly population, with males typically experiencing an average onset age of 60 and females at 55 (4). However, it is worth noting that CRC tends to manifest at a younger age within the Saudi population (5). Research indicates that early onset of CRC, defined as occurring in individuals under 50 years of age, is more prevalent among the Saudi population compared to global statistics (6). This finding holds significant implications for the implementation of screening programs and the formulation of national policies.

Local studies have demonstrated that the survival rates for CRC in SA are lower than those observed in the United States (3). Specifically, the 5-year survival rate for CRC in SA ranges from 40% to 52%, whereas in the United States, it exceeds 60% (3). This disparity may be attributed to the delayed diagnosis of CRC in SA (3). Another reason may be due to the significant increase in the number of new cases and estimated age-standardized incidence rates per 100,000 individuals among both Saudi males and females (3). In SA, significant efforts have been made to enhance the control program for CRC (6). These initiatives encompass the formulation and execution of comprehensive protocols on a national scale, with the objective of facilitating CRC screening and enabling timely identification.

The escalating mortality rates and mounting burden of CRC in SA emphasize the necessity for a more profound and comprehensive comprehension of this ailment (7). The significance of obtaining such comprehension is emphasized by the fact that prompt recognition and intervention greatly enhance the effectiveness of treatment results.

In the present study, our research endeavors to make a significant scholarly contribution by conducting a comprehensive investigation into the demographics, characteristics, histological variants, and risk factors linked to patients who have been diagnosed with CRC. Our research focuses specifically on the institutional context of King Abdulaziz University Hospital (KAUH) in Jeddah, SA. The main aim of this study is to investigate the epidemiological characteristics of CRC.

Methods and Materials

This retrospective study was conducted at KAUH, which is a tertiary care hospital in Jeddah, SA. Data were obtained from the electronic medical records of patients with a confirmed diagnosis of CRC based on clinical records and who underwent surgical procedures at KAUH from 2015 to 2023. The study enrolled patients who met the inclusion criteria of being above the age of 18 and having a confirmed diagnosis of CRC. Any patients who were transferred from another hospital with a confirmed diagnosis and were not investigated at KAUH were excluded.

Ethical approval was obtained from the Unit of Biomedical Ethics at King Abdulaziz University. The Institutional Review Board has granted a waiver for the informed consent requirement, as this study was conducted retrospectively, and patient data were anonymized to ensure privacy protection.

Data of patients who satisfied the specified inclusion criteria were obtained. Information regarding patient characteristics, such as age, gender, and presence of comorbidities, was gathered. CRC characteristics, including the diagnostic method, cancer site, tumor, node, and metastasis (TNM) staging, histopathological findings, and associated risk factors, were also documented. Additionally, the management approach and associated complexities were documented.

Data extraction was conducted utilizing a customized data sheet that was tailored to align with the research objectives of the study. The extracted data were securely stored in an Excel spreadsheet on a designated computer to uphold patient confidentiality. Data analysis was

conducted using International Business Machines Statistical Product and Service Solutions (IBM SPSS) version 25 (IBM, Chicago, IL, USA). Descriptive statistics, including measures such as the mean, median, and standard deviation, were employed to provide a summary of the continuous variables.

Table 1. Demographics and characteristics of colorectal cancer patients (N=204)

Variable	**n (%)**
Gender distribution	
Male	107 (52.5)
Female	97 (47.5)
Nationality	
Saudi	120 (58.8)
Non-Saudi	84 (41.2)
Mean age (mean±SD)	56.9±13.26
Median age (years)	58
Age group (years)	
18–29	6 (2.9)
30–44	31 (15.2)
45–59	75 (36.8)
60+	92 (45.1)
Health conditions	
Hypertension	64 (31.4)
Diabetes	58 (28.2)
Cardiac disease	19 (9.3)
Hyperlipidemia	16 (7.8)
Irritable bowel syndrome	8 (3.9)
Inflammatory bowel disease	6 (2.9)
Asthma	3 (1.5)
Cancer history	
Personal history	45 (22.1)
Family history	15 (7.4)
Lifestyle factors	
Smokers	24 (11.8)
Alcohol consumption	1 (0.5)

SD, standard deviation.

Categorical variables are commonly summarized by their frequencies and percentages. The chi-square test and independent *t*-test were employed to evaluate the associations between variables.

Results

Demographic and characteristics of the cohort

A total of 204 patients were included. We observed a balanced gender distribution, with 107 (52.5%) male and 97 (47.5%) female participants. There was no statistically significant difference between females and males in the diagnosis of CRC (p = 0.562). The age of individuals diagnosed with CRC ranged from 19 to 89 years old. The median age was 58 years old. We categorized our patients into four age groups, and the most common age group was 60 years and older (45.1%) (Table 1). Noteworthy health statistics reveal a prevalence rate of 31.4% for hypertension and 28.2% for diabetes. Furthermore, a notable proportion of participants (22.1%) indicated a personal history of cancer, with most of them receiving palliative management (60%) (p = 0.003). Lifestyle factors

revealed that 11.8% of the participants were smokers. All demographic and characteristic data are summarized in Table 1.

Colorectal cancer presentation

Our study has uncovered a wide range of patterns in the clinical presentation and characteristics of patients diagnosed with CRC. Among the whole cohort, the predominant diagnoses consisted of primary CRC (68.1%), followed by metastatic CRC (27.5%) and recurrent CRC (4.4%). Further examination of CRC sites revealed variations, with the sigmoid colon (33.8%) as the predominant location (Table 2).

Table 2. Time disparities in the diagnosis of colorectal cancer across different sites

Site of CRC	**Total patients, N (%)**[a]	**Days from initial symptoms to diagnosis, mean±SD**[b]	**Days from initial symptoms to diagnosis in other sites combined, mean±SD**[c]	***p* value**[d]
Sigmoid colon	69 (33.8)	35.6±77.2	73.2±158.5	0.057
Rectum	59 (28.9)	54.4±122.2	62.1±142.2	0.752
Ascending colon	47 (23)	51.5±95.7	61.4±142.9	0.747
Rectosigmoid junction	27 (13.2)	94.8±211.9	53.1±116.4	0.368
Descending colon	23 (11.3)	29.3±27.3	63.0±142.4	**0.022**
Transverse colon	19 (9.3)	10.6±18.4	63.8±140.6	**0.000**
Cecum	14 (6.9)	9.1±9.7	63.5±140.2	**0.000**
Hepatic flexure	11 (5.4)	8.0±5.6	62.7±139.3	0.270
Splenic flexure	9 (4.4)	91.8±236.2	57.6±127.8	0.466
Ileocecal junction	3 (1.5)	10.5±12.0	60.4±136.8	0.608

Independent t-test.

aTotal patients, N (%): total number and percentage of patients diagnosed with colorectal cancer at the specified site, including both symptomatic and asymptomatic patients.

bMean±SD time, in days, from the onset of symptoms to the diagnosis of CRC for each site.

cMean±SD time, in days, to diagnosis for CRC at each site against the average time for all other sites combined.

dThe statistical significance of the difference between the time to diagnosis at a particular site and the time to diagnosis at other sites combined.

CRC, colorectal cancer; SD, standard deviation.

Among the entire cohort, a proportion of 82.9% of the patients displayed symptoms. Among the symptomatic individuals, a considerable percentage reported the occurrence of abdominal pain (72.1%) as the most prevalent symptom. Symptoms are illustrated in Figure 1. The average duration from the initial manifestation of the symptoms to the diagnosis was 59.7±136 days. Patients also presented with complications, including anemia (41.2%), intestinal obstruction (21.6%), and rectal bleeding (20.6%). The occurrence of CRC complications in cases of intestinal obstruction showed a significant association with the need for emergent surgery ($p = 0.005$). Colonoscopy was employed in 74% of the patient population, whereas sigmoidoscopy was performed in 5.4% of patients. Additionally, computed tomography (CT) colonography was utilized in 2.9% of the cases. Radiological modalities used to diagnose CRC showed that most patients had a CT scan (81.4%), followed by an X-ray (48.5%). These modalities were significantly associated with patients presenting with abdominal pain (*p*-values of 0.044 and 0.007, respectively). Findings include colon mass (61.8%), intestinal obstruction (14.7%), intestinal perforation (4.9%), free air (7.4%), and pneumoperitoneum (2%).

Upon analyzing the CRC site, it was noted that patients with CRC in the cecum, transverse colon, and descending colon had a significantly shorter duration from the onset of symptoms to diagnosis compared to patients with CRC in other locations (p = 0.000, p = 0.000, and p = 0.022, respectively) (Table 2).

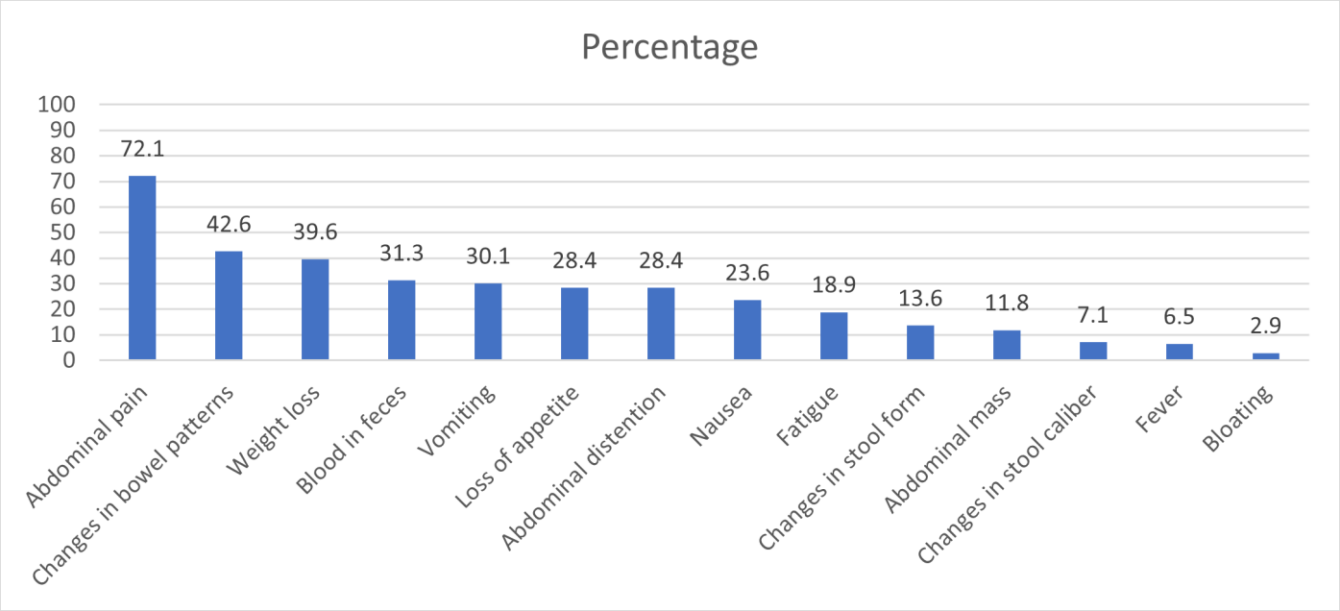

Figure 1. Prevalence of symptoms among symptomatic patients.

Table 3. Histopathological distribution and TNM staging of colorectal cancer (N=204)

Variable	**n (%)**
Histopathology	
Adenocarcinoma	137 (67.2)
Tubular adenoma	25 (12.3)
Mucinous carcinoma	6 (2.9)
Signet ring cell	3 (1.5)
Neuroendocrine	3 (1.5)
Tubulovillous	2 (1)
Medullary	2 (1)
Undifferentiated	1 (0.5)
Diffuse large B-cell lymphoma	1 (0.5)
TNM staging	
Stage 0	15 (7.4)
Stage 1	8 (3.9)
Stage 2	35 (17.2)
Stage 3	70 (34.3)
Stage 4	50 (24.5)
Unreported	26 (12.7)

TNM, tumor, node, and metastasis.

Patients diagnosed with CRC in the hepatic flexure and ileocecal junction demonstrated an average duration of symptom presentation until the diagnosis of 8±5.65 days and 10.5±12.0, respectively (Table 2). However, these

findings lacked statistical significance ($p = 0.270$ and $p = 0.608$, respectively) (Table 2).

Histopathological analysis and TNM staging

Histopathological analysis indicated that adenocarcinoma was the prevailing form (67.2%). Tumor staging, as determined by the TNM classification system, revealed that stage 3 was the most prevalent (34.3%). The remaining histopathological forms and TNM stages of CRC are presented in Table 3. For patients with unreported TNM, they were either diagnosed outside of KAUH or their data were missing.

Management strategies for colorectal cancer

The findings of the study suggest that a considerable percentage of patients (59.3%) received surgical intervention as part of their treatment. It is worth mentioning that nearly 96% of patients who received surgical intervention had procedures that were elective. Among the diverse range of surgical procedures performed, 53.7% were categorized as open surgeries, with 80% of the emergent surgeries being open surgeries. The remaining 46.3% of procedures were classified as laparoscopic procedures. Among the patients who underwent surgical procedures, it was found that 33.9% of them had a stoma. Among the cohort of patients who underwent surgical procedures, 9.1% had post-operative complications, specifically wound infection (4.1%), anastomosis leakage (4.1%), and urinary tract infections (UTIs) (0.8%). The primary factor contributing to post-operative complications in the patient population was identified as the open surgical approach. Although not statistically significant, the study revealed that 80% of patients who experienced post-operative wound infection had undergone an open surgical approach ($p = 0.052$) (Table 4).

Table 4. Surgical approaches and post-operative complications in colorectal cancer

Type of surgical approach	**Complications associated with the surgical approach**	**Number of patients who had the complication/total number of patients who had the surgical approach (%)**
Open approach	Wound infection	4/65 (6.1)
	Anastomosis leakage	5/65 (7.7)
	UTI	1/65 (1.5)
Laparoscopic approach	Wound infection	1/56 (1.7)
	Anastomosis leakage	0/56 (0)
	UTI	0/56 (0)

UTI, urinary tract infection.

Additionally, all patients who experienced anastomosis leakage and UTI had undergone an open surgical approach ($p = 0.040$ and $p = 0.341$, respectively) (Table 4). The remaining patients received palliative care (40.7%). The study findings indicated that a significant proportion (76%) of individuals who received palliative therapy were aged 45 years or older.

End of hospital stay outcomes

Most patients in the cohort were discharged (84.8%), whereas the remaining (15.2%) died. Among the discharged patients, a significant proportion of individuals (25.4%) were readmitted within a 4-week period following their initial discharge. A statistically significant finding ($p = 0.010$) indicates that 80% of patients who died exhibited abdominal pain as an initial symptom. Notably, none of the patients who died exhibited symptoms of irritable bowel syndrome (IBS) or inflammatory bowel disease (IBD). Among the patients who died, loss of appetite (45.1%) and loss of weight (54.8%) exhibited a significant association with mortality ($p = 0.005$ and $p = 0.007$, respectively).

Discussion

The findings of the study indicate a balanced distribution of genders among the participants, with 52.5% identified

as males and 47.5% as females. The statement provided is in accordance with the existing body of global literature on CRC, which indicates that both genders are vulnerable to this condition (8). In 2018, the Saudi Health Council National Cancer Center Saudi Cancer Registry released their latest report on the prevalence of CRC (9). The findings of the report revealed that CRC was slightly more prevalent in females (54.9%) compared to males (45.1%) (9). The statistical analysis, however, indicated that there was no significant difference in the distribution between the two genders. Therefore, we can conclude that the gender distribution of CRC is unchanged.

In relation to the distribution of age, individuals who were diagnosed with CRC exhibited that the median age of the participants was 58 years. The median age observed in our sample is consistent with the age range reported in national literature, which indicates a range of 55 to 60 years (6, 10). The results suggest that there is no significant alteration in the association between gender and age with CRC. The recommendation for initiating screening in SA is to start at the age of 45 (11). This age range aligns with the majority of individuals in our sample, making it a suitable guideline for our study. Specifically, our analysis reveals that 81.9% of the cohort under investigation belongs to the age group of 45 years or above. However, a considerable percentage (76%) of patients who received palliative treatment were 45 years or older, which indicates late detection of the disease. Furthermore, a study conducted by Alyabsi et al. in 2021 indicated that 20–30% of Saudi patients experienced early-onset CRC (6). The high proportion of patients receiving palliative treatment, coupled with the high incidence of early-onset CRC, raises the question of whether lowering the screening age for early detection of CRC from 45 to 40 years would be advantageous in reducing the percentage of CRC patients requiring treatment. Additional research and data are necessary to explore this potential intervention. The distribution of CRC within the study cohort was primarily observed in the sigmoid colon (33.8%), rectum (28.9%), and ascending colon (22.9%), indicating a predominant distribution pattern (Table 2). The findings of this study coincide with the prevailing global literature that suggests that CRC primarily manifests in the rectum, sigmoid colon, and ascending colon (12). Furthermore, a local study published in Tabuk reported findings that differed slightly from our research, indicating that the most prevalent location for cancer was the right side of the colon (39.1%), followed by the rectosigmoid region (23.9%) and rectal region (19.6%) (13). This suggests that there may be minor variations in cancer prevalence across different regions of SA. Upon careful examination of the CRC site, it was noted that individuals diagnosed with CRC in the cecum, transverse colon, and descending colon experienced a significantly reduced time interval from the onset of symptoms to diagnosis in comparison to those with CRC in alternative locations ($p = 0.000$, $p = 0.000$, and $p = 0.022$, respectively) (Table 2). The information provided is of considerable interest. The positioning of CRC within the colon can potentially impact the duration required for disease detection. This phenomenon can be ascribed to the distinct and pronounced symptoms linked to these regions, which serve as a driving force for patients to promptly seek medical intervention. The study revealed that patients who were diagnosed with CRC in the hepatic flexure and ileocecal junction experienced an average duration of symptoms until the diagnosis of 8±5.65 days and 10.5±12.0 days, respectively (Table 2). However, this finding did not reach statistical significance ($p = 0.270$ and $p = 0.608$, respectively). This implies that the disparity in the duration of diagnosis could potentially be attributed to random fluctuations rather than a substantial influence. These findings may carry significant implications for the prompt identification and effective management of CRC. Further investigation is required to validate these findings and gain a comprehensive understanding of the variables that contribute to these discrepancies.

In the realm of management strategies, the surgical approach exhibits a slightly higher prevalence (59.3%). Among the patients who underwent surgical management, 53.7% elected to undergo an open surgical approach, whereas the remaining 46.3% opted for a laparoscopic surgical approach—the prevalence of the open surgical approach was slightly higher compared to

the laparoscopic surgical approach. A study has provided evidence indicating that the utilization of the laparoscopic surgical approach is correlated with a reduced incidence of post-operative complications, including anastomotic leakage and wound infection, in comparison to the open surgical approach. However, the study did not observe a statistically significant difference (14). In accordance with our research findings, it was observed in our sample that the utilization of the open surgical approach was identified as the primary determinant leading to post-operative complications in the patient cohort. The findings of the study revealed that all of the patients who had anastomosis leakage had the open surgical approach ($p = 0.040$). Additionally, although no significant statistical association, the majority of patients (80%) who encountered post-operative wound infection had undergone an open surgical approach ($p = 0.052$) (Table 4). However, it is worth noting that there may be clinical significance in this relationship.

Similar to a study in the literature, our research also identified intestinal obstruction as the most prevalent indication for emergent surgical management (15). Our findings also revealed a noteworthy correlation between the incidence of complications in CRC cases presenting with intestinal obstruction and the requirement for emergent surgical intervention ($p = 0.005$). Research findings indicate that the utilization of an emergent surgical approach resulted in less favorable outcomes compared to elective surgery (16). Additionally, it is worth noting that 80% of the emergent surgeries performed were open surgical procedures, a factor that could potentially have had a negative impact on the patients' outcomes. As it has been previously stated that the open surgical approach is correlated with a higher incidence of complications compared to the laparoscopic surgical approach.

The examination of symptoms indicated that a substantial percentage (80%) of patients who died initially presented with abdominal pain. Additionally, a significant proportion of patients who died experienced loss of appetite (45.1%) and weight loss (54.8%) ($p = 0.005$ and $p = 0.007$, respectively). These symptoms may serve as significant indicators of disease progression and therefore require close monitoring within the context of patient care. This finding highlights the potential prognostic significance of this symptom in predicting patient outcomes. However, none of the patients who died exhibited any signs of IBS or IBD, suggesting that these conditions may not have a substantial impact on the mortality rate within this specific patient population.

Despite the valuable insights from our study on CRC in Jeddah, SA, it is crucial to acknowledge the inherent limitations associated with a single-center retrospective design. The restricted extent of our investigation, which exclusively concentrates on a solitary medical facility, may impede the generalizability of our results. Another significant limitation relates to the insufficiency of medical records for individual patients, leading to potential gaps in information. Another important limitation is not including whether patients underwent screening prior to being diagnosed with CRC, as it might support our recommendation to reduce the screening age.

Conclusion

In conclusion, the study provides valuable insights into the demographics, clinical presentation, and surgical management strategies for CRC at KAUH. The findings highlight that most patients receiving palliative care were 45 years old or older. Abdominal pain was the presenting complaint in more than half of the patients. Adenocarcinoma was identified as the most prevalent form of cancer. The analysis of cancer sites revealed a certain degree of diversity, with the sigmoid colon emerging as the most common location. We recommend further studies to investigate lowering the screening age threshold for CRC to 40 years to enhance early detection of the disease.

Author contributions

MFA led in writing, reviewing & editing of the original draft. All authors equally contributed to conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision,

validation, visualization and in writing, reviewing & editing of the original draft.

References

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024; 74(3): 229-63.
2. Almatroudi A. The incidence rate of colorectal cancer in Saudi Arabia: an observational descriptive epidemiological analysis. Int J Gen Med. 2020; 13: 977-90.
3. Elwali NE, Jarrah O, Alzahrani SG, et al. Colorectal cancer in Saudi Arabia: the way forward. Asian Pac J Cancer Prev. 2023; 24(1): 13-9.
4. Rawla P, Sunkara T, Barsouk A. Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors. Prz Gastroenterol. 2019; 14(2): 89-103.
5. Alsanea N, Abduljabbar AS, Alhomoud S, et al. Colorectal cancer in Saudi Arabia: incidence, survival, demographics and implications for national policies. Ann Saudi Med. 2015; 35(3): 196-202.
6. Alyabsi M, Algarni M, Alshammari K. Trends in colorectal cancer incidence rates in Saudi Arabia (2001-2016) using Saudi national registry: early- versus late-onset disease. Front Oncol. 2021; 11: 730689.
7. Al-Ahwal MS, Shafik YH, Al-Ahwal HM. First national survival data for colorectal cancer among Saudis between 1994 and 2004: what's next? BMC Public Health. 2013; 13(1): 1-6
8. Wu Z, Chen K, Li J, Dai X. The global, regional, and national burden of colorectal cancer in 204 countries and territories from 1990 to 2019. Z Gesundh Wiss. 2024; 32: 609-18.
9. Saudi Health Council, National Cancer Center, Saudi Cancer Registry. Cancer incidence report in Kingdom of Saudi Arabia 2018. Available from https://shc.gov.sa/Arabic/NCC/Activities/AnnualReports/2018.pdf
10. Bakarman MA, AlGarni AM. Colorectal cancer patients in western Saudi Arabia. Outcomes and predictors for survival over a 10-years period (2002-2014). Saudi Med J. 2019; 40(12): 1227-34.
11. Alsanea N, Almadi MA, Abduljabbar AS, et al. National Guidelines for Colorectal Cancer Screening in Saudi Arabia with strength of recommendations and quality of evidence. Ann Saudi Med. 2015; 35(3): 189-95.
12. Duan B, Zhao Y, Bai J, et al. Colorectal cancer: an overview. In: Gastrointestinal Cancers. In: Morgado-Diaz JA, ed. Gastrointestinal Cancers. Brisbane (AU): Exon Publications. 2022: 1-12.
13. Alghamdi S. Colorectal cancer trends and characteristics in Tabuk, Saudi Arabia. Clin Cancer Investig J. 2023; 12(6): 6-9.
14. Hakami R, Alsaffar A, AlKhayal KA, et al. Survival and outcomes after laparoscopic versus open curative resection for colon cancer. Ann Saudi Med. 2019; 39(3): 137-42.
15. Bawa D, Khalifa YM, Khan S, et al. Surgical outcomes and prognostic factors associated with emergency left colonic surgery. Ann Saudi Med. 2023; 43(2): 97-104.
16. Bin Traiki TA, AlShammari SA, AlRabah RN, et al. Oncological outcomes of elective versus emergency surgery for colon cancer: a tertiary academic center experience. Saudi J Gastroenterol. 2023; 29(5): 316-22.