.

MEKELLE UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF SURGERY

CLINICOPATHOLOGIC PATTERN AND TREATMENT OUTCOME OF COLORECTAL CANCER AT AYDER COMPREHENSIVE SPECALIZED HOSPITAL FROM 2017 to 2024.

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LIST OF ACRONYMS AND ABBREVIATIONS

AJCC	American Joint Committee on Cance
AUS	Abdomino - pelvic Ultrasound
CEA	Carcinoembryonic antigen
CRC	Colorectal Cancer
CHS	College of health sciences
CT	Computed tomography
CT	Chemotherapy
DVT	Deep vein thrombosis
FOT	Fecal Occult Test
HAI	Hospital Acquired Infection
IBD	Inflammatory Bowel Disease
MRI	Magnetic Resonance Imaging
MU	Mekelle University
RT	Radiotherapy
SBO	Small Bowel Obstruction
SCC	Squamous cell carcinoma

Abstract

Background - Colorectal cancer (CRC) is a broad term and a major public health problem which includes tumors arising from colonic, rectum and anus. CRC is the most common cancer representing 13% of all malignant tumors in the gastrointestinal tract. In Ethiopia, colorectal cancer is among the leading causes of cancer morbidity and mortality in both sexes. Adenocarcinoma is the commonest histologic type with relatively better prognosis. Commonest presentation is abdominal pain and rectal bleeding. In CRC, the primary treatment options are surgery, chemotherapy (CT), targeted agents, and radiotherapy (RT). The predictors of mortality in CRC patients are Age, marital status, CEA level, cancer stage and comorbidities.

Objective: The purpose of this study is to assess the clinicopathologic patterns and treatment outcomes of colorectal cancer patients at Ayder Comprehensive Specialized Hospital from 2017 to 2024.

Methods: A retrospective institution-based cross-sectional study was done on total of 304 CRC patient who visited ACSH from 2017 to 2024.Trained physicians/residents using an ODK tool collected secondary data from patient charts that was retrieved from archive. Data entered to SPSS, Patient demographics, clinical features, tumor characteristics, treatment modalities, and outcomes were analyzed. Descriptive statistics, cumulative incidence, incidence density, median survival time, and adjusted hazard ratio were calculated to describe variables.

Result: A total of 304 patients were recorded in this study. The mean age of presentation was 51.1years (SD=15). The most common chief complaint was rectal bleeding (33.9%), followed by abdominal pain (23%). Metastatic symptoms were detected in 41(13.5%) of patients at presentation. The most common being back pain (6.3%), cough, vaginal bleeding (2%).112(36.8%) of patients had anemia .73.4% (47) had low albumin. CEA> 5 ng/ml value was seen in 44(48.9%) of patient.211 (69.4%) had pre op colonoscope and 145(68.7%) had ulcerative lesion. The most Common site was lower rectum found to be 95(46.6%) and lowest incidence was at transverse colon 7(3.4%) both with imaging US/CT and colonoscope. from the preoperative biopsy result adenocarcinoma 192(76.5%) and 14(5.6%) were poorly differentiated. 56 (35.2%) presented advanced. stage 4, 33(20.8%) stage 3C. 87 patients (28.6%) received neoadjuvant chemotherapy. With FOLFOX 53 (60.9%), CAPOX 14(16.1%). mean number of chemo cycle provided was 6(SD=4). nineteen (21.8%) had radiological, clinical, CEA response. out of 364 patients 168(55.3%) were operated, subsequently 98(32.2%) received adjuvant chemotherapy, 2 (0.7%) received radiotherapy and 74(24.3%) did not receive any treatment due financial, personal and social reasons. Of the total patients

23(7.6%) died at discharge. Of the 168 patients operated 199 procedures done 67.3% were done on elective basis. Of which 44.8% Ro resections were done. Of all most common procedure done was colostomy 76(38.2%), followed by segmental resection 36(18.1%), APR (14.1%), right hemicolectomy (11.1%). Total of 18(9%) intraoperative accidents were recorded. The most common intraoperative complication was adjacent organ injury (61.1%) followed by tumor rupture and fecal spillage (16.7%). There was 1 intraoperative death recorded. There were 61 (30.7%) post operative complications, SSI was the most common complication (32.8%), anastomotic leak (13.1%). for which 15(7.5%) required surgical intervention /reoperations.30 days post operative mortality was 6%. At the 5yr follow up 70 out of 304 were deceased. Out of 168 operated 44 were deceased.

Conclusion: The clinical presentation of the CRC patients was similar to other studies conducted in Ethiopia and other LMICs with rectal bleeding being the most common chief complaint. Rectal cancer is more common than colon cancer. Most patients present at advanced stages, often from rural areas outside Mekelle, indicating limited access to early diagnostic services. One-fifth of the patients were younger. The most common histological type is well-differentiated adenocarcinoma, aligning with global CRC pathology trends. Assessing the clinic pathology pattern and treatment of study area is important to understand and initiate early detection, screening and treatment for better outcome

Keywords: colorectal cancer, clinicopathology pattern, complication, outcome

1. INTRODUCTION

1.1 BACKGROUND

Colorectal cancer (CRC) is a broad term and a major public health problem which includes tumors arising from colonic , rectum and anus .[1] Rectal cancers have been traditionally classified as upper-, mid-, and lower-rectal cancers depending on the distance from the anal verge.[2] . CRC is the most common cancer representing 13% of all malignant tumors in the gastrointestinal tract.[3] globally, Colorectal cancer ranks third in terms of incidence and second in terms of mortality .[2] In Ethiopia, colorectal cancer is among the leading causes of cancer morbidity and mortality in both sexes.[4] The median age at diagnosis was above age of 50yr in most developed countries such as Germany ,Oman but younger age of presentation (46 year) were seen in Ethiopia [3,5].

There are different risk factors for development of colorectal cancer (CRC) such as age, family history, age above 50 , hereditary syndromes like Lynch syndrome , obesity, physical inactivity, smoking, excessive alcohol consumption, high consumption of red and processed meats, low fiber intake, history of adenomatous polyps or inflammatory bowel disease (IBD) also heightens risk.[3]

The extent of colorectal cancer can be staged using the Dukes or the American Joint Committee on Cance (AJCC), TNM staging which describes based on the depth of tumor invasion ,the presence of lymph node and presence of metastasis. which is important to assess the progression of CRC, helping guide treatment decisions and predict patient outcomes.[6]

Colonic cancer can arise from different part right colonic cancer commonly present with symptoms of anemia, abdominal bleeding due to ulcerative behavior while left colonic cancer present with obstructive features due their polypoid pattern. Adenocarcinoma being commonest histologic type with relatively better prognosis other pathology variants exist such as mucinous, signet cell neuroendocrine and squamous cell carcinoma which up hold poorer prognosis[7]. Outcome also depends on their grade of differentiation well differentiated having better outcome than poorly differentiated and undifferentiated variants .for rectal cancer commonest presentation is rectal bleeding and lower rectum is commonest site . [7] [2]

Diagnostic Investigations from simple FOT to colonoscopy, Imaging CT /MRI have diagnostic importance while hemoglobin, serum albumin, total protein level, CEA level has purpose of dictating patient outcome in terms of complication and recurrence. [8]

In CRC, the primary treatment options are surgery, chemotherapy (CT), targeted agents, and radiotherapy (RT), but the choice largely depends on the site of the tumor, stage at presentation, individual patient factors.[5]. In a paper done by Teka et al.2021 [9] patients who underwent surgery showed lower rate of death than those who did not regardless of the stage at diagnosis[4].however colorectal cancer surgery is associated with a great number of complications such as SSI ,DVT ,Anastomotic leakage ,adhesion, ileus, urinary dysfunction. Preoperative evaluation, intraoperative care and postoperative measures can reduce the incidence of these complications.[10][11]

The predictors of mortality in CRC patients are Age, marital status, CEA level, cancer stage and comorbidities, like hypertension, diabetes, myocardial infarction, chronic obstructive pulmonary disease, and asthma were strong predictors of mortality in colorectal cancer patients[1]other studies have also showed that the initial treatment administered, tumor grade, tumor size and pathologic stage of tumor are significantly associated with the survival of CRC patients.[4,12]

1.2. STATEMENT OF THE PROBLEM

Significant numbers of CRC patients do not receive standard recommended therapies in most low-income countries, including Ethiopia. This is attributable to health-seeking behavior and, more crucially, the scarcity of integrated care. According to a report by Girum et al.2023 .[5] Only 27 of the 43 SSA (Social Security administration) registered nations have structured cancer registration systems; data quality varies, and national coverage is limited.[5]

Mortality figures for CRC are primarily estimated from population-based cancer registries, This system is crucial for acquiring accurate data on clinico pathologic pattern, diagnostic gaps, treatment effectiveness, and asses overall outcomes. Which serves as the back bone for informed decision-making in healthcare and research. Given the infancy stage of population-based cancer registration in Africa, including Ethiopia, individual cohort studies play a crucial role. They provide valuable insights into the cancer burden until a comprehensive national and regional cancer registry system is fully developed.[1]

As a nation in Ethiopia, there is a single population based cancer registry exists which barely includes 3-5% of total population more focused on the urban areas. [1]in Tigray our catchment area there is no any registry to dictate the demographic pattern, clinical presentation, histologic pattern. The overall outcome of our therapeutic modalities is completely un studied with no any objective measurements.

1.3. SIGNIFICANCE OF THE STUDY

Our study has addressed the clinic pathologic and treatment patterns and outcomes of CRC patients, which has given insight into the gaps in the current treatment interventions and inform future strategies for quality comprehensive cancer care in the region. By analyzing tumor characteristics and histological features healthcare providers can tailor therapies to individual patients, improving outcomes and management strategies. It will have important implications for the development of a multi-level assignment in the screening, diagnosis, management, and follow-up of CRC patients and serve as a ground base for future investigators and upcoming prospective studies.

2. LITERATURE REVIEW

2.1. INTRODUCTION

Colorectal cancer is a tumor which arise from the colon and rectum which spans from the cecum down to the dentate line. Based on site of onset rectal cancer more common than colon cancer accounting for 49.66%. [13] Among colon cancer commonest site is sigmoid colon (55%), ascending colon, transverse colon, descending colon, cecum accounting 23.3%, 8.5%, 8.1% and 8%, respectively.

The gross types of CRC mainly include uplift, ulceration, and infiltration. In early stages, CRC is confined to the intestinal mucosa and submucosa. When the tumor breaks through the submucosa, lymphatic metastasis occurs in about 10% of patients CRC spreads and metastasizes mainly through the following four pathways, Local invasion: Lymphatic metastasis, Hematogenous metastasis Implantation and metastasis.

2.2. EPIDEMOLOGY

Colorectal cancer (CRC) is ranked the third in terms of incidence and second in terms of cancer-related death Globally.[11] [2]As the NCD burden is increasing in most LMIC including Ethiopia. The incidence of CRC in Ethiopia increased with an estimated rate of 8.5 and 6.3 per 100 000 for men and women, respectively. Making it the third most incident and fourth cause of mortality for both sex .[14]. In Addis Ababa, CRC is the most common cancer among men, accounting for 12.4% of all cancers, and the fourth most common cancer among women, accounting for 5.4% of all cancers. [3]

A study in Ghana by Francis et al found that the average age of people with the first CRC diagnosis was 54 ± 16.8 years .[12] In Ethiopia the mean age of presentation for CRC was 47.7 years [7].but currently The incidence of CRC is increasing among young people of all races, who often present with more advanced tumors.[2] Those young patients are reported to have family history of cancer from their first degree relatives and had history of associated comorbidities.[4]

2.3. HISTOLOPATHOLOGICAL PATTERN OF CRC

Colorectal cancer has different histologic variants such as adenocarcinoma, tubular adenocarcinoma, mucinous adenocarcinoma, signet-ring cell carcinoma, undifferentiated carcinoma, melanoma, squamous cell carcinoma and neuroendocrinetumors(NET).[4,15] Adenocarcinoma (90%) has the highest incidence Among all CRC patients followed by signet ring cell carcinoma (3.9)%. [2,16] Based on their degree of Differentiation CRC Classified as Well, Moderately and Poorly Differentiated Areas. Adenocarcinomas NOS (93.8%) are commonest followed by moderately differentiated (59.6%), poorly differentiated 18.5% .[4] poor differentiation is associated with poorer outcome in all histology including signet ring and mucinous.[5]

2.4 CLINCAL PRESENTATION

In study done at a tertiary care center of CRC at India, the commonest symptom among patients with colon cancer was abdominal pain; 55.6% of patients had a right-sided primary tumor as compared with 42.2% with left-sided tumors. The commonest symptom among patients with rectal cancer was bleeding per rectum. The predominant location of the tumor was in the lower rectum (58%).[2] Similarly, in study done At one of oncology centers in Ethiopia, among 209 patients ,64.1 % of CRC patients had bowel habit change and 26.8 % presented acutely with obstructive symptoms . Abdominal pain (38.9%) was the commonest presenting symptom for colonic cancer followed by weight loss and rectal bleeding 35.4%, 20.1% respectively. for rectal cancer commonest presenting symptom was rectal bleeding (91.4%) followed by abdominal pain, weight loss.[5] The commonest physical examination finding in rectal cancer patients is mass peri rectum.

2.5 INVESTIGATIONS AND SCREENING

Colorectal cancer (CRC) typically develops through a multistep process involving various histological, morphological, and genetic changes over time. This progression allows for the early detection of precancerous polyps, significantly reducing the incidence of CRC through screening. Noninvasive methods like the Fecal Occult Blood Test (FOBT) and Fecal Immunochemical Test (FIT) can be performed at home and have been shown to reduce CRC mortality by 15%–33%. Colonoscopy remains the gold standard for CRC screening, recommended every 10 years for average-risk individuals aged 50 and older, with a sensitivity of 95% for detecting CRC and 88%–98% for advanced adenomas.[8]

In addition to colonoscopy, CT scans also play a role in CRC detection, showing sensitivity rates of 90% for CRC and polyps ≥10 mm, and 78% for polyps ≥6 mm. Studies indicate that colonoscopy can lead to a 53%–72% reduction in CRC incidence and a 31% reduction in CRC-related mortality. These screening methods are crucial for identifying early-stage cancers and precancerous conditions, ultimately contributing to improved patient outcomes and reduced mortality rates associated with colorectal cancer.[8]

2.6 TREATMENT OUTCOMES OF CRC PATIENTS

2.6.1 Overview of Treatment Modalities

CRC, the primary treatment options are surgery, chemotherapy (CT), targeted agents, and radiotherapy (RT), but the choice largely depends on the site of the tumor, stage at presentation, individual patient factors, and its molecular subtype. Over time systemic treatment for CRC has evolved from 5-fluorouracil (5 FU) to combination regimens involving 5-FU, oxaliplatin, irinotecan, or both, as well as the introduction of targeted agents for those with metastatic settings. Despite advances in personalized cancer treatment in developed

countries, cancer management in developing nation's remains limited due to the lack of access to surgical care, availability of CT and RT, limited availability of healthcare professionals, and associated high costs.

2.6.2 Post-operative complications among colorectal cancer patients who underwent surgical management

Surgery is core of multidisciplinary management of CRC. Safe and Effective surgical care is crucial to lower CRC mortality. According to the Clavin-Dindo Classification (CDC), a validated scoring system for postoperative complications, which classifies it as grade I–V based on treatment given. major complication encompasses Death ,unplanned reintervention, unplanned readmission to a health-care facility; cancer-specific complications anastomotic leak ,surgical site infection , post operative infection, VTE and bleeding .[11][17] This complications such as ileus ,SSI anastomotic leak reported to reduce if mechanical bowel preparation (MBP) done .while comorbidities like DM ,steroid use , emergency resection ,advanced age , low BMI , chemotherapy intake ,contamination increases it . [10]

SBO secondary to adhesion is the commonest post operative complication (10%) with recurrent episodes having reduced survival rate. [7] [10]. venous thromboembolic events VTE (2.5%), SSI fourfold higher for colorectal surgeries anastomotic leak ,colonic ischemia [10]

Postoperative 30 day mortality after colorectal surgery was (0-8%) in Norway and (5-6%)in sub-Saharan countries ,this difference in the LMIC and HIC was due to quality of preoperative preparation ,stage of presentation, presence of comorbidities, intraoperative incidents . [18–20]

2.7 SURVIVAL RATES AND MORTALITY PREDICTORS

In most studies done in Africa, the median OS of CRC over five periods was 15 month, OS rate 16%. [12]This depended on stage of clinical presentation, patients with metastasis has lower MOS than local spread CRC .In Ethiopia the median OS for those presenting at stage III and IV And completed chemo was 24 and 10.5 months, respectively .The MS for those who underwent the planned surgical intervention was 26 months, compared to 16 months for those who did not ,which is comparative from other studies [12][21]

In study done in Addis Ababa, Hawassa an analysis of PFS was conducted on 205 patients 71.70% patients experienced progression at some point during the study period. This included death and recurrence. Stage bases difference in PFS and DFS was also observed in CRC, with shorter PFS as the stage of cancer progressed. [16][21]

In Ethiopia, the mortality rate among individuals diagnosed with CRC is high, with two out of five patients dying from this disease.[7] This has been noticed in studies published since 2017. Age, marital status, CEA level, comorbidities, and cancer stage were identified as predictors of mortality in CRC patients.[3]

Based on clinical stage of presentation, According to TNM staging More than three-fourths (79.4%) of the patients were found to have advanced disease (stages III/IV) (47.8%) and (13.7%), respectively during their first diagnosis. More than half had metastatic cancer with elevated CEA level. [7] Patients diagnosed at clinical stage IV, III ,II had 4-8 fold of increased risk of mortality than those who presented at clinical stage I.[22]

According to the COLOFOL clinical trial which was conducted in 24 hospitals across Denmark, Sweden, and Uruguay higher preoperative CEA level indicates poor treatment response ,high recurrence rate and poor treatment outcome which is similar to studies done at LMIC.[23]

Patients with existing comorbidities had Comorbidities like hypertension, diabetes, myocardial infarction, chronic obstructive pulmonary disease, and asthma were strong predictors of mortality in colorectal cancer patients .[24][25]

2.7.1 Overall, 1-year, 3-year, and 5-year survival rates of colorectal cancer patients

In the United States and 51.4% of colorectal deaths occurred within 5 years of diagnosis. The average median follow-up time for Ethiopia was 28.74 months. There are Variations in survival rates among countries which is due to stage of CRC at diagnosis and treatment options. The 1, 3, and 5-year survival rate of colorectal cancer was 82.3%, 48.8% and 26.6% respectively. While 1 year survival for Sub-Saharan Africa 74 %, Eastern Mediterranean Region Countries 70%, European 74 - 84%.The 3-year and 5 -year survival rate for CRC patients in Ethiopia was found to be 48.8% which is much lower compared to the survival rates observed in others but better than other African countries.[16][12]

3. OBJECTIVES

3.1 General objective

To Investigate the clinicopathologic patterns and treatment outcomes of colorectal cancer patients at Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Ethiopia.(From January 2017- December2024)

3.2 Specific objectives

1. To Describe the clinical presentation of colorectal cancer
2. To Describe the pathologic patterns of colorectal cancer
3. To Describe management modalities of colorectal cancer
4. To evaluate the treatment outcomes of colorectal cancer patients.

4. METHODS and MATERIALS

4.1 study areas

This study was conducted at Ayder Comprehensive Specialized teaching tertiary Hospital (ACSH) in Tigray Regional State, Northern Ethiopia. after its commencement in 2008 the hospital started to render its referral and non-referral services to around 9 million population in its catchment areas of the Tigray, Afar and North-eastern parts of the Amhara Regional States. It is one of the few providers of oncological services in Ethiopia. It is the only facility in the region fully equipped to offer comprehensive care for colorectal cancer (CRC) patients, including well-equipped pathology, colonoscope, oncology unit ACSH provides a range of definitive multimodal treatment options, including surgery performed by the region's only trained gastrointestinal (GI) surgeons, general surgeon and residents. The Hospital is also used as a teaching hospital and research center for the College of Health Sciences, Mekelle University.

4.2 study period

The study was conducted over a defined period, extending from January 1, 2017 to December 31 2024.Data collection was performed from January 20 - February 25, 2025 utilizing patient charts to extract relevant information.

4.3 Study design

An Institution based retrospective cross sectional study was done to address the objective of the study.

4.4 Source population and study population

4.4.1 Source population

All CRC patients who visited ACSH and confirmed to have CRC through pathologic examination.

4.4.2 Study population

This study included all 304 pathology confirmed CRC patients who visited ACSH from January 1 ,2017 – December 31, 2024.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

- All pathology confirmed CRC patients who visited ACSH.
- Patients treated at ACSH between January 2017 and December 2024.
- Adults aged 18 and above.

4.5.2 Exclusion criteria

- Patients with incomplete documentation.

4.6 Sample size determination and sampling technique

4.6.1 Sample size

Sample size is calculated using single proportion formula by the help of Epi Info 7.2 software. Input values like 5% margin of error, 95% confidence interval were assumed during the calculation. The proportion = 67.5% taken from study at Addis Ababa by Zingeta .et al 2023.[5]

- The formula for single proportion is:

$$n = \frac{(z_{\alpha/2})^2 p(1-p)}{d^2} = \frac{(1.96)^2 0.675(1-0.675)}{0.05^2} = 338$$

Where;

- P = Mortality rate of CRC
- $z_{\alpha/2=}$ critical Z value for 95% confidence level=1.96
- d =margin of error which is 0.05

- But, in ACSH there were about 662 patients registered with presumed colorectal cancer over the study period. After correcting for finite population using the formula
  - nf=n/(1+(n-1)/fp) = 338/ (1+(338-1)/662) =224

Where;

- nf = sample size for finite population
- fp= size of the finite population (which is 662)
- n = sample size for infinite population (which is 338)

Therefore, the minimum sample size required for this study is 224. But we w included all patients with pathologically confirmed colorectal cancer and complete record during the study period.

4.6.2 Sampling technique

In this study no sampling technique was applied and all patient who visited ACSH with in study period were included.

4.7. Study variables

Clinical variable: Clinical presentation, Stage of CRC, pathology and imaging findings , hemoglobin level, Albumin level, CEA level

Sociodemographic variable: Age, Gender, Comorbidities

Treatment variable: Type of treatment, Type of surgery, Type of chemotherapy

Outcome variable: Treatment outcomes of CRC, post operative complication

4.8 Data collection procedure

After reviewing different research papers check list were developed in accordance to our objectives. Subsequently, Patient registration number was retrieved from the OR, OPD, pathology unit, endoscopy unit and oncology unit. Charts were retrieved after permission for Access is obtained from registry office and medical director office.

Data from the eligible patients' medical records was extracted and imported into the Kobo toolbox. The data were then collected by using ODK collect. Data were collected from the Eligible patients charts by selected General surgery Residents Who were trained. The data collectors were supervised by the coordinators. Data submitted were double checked for any discrepancy and completeness from the server on daily basis. Data's that were not available on the charts were collected from the patient with the contacts via phone call

4.9 Data quality assurance

To assure the Data quality, Data collectors were General surgery residents. they received a one-day training session covering the purpose of the study, duration, content of the data collection tool and procedures, and ethical considerations.

The Principal Investigator, along with the Supervisor, closely were monitoring the data collection process throughout data collection and reviewed data daily to ensure completeness and consistency. The consistency and completeness of the collected data was examined on daily basis. The ODK Collect mobile application were used to enter data. Using the ODK Collect mobile application helped to avoid skip logic and consistency issues and minimize coding and typing errors. It also provided the ability to continuously monitor the data collected and provided timely feedback to the data collectors.

Pretesting was done 5% of our total sample size two weeks prior to collection date by sending the link to other hospital in the region. In order to assess its consistency, appropriateness, completeness, ease of understanding,

and accuracy of responses. (5%x 332 =16 patient charts) on 15 patient charts, Necessary changes and corrections was done accordingly to suit all possible scenarios and presentations.

4.10 Data analysis procedure

To facilitate additional data management and analysis, the data stored on the cloud server was exported to Statistical package for Social Science (SPSS) version 27. Both descriptive and inferential statistics was applied to the data. Frequency and percent were used to describe categorical variables in descriptive statistics. Measures of central tendency and dispersion were used appropriately to describe continuous variables. The mean and standard deviation (SD) were used if the continuous variables have a normal distribution. Interquartile range (IQR) and median was used in the continuous variables which were skewed.

Overall, the result is presented using text, graphics and tables.

4.11 Operational definitions

Right-sided tumor: a tumor that involve cecum, ascending colon, hepatic flexure and

Left sided tumors: a tumor that involve splenic flexure, descending colon, sigmoid colon

We operationalized Treatment outcomes can be defined as the effectiveness of the treatment administered to colorectal cancer patients, measured by:

Recurrence Rate: The percentage of patients who experience a return of cancer after treatment.

Postoperative Complications: Incidence of complications such as infections, bleeding, or organ dysfunction.[26][11][26]

Surgical Margins: Negative Surgical Margins: No cancer cells at the edges of the removed tissue, indicating complete removal of the tumor.

Length of Hospital Stay: defined as number of days following surgery to discharge was calculated.

CRC of young adult: Those who had their initial presentation at age of 40 and below.[16]

4. 12 Dissemination of the result

The findings of this study will be submitted to department of Surgery, College of health science, Mekelle University. It will also be disseminated to Tigray regional health bureau. Copies of the research report will also be available in the Department library. Efforts will be made to publish in peer-reviewed scientific journals, and present at national and international seminars and symposium. The results will be shared with the hospital administration and the Department of Surgery, pathology and oncology at ACSH to have an informed clinical practice and future research.

4.13 Ethical clearance

Ethical approval was obtained from the Institutional Review Board (IRB) **(reference number: MU-IRB 2487/2025)** of Mekelle university college of health science. Confidentiality of patient information was maintained throughout the study. The data was confidentially kept through restricted access. The study was conducted in accordance with the principles of the Declaration of Helsinki.

5. Results

A Total of 662 MRN was collected from the Gi clinic, surgical outpatient unit, gastrointestinal referral clinics, oncology unit, pathology unit, and log book. From those 234 charts were not found from the archive and registration stores. Of the 428-patient chart retrieved 80 had wrong diagnosis, 44 had incomplete and missing basic elements including biopsy reports other history and physical examination result. Finally, 304 patients with pathologically confirmed CRC with in allocated study period with complete data were identified and included in the study.

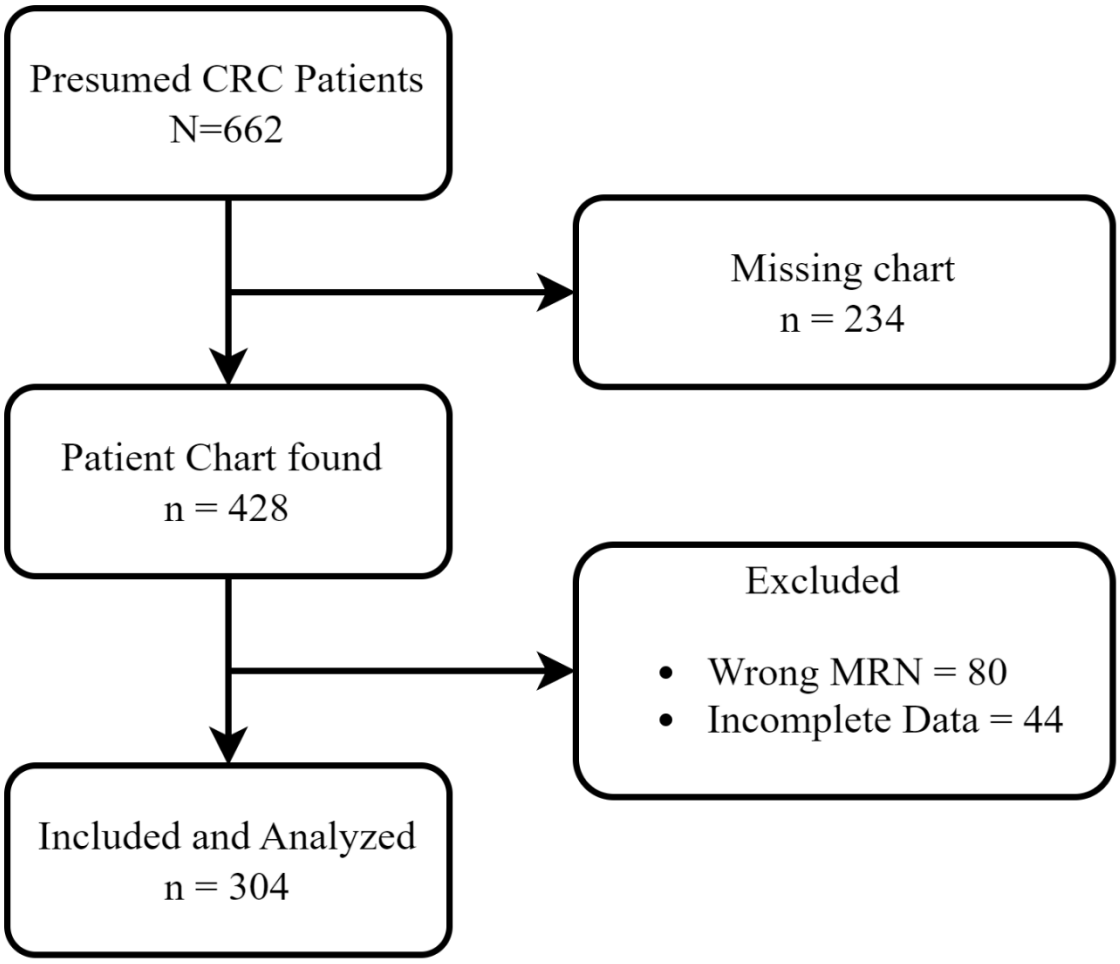

Figure 1:Flow chart for study on clinicopathologic pattern and treatment outcome of CRC at ACSH, From 2017-2024.

5.1. Sociodemographic characteristics

In our study, which included 304 CRC patients the mean age at presentation was 51.1 years (SD=15.0). Even though most patients presented at age above 40 ,7.9 % of the patient was under 30 years. female 50 years (=13.9), male 52.1(=15.9)

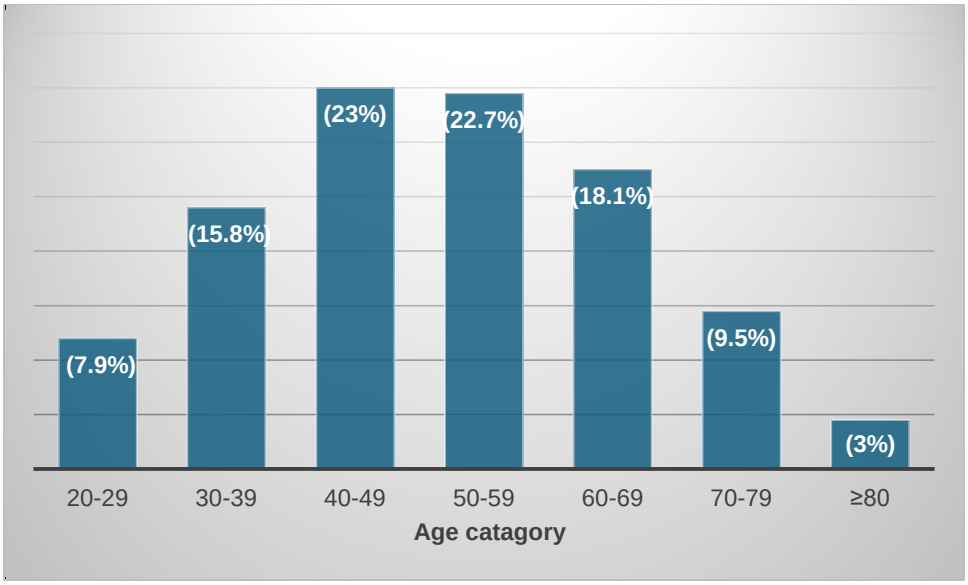

Figure 2: age distribution at presentation of CRC patients at ACSH

Male to Female ratio is 1.01. Nearly three-fourths (74) of the participants came from outside Mekelle. Two patients had family history of cancer. Eight (2.6%) of patients had documented history of inflammatory bowel disease. Comorbidities were found in 37 (11%) patients and the most common comorbidities were HIV/AIDS (5.6%), hypertension (3.3%), and diabetes (2%).

Table 1: socio- demographic and behavioural characteristic of colorectal cancer patients of ACSH 2017-2024. (N=304)

Variables		Frequency (N=304)	Percent (%)
Sex	Male	153	50.3
	Female	151	49.7
Residence	Mekelle	79	26.0
	Outside of Mekelle	225	74.0
Family history of cancer	Yes	2	0.7
	No	276	90.8
	Not documented	26	8.6
Any previous history of Inflammatory bowel disease	Yes	8	2.6
	No	281	92.4
	Not documented	15	4.9
Previous history of definitely treated colorectal cancer	Yes	17	5.7
	No	283	94.3
Comorbidities	None	267	89.0
	DM	6	2.0
	Hypertension	10	3.3

	HIV/AIDS	17	5.6
	CKD	3	1.0
	CLD	1	0.3

5.2. Clinical presentation

In all CRC patients, the most common chief complaint was rectal bleeding (33.9%) followed by abdominal pain (23%), and obstructive symptom (16.4%). At presentation most patients (55.6%) had weight loss, followed by rectal bleeding (50%), abdominal pain (49.3%) and change in bowel habitus (34.2%). Eighty two percent of patient with rectal bleeding had isolated rectal cancer while 16.4 percent had colonic cancer. Metastatic symptom was detected in 41 (13.5%) patients at presentation, among which the most common metastatic symptoms were back-pain (6.3%), cough (3.6%), and vaginal bleeding (2%).

Table 2: pattern of clinical presentation s of patients with colorectal cancer pateints of ACSH, (N =304).

Variables		Frequency (N=304)	Percent
Chief complaint	Abdominal pain	70	23.0
	Abdominal mass	24	7.9
	Rectal bleeding	103	33.9
	Obstructive symptom	50	16.4
	Peri Rectal mass	18	5.9
	Tenesmus	5	1.6
	Weight loss	4	1.3
	Loss of appetite	6	2.0
	Light headedness	2	0.7
	Change in bowel habit	22	7.2
Symptom at presentation	Abdominal pain	150	49.3
	Abdominal mass	32	10.5
	Rectal bleeding	152	50.0
	Obstructive symptoms	78	25.7
	Peri Rectal mass	55	18.1
	Tenesmus	57	18.8
	Weight loss	169	55.6
	Loss of appetite	113	37.2
	Light headedness	44	14.5
	Change in bowel habit	104	34.2
General appearance	Well looking	73	24.0
	Acute sick looking	83	27.3
	Chronic sick looking	112	36.8
	Acute on chronic sick looking	36	11.8
Physical finding	Pale conjunctiva	83	27.3
	Abdominal mass	46	15.1
	Abdominal distension	33	10.9
	Peri-rectal mass	149	49.0
	Lymphadenopathy	6	2.0

	No pertinent positive finding	60	19.7
Metastatic symptoms	None	263	86.5
	Cough	11	3.6
	Chest pain	1	0.3
	Ascites	3	1.0
	Jaundice	2	0.7
	Vx bleeding	6	2.0
	Back pain	19	6.3
	Long bone pain	3	1.0
	Neck swelling	1	0.3
	Recto vaginal fistula	1	0.3
	Urine obstruction	1	0.3

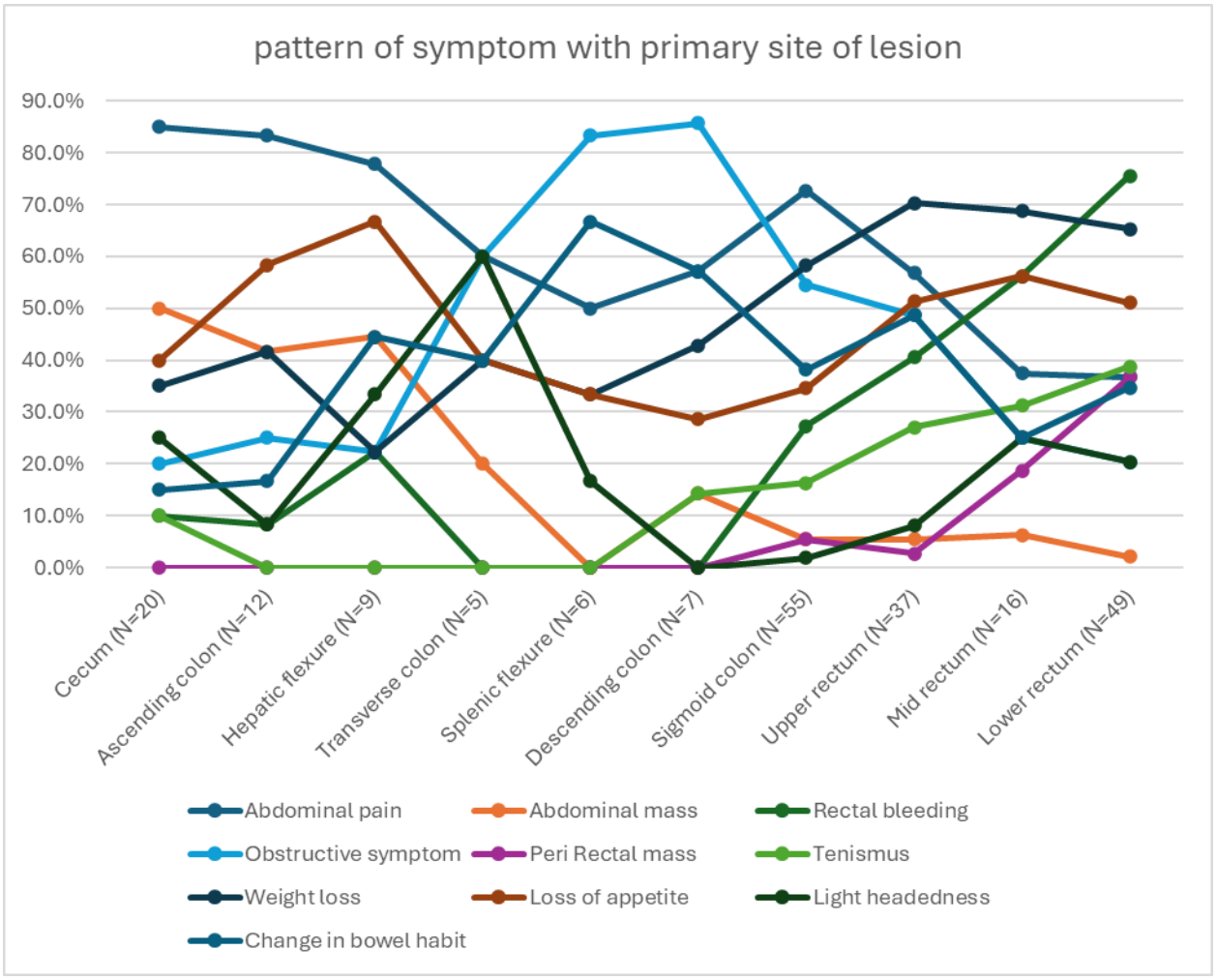

Figure 3:pattern of symptom of CRC with colonoscopy based primary site of tumour

Clinical presentation varied based on the anatomic location, right colon lesion presented with abdominal pain, obstructive symptoms seen with left colonic cancer. Rectal bleeding was common among mid, lower rectum and anal cancer.

Table 3: presenting symptom with colonoscopy primary site of lesion (N=204)

Symptoms	Right colon		Transverse colon	Left Colon		Rectosigmoid		Rectum	
	N=34	(%)	N=3	N=27	(%)	N=17	(%)	N= 122	(%)
Abdominal pain	25	73.5	2	18	66.7	10	58.8	40	32.8
Abdominal mass	11	32.4	1	5	18.5	1	5.9	4	3.3
Rectal bleeding	7	20.6	0	6	22.2	9	52.9	88	72.1
Obstructive	3	8.8	1	8	29.6	4	23.5	22	18.0

symptom									
Rectal mass	1	2.9	0	0	0	0	0	38	31.1
Tenesmus	2	5.9	0	2	7.4	6	35.3	33	27.0
Change in bowel habit	11	32.4	1	9	33.3	9	52.9	43	35.2
Light Headedness	11	32.4	1	3	11.1	1	5.9	23	18.9

At presentation 36.8% were chronically sick looking, 27.3% were acute sick looking. Among the 304 patients, 104 (49%) of the peri rectal mass, 83(27.3%) has pale conjunctiva and 46(15.1%) had abdominal mass, 60 (19.7%) had no positive finding and only 6 had lymphadenopathy.

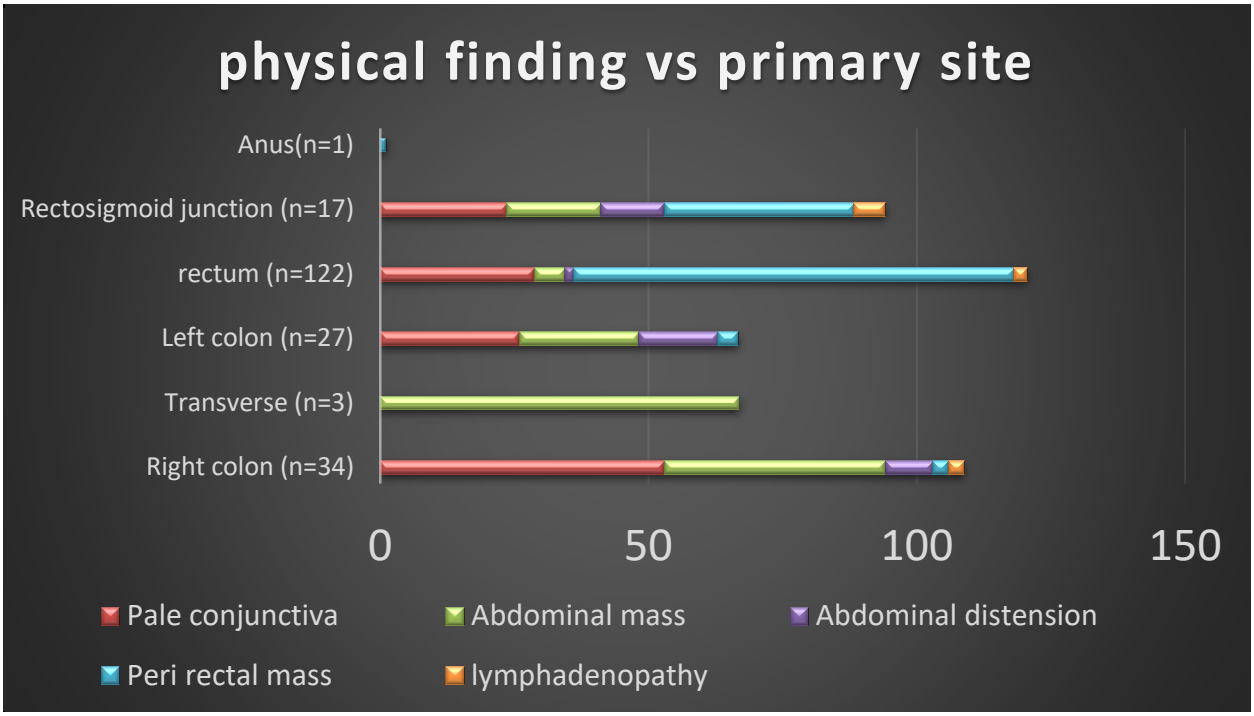

Figure 4:physical finding of CRC with primary lesion site colonoscope (N=204)

5.3. Laboratory investigations and imaging

Among the 304 patients, 112 (36.8%) presented with mild anemia, and 48 (15.8%) had severe anemia (Hgb < 7mg/dl). Of the 304 patients, 64 had documented albumin levels; among these, 73.4% (47 patients) had hypoalbuminemia, while the rest were within the normal range.

In the 14 patients where the FOT was performed, more than half tested positive. The preoperative CEA values for the 90 patients who underwent the investigation showed that 44 (48.9%) had values of five or below.

Table 4: laboratory profile of CRC patients of Ayder(n=304)

Variables		Frequency (N=304)	Percent
Hemoglobin status			
	Normal	65	21.4
	Mild anemia	112	36.8
	Moderate anemia	79	25.0
	Severe anemia	48	15.8
Albumin (N=64)			
	Normal	17	26.6
	Low	47	73.4
Fecal occult test result (N=14)			
	Positive	12	85.7
	Negative	2	14.3
CEA (ng/l) (N=90)			
	≤ 5	44	48.9
	>5	46	51.1

Among the 304 patients, 174 (57.6%) underwent abdominal CT scans, of which 159 (90.9%) had positive findings. Based on the CT results, the most common primary cancer site was the lower rectum, with 68 patients (42.3%), followed by the sigmoid colon with 51 patients (32.1%), upper rectum with 30 patients (30.2%), mid rectum with 21 patients (21.4%), and anal canal with 14 patients (14.5%). Of these 159 patients, 67 (42.1%) had T3 lesions, while 55 (31%) had T4 lesions. Additionally, 119 patients (74.8%) had node-positive status, and 16 patients (10.1%) had unknown nodal status. Furthermore, 59 patients (37.1%) had metastasis at diagnosis, while 56 patients (35.2%) presented at stage 4, and 18 patients (11.3%) were not staged.

A total of 207 patients (89.5%) had abdominopelvic ultrasounds, of which 184 patients (67.6%) showed mass/thickening, 61 patients (22.4%) had normal findings, 50 patients (18.4%) had distant metastasis, and 29 patients (10.7%) had ascites; none had vascular invasion. The most common site of the mass on ultrasound was the lower rectum, with 77 patients (41.8%), followed by the sigmoid colon, mid rectum, and upper rectum, with 39 patients (21.2%) each and 38 patients (20.7%), respectively.

Table 5:imaging finding of CRC patients of ACSH 2017-2024 (N=304)

Variables		Frequency (N=304)	Percent
MRI/CT			
	Yes	175	57.6
	No	129	42.4
Positive finding on MRI/CT (N=175)			
	Yes	159	90.9
	No	16	9.1
Primary site on MRI/CT (N=159)			
	Cecum	11	6.9
	Ascending colon	22	13.8
	Hepatic flexure	4	2.5
	Transverse colon	7	4.4
	Splenic flexure	5	3.1
	Descending colon	7	4.4
	Sigmoid colon	51	32.1
	Upper rectum	48	30.2
	Mid rectum	34	21.4
	Lower rectum	68	42.8
	Anal canal	23	14.5
T-stage on MRI/CT (N=159)			
	T1	1	.6
	T2	12	7.5
	T3	67	42.1
	T4	55	34.6
	Unspecified	24	15.1
Nodal status on MRI/CT (N=159)			
	Node positive	119	74.8
	Node negative	24	15.1
	Nodal status unknown	16	10.1
Metastases			
	Mx	11	6.9
	M0	89	56.0
	M1	59	37.1
TNM Staging (N=159)			
	Stage 1	3	1.9
	Stage 2a	6	3.8
	Stage 2b	8	5.0
	Stage 2c	2	1.3
	Stage 3a	11	6.9
	Stage 3b	22	13.8
	Stage 3c	33	20.8
	Stage 4	56	35.2
	Not staged	18	11.3
Abdominal pelvic ultrasound		Frequency (N=304)	Percent
	Yes	272	89.5
	No	32	10.5

Finding on ultrasound (N=272)			
	Ascites	29	10.7
	Metastasis to adjacent structure	27	9.9
	Distant metastasis	50	18.4
	LN involvement	21	7.7
	Omental involvement	7	2.6
	Abdominal wall involvement	4	1.5
	Mass/Thickening	184	67.6
	Normal	61	22.4
Site of Mass/Thickening on ultrasound (N=184)			
	Cecum	17	9.2
	Ascending colon	20	10.9
	Hepatic flexure	5	2.7
	Transverse colon	5	2.7
	Splenic flexure	3	1.6
	Descending colon	14	7.6
	Sigmoid colon	39	21.2
	Upper rectum	38	20.7
	Mid rectum	39	21.2
	Lower rectum	77	41.8
	Anal canal	4	2.2
	Not specified	18	9.8

All imaging findings cumulatively assessed and distribution of all 304 CRC patients were mapped. though the overlapping character is attributed to descriptions on the imaging. Lower rectum was the most dominant site while anus and transverse colon had lowest distribution.

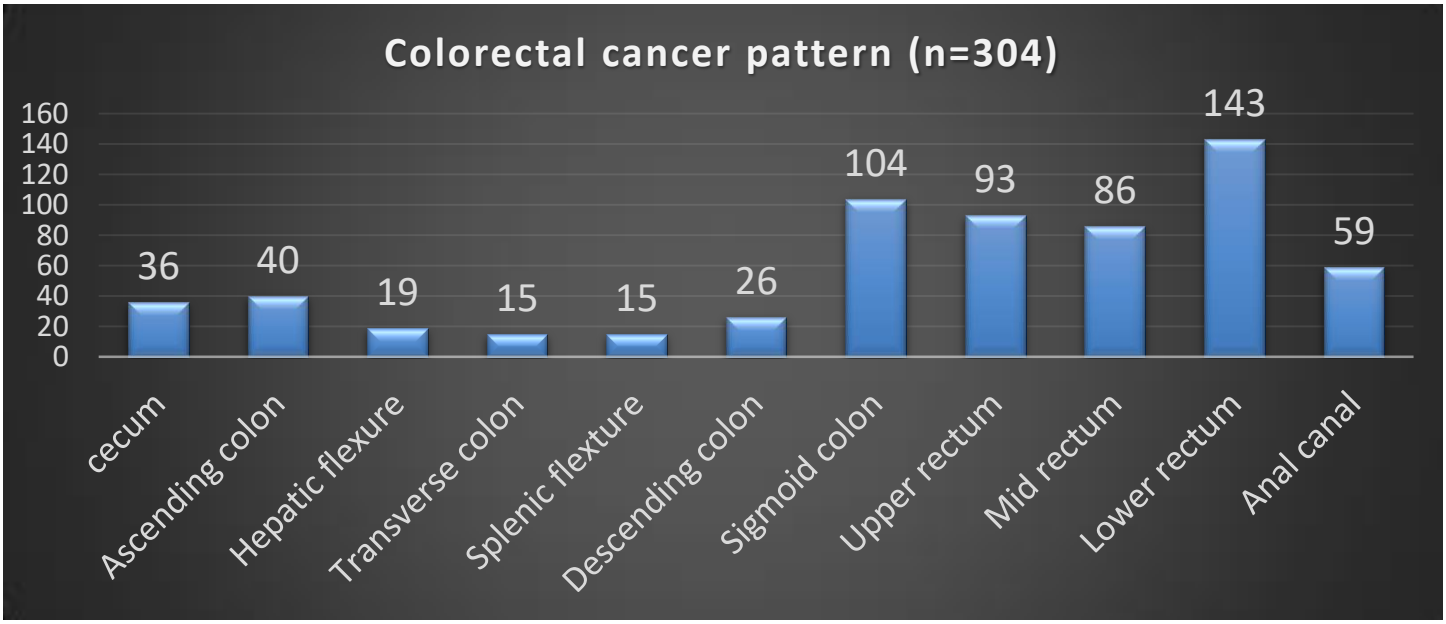

Figure 5: primary tumour site distribution of CRC (N=304) based on all imaging findings (US,CT,colonoscope).

A total of 219 patients had chest X-rays done as part of the metastasis workup. Among these, 219 patients (87.6%) had normal findings, while 22 patients (8.8%) had nodules or masses. of these 5 had cough up on initial presentation.

Table 6:Preoperative and post operative colonoscopy evaluation of CRC patients seen at ACS

Chest X-Ray(N=304)			
	Yes	250	82.2
	No	54	17.8
Finding on chest X-Ray (N=250)			
	Normal	219	87.6
	Pleural effusion	6	2.4
	Nodule/Mass	22	8.8
	Pathology not specified	3	1.2
Endorectal ultrasound/EUS/			
Yes	1	0.3	
No	303	99.7	

Of the 304 patients, 211 (69.4%) underwent colonoscopy. Among those, 145 patients (68.7%) had ulcerative lesions, 24.2% had polypoid lesions, and 6 patients (2.8%) had inconclusive results. The most common site excluding the 7 normal findings based on colonoscopy was the lower rectum, with 95 patients (46.6%), while the lowest distribution site was in the anus (0.5%) transverse colon, with 4patients (1.2%).

The gross types of CRC mainly include uplift, ulceration, and infiltration. In our study ulcerative 145 (68.7%) lesions were the most seen pattern in the colonoscope reports.

Table 7: colonoscopy finding of patients with CRC (N=211)

Pre-op colonoscopy(N=304)			
Yes		199	65.5
No		105	34.5
Total Colonoscopy(N=304)			
	Yes	211	69.4
	No	93	30.6
Lesion appearance on colonoscopy (N=211)			
	Normal	7	3.3
	Flat	2	.9
	Ulcerative	145	68.7
	Polyp	51	24.2
	Inconclusive	6	2.8

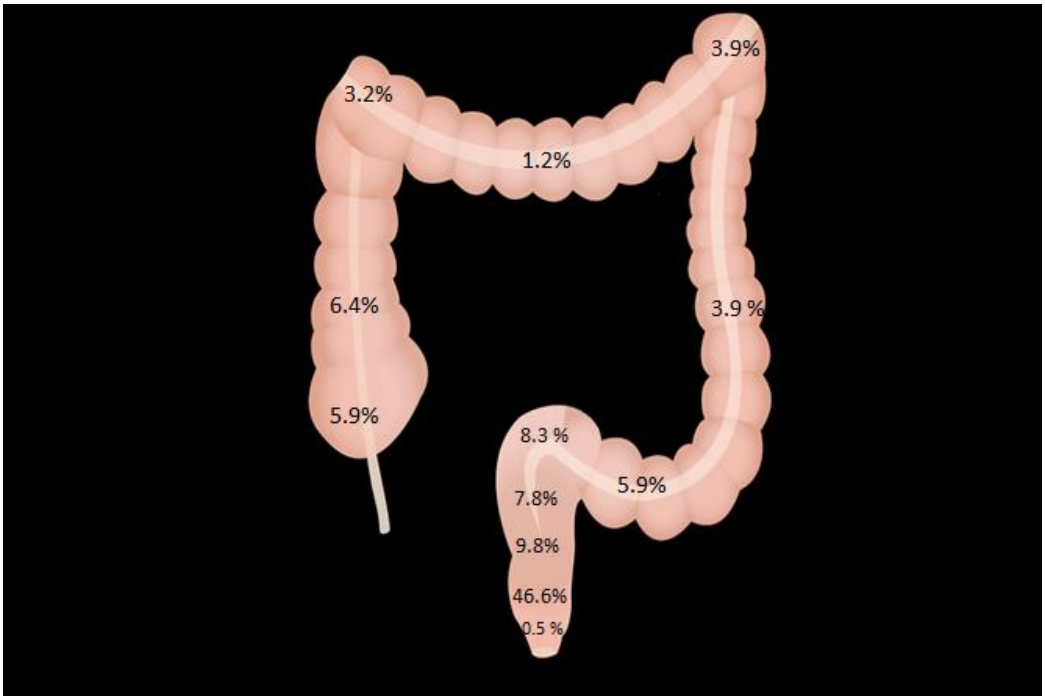

Figure 6 : primary tumour distribution site for pateints with colonoscopy report (n=204)

Pre operative biopsies were performed on 251 patients under sedation using both open techniques and with colonoscopy. The most common pathology was adenocarcinoma, found in 192 patients (76.5%), followed by tubulovillous adenoma in 9 patients (3.6%), squamous cell carcinoma in 8 patients (3.1%), in signet ring cell carcinoma in 4 patients (1.6%), and mucinous carcinoma in 2 patients (0.8%). Other pathologies, such as neuroendocrine tumors, liposarcoma, non-Hodgkin lymphoma, melanoma and intramucosal carcinoma, accounted for 0.3% each. Fourteen patients (5.6%) had poorly differentiated histology, while histologic grade was not documented for 90.4% of the cases.

Table 8:Preoperative biopsy result of CRC patients taken both open and with colonoscope combined of all CRC.

Pre-op Biopsy (N=304)		
Yes	251	82.6
No	53	17.4
Pre-op Biopsy Result (N=251)		
Adenocarcinoma	192	76.5
Mucinous	2	.8
Tub villous	9	3.6
Signet ring cell	4	1.6
Non representative	3	1.2
Others	33	13.1
Squamous cell carcinoma	8	3.1
Histologic grade (N=251)		

Well differentiated	9	3.6%
Moderately differentiated	1	0.4%
Poorly differentiated	14	5.6%
Not documented	227	90.4%

5.4. Pre-op chemotherapy

Out of of 304 patients, 87 (28.6%) received neoadjuvant chemotherapy. The most common regimen used was FOLFOX, administered to 53 patients (60.9%), followed by CAPOX in 14 patients (16.1%), FOLFIRINOX in 4 patients (4.6%), and a mixed regimen in 12 patients (13.8%); others were not specified.

Of the 87 patients, 29 (33.3%) had no response, while 10 patients (52.6%) had a laboratory response, 7 patients (36.8%) had a clinical response, and 11 patients (57.9%) had a radiological response. The mean number of chemotherapy cycles was 6 (SD = 4).

Table 9:neoadjuvant chemotherapy profile and response (N=87)

Variables		Frequency (N=304)	Percent
Pre-op chemotherapy	Yes	87	28.6
	No	217	71.4
If yes, regimen used (N=87)	FOLFOX	53	60.9
	CAPOX	14	16.1
	FOLFIROX	4	4.6
	Not specified	4	4.6
	Mixed	12	13.8
If yes, response (N=87)	Yes	19	21.8
	No	29	33.3
	Not assessed	39	44.8
Type of response (N=19)	Clinical	7	36.8
	Radiologic	11	57.9
	Laboratorical/CEA	10	52.6

5.5. Treatment

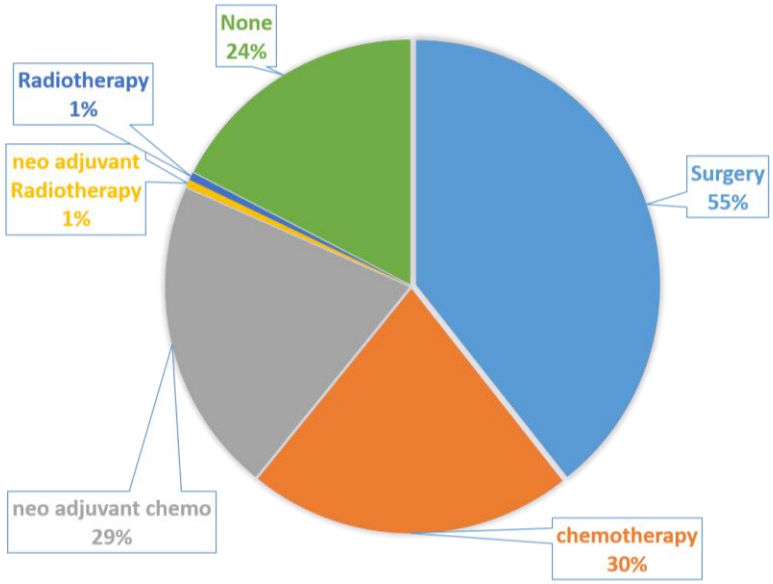

Figure 7:Treatment given for CRC patients at ACSH (n=304)

Out of 304 patients, 168 (55.3%) underwent surgery, 87 (28.6%) received neoadjuvant chemotherapy, 93 (30.5%) received chemotherapy, and only 2 patients (0.7%) received radiotherapy, while 74 patients (24.3%) did not receive any treatment.

Out of 168 operated patients ,81 patients (51.8%) took adjuvant chemotherapy ,2 patients (1.2%) adjuvant radiotherapy.

On subsequent follow-up, 31 patients (18.5%) experienced recurrence, of which 16 patients (51.6%) had both regional and distant recurrence, while 15 patients (48.4%) had local recurrence.

Of the 168 patients who were operated on, 119 (70.8%) had single procedures, while 35 patients (20.8%) underwent two surgeries, and 11 patients (6.5%) had three CRC-related surgeries

Table 10:Treatment given for CRC patients of ACSH (N=304)

Treatment given	Frequency (N=304)	Percent
Surgery	168	55.3
Chemotherapy	93	30.5
Neo adjuvant chemotherapy	87	28.6
Neo adjuvant radiotherapy	2	0.7
Radio therapy	2	0.7
None	74	24.3
Adjuvant chemo and radiotherapy	Frequency	Percent

		(N=168)	
Documented Adjuvant Chemotherapy (N=168)	Yes	81	48.2
	No	87	51.8
If yes, Chemotherapy type (N=81)	FOLFOX	51	63.0
	CAPOX	15	18.5
	FOLFIROX	2	2.4
	Mixed	13	16.0
Documented Adjuvant Radiotherapy (N=168	Yes	2	1.2
	No	166	98.8
Post-op recurrence (N=168)	Yes	31	18.5
	No	137	81.5
Type of recurrence (N=31)	Local recurrence	15	48.4
	Regional recurrence	16	51.6
	Distant recurrence	16	51.6

Out of 120 patients (71.4%) with pathology reports, the most common diagnosis was adenocarcinoma in 101 patients (84.2%), followed by 10 patients (8.3%) with mucinous carcinoma. Signet ring cell carcinoma, neuroendocrine tumors, squamous cell carcinoma, and liposarcoma each accounted for 2 patients (1.7%). Among the examined patients, 73 (60.8%) had well-differentiated histology, while 15 patients (12.5%) had poorly differentiated histology. Of the patient's preoperative histology exam was done, who had tubulovillious (9) finding ,6 were operated for colorectal cancer in the preoperative later and found to have adenocarcinoma Additionally, 19 patients (15.8%) had histological grades that were not documented. Of the 120 examined, 77 patients (64.2%) had negative surgical margins, while the status was not specified for 28 patients (23.3%).

Table 11:Post operative specimen Pathology analysis and results

Pathology results (N=168)	Available	120	71.4
	Not available	48	28.6
	Total	168	100.0
Histological type (N=120)	Adenocarcinoma	101	84.2
	Mucinius	10	8.3
	Signet ring cell	2	1.7
	Other(1intra-muscular carcinoma, 2 liposarcoma/sarcoma, 2 neuroendocrine tumor, 2 squamous cell carcinoma)	7	5.8
If yes, histologic grade (N=120)	Well differentiated	73	60.8
	Moderately differentiated	13	10.8
	Poorly differentiated	15	12.5
	Not documented	19	15.8
Resection margin (N=120)	Negative	77	64.2
	Positive	15	12.5
	Not specified	28	23.3

5.6 7,30 ,60,90 - day post operative Outcome and 5-year status

Out of the 168 patients who were operated on, 4 patients (2.4%) died within 7 days of surgery, 11 patients (6.5%) died within 30 days, 13 patients (7.7%) died within 60 days, 16 patients (9.5%) died within 90 days, and 44 patients (26.2%) died within 5 years postoperatively. Additionally, 48 patients (26.7%) were lost to follow-up at 5 years, and for 49 patients (29.2%), data were not applicable to assess 5-year survival.

Table 12: post operative status of CRC patients operated in ACSH (N=168)

Variables		Frequency	Percent
Day 7 status after definitive surgery in ACSH (N=168)	Alive	160	95.2
	Dead	4	2.4
	Lost to follow up	4	2.4
Day 30 status after definitive surgery in ACSH (N=168)	Alive	150	89.3
	Dead	11	6.5
	Lost to follow up	7	4.2
Day 60 status after definitive surgery in ACSH (N=168)	Alive	126	75.0
	Dead	13	7.7
	Lost to follow up	26	15.5
	Not applicable	3	1.8
Day 90 status after definitive surgery in ACSH (N=168)	Alive	120	71.4
	Dead	16	9.5
	Lost to follow up	28	16.7
	Not applicable	4	2.4
5-year status after definitive surgery in ACSH (N=168)	Alive	27	16.1
	Dead	44	26.2
	Lost to follow up	48	28.6
	Not applicable	49	29.2

Out of a total of 304 patients, 277 (91.1%) were alive and 27 patients (8.9%) were deceased at the time of discharge out of which 20 were operated. Out of the total 304 patient managed both operatively (44) and non-operatively (26) total of 70 patients are deceased. Thirty-eight are alive as confirmed with phone call and 197 of the patients are unreachable and current status. Of these 62(88.7%) had no comorbidities. Fourteen (20%) were below age of 40 years. Sixteen patients (28.6%) of the operated were duke stage C. thirty-three (26.4%) had adenocarcinoma histology. seventy fifty three (75%) had anemia. Eighteen (20%) had CEA level determined, Eight had elevated CEA value of above 5ng/ml .

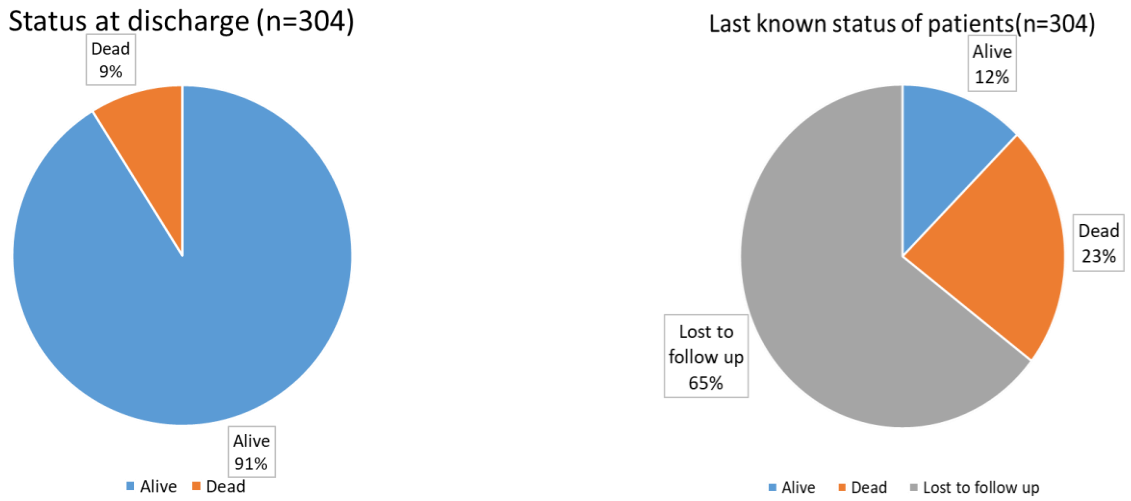

Figure 8:status of all CRC patient at last discharge vs last known status(n=304)

5.7 Procedure related characteristics

A total of 168 patients underwent surgery. Among them, 119 patients (70.8%) had single surgeries, 35 patients (20.8%) had two CRC-related surgeries, and 11 patients (6.5%) and 3 patients (1.8%) had three and four surgeries, respectively. Out of these 199 total procedures, 134 (67.3%) were performed on an elective basis, with 72 out of 134 patients (53.7%) being preoperatively evaluated and staged with CT. Among those staged, 56 patients (77.8%) were classified as DUKE stage C, and 5 patients (6.9%) were classified as DUKE stage D.

Out of the 134 electively operated patients, 94 patients (71.6%) had bowel preparation done, 75 patients (78.1%) undergoing a 3-day course and 69.7 % having both mechanical and medical preparation. Additionally, 60 patients (44.8%) had RO resection, 29 patients (21.6%) had R1 resection, 17 patients (12.7%) were deferred, 20 patients (14.9%) had procedures for reversal, and 8 patients (6.0%) underwent other CRC-related procedures such as biopsy or stoma creation.

Out of 65 patients operated on an emergency basis, segmental resection and stoma creation were performed for 29 patients (44.6%), segmental resection with anastomosis for 14 patients (21.5%), diversion stoma for 12 patients (18.5%), and 3 patients (4.6%) underwent other procedures, including stoma refashioning.

Table 13:perioperative details of colorectal surgeries done at ACSH (N=199)

Variable		Frequency (N=199)	Percent
Order of procedure	First	148	74.4
	Second	42	21.1
	Third	9	4.5
Schedule type	Emergency basis	65	32.7
	Elective basis	134	67.3
Pre-op staging CT done for elective procedure (N=134)	Yes	72	53.7
	No	45	33.6
	Not applicable	17	12.7
If yes, clinical staging (Dukes) (N=72)	Stage A: Limited to muscularis propria; nodes not involved	4	5.6
	Stage B: Extending beyond muscularis propria; nodes not involved	7	9.7
	Stage C: Nodes involved but highest (apical) node spared	56	77.8
	Stage D: Distant metastatic spread	5	6.9
If elective, bowel prep (N=134)	Yes	96	71.6
	No	40	28.4
If yes, type of bowel prep (N=96)	Mechanical	11	11.4
	Medical	18	18.7
	Both	67	69.7
If yes, duration of prep (in days) (N=96)	2	21	21.9
	3	75	78.1
If elective, procedure done (N=134)	Deferred	17	12.7
	RO resection	60	44.8
	R1 resection	29	21.6
	Other	8	6.0
	Reversal	20	14.9
If on Emergency, procedure done (N=65)	Deferred	1	1.5
	Diversion stoma	12	18.5
	Stoma + biopsy	6	9.2
	Segmental resection and stoma	29	44.6
	Segmental resection and anastomoses	14	21.5
	Other	3	4.6

5.7.1 Intra-Operative Finding

Intraoperatively, 158 patients (79.4%) had a mass. Additionally, 14 patients (7%) had perforations The most common primary sites were the sigmoid colon (69 patients, 34.7%), lower rectum (55 patients, 27.6%), upper rectum (45 patients, 22.6%), mid rectum (24 patients, 12.1%), cecum (22 patients, 11.1%), and the least common site was the transverse colon (5 patients, 2.5%). Eight patients had no documentation. Among the patients, 27.6% (55 patients) were locally advanced with adjacent structure invasion, while 10 patients (5%) had carcinomatosis.

Out of 199 procedures, colostomy was the most commonly performed procedure, done in 76 patients (38.2%), followed by segmental resection in 36 patients (18.1%), abdominoperineal resection (APR) in 28 patients (14.1%), right hemicolectomy in 22 patients (11.1%), and panproctocolectomy, subtotal colectomy, and transverse colectomy were each performed in a single patient. Four patients had no documentation. Additionally, 17of previously operated patients (8.5%) had their stoma reversed.

Out of the total procedures, 18 (9%) intraoperative accidents were registered. Of these, 61.1% (11 patients) had adjacent organ injuries, 3 patients (16.7%) had faecal/GI content spillage, 2 patients had tumour ruptures, and 14 patients required transfusions, of which 16.7% required the initiation of a massive transfusion protocol. There was also 1 recorded intraoperative death.

Table 14: Intra-operative details of CRC associated surgeries at ACSH (N=199)

Variable	Frequency (N=199)	Percent
Intra-op finding		
Mass	158	79.4
Perforation	14	7.0
Adjacent structure invasion	55	27.6
Vascular invasion	3	1.5
Carcinomatosis	10	5.0
Distal metastasis	9	4.5
Primary Location of Mass(N=157)		
Cecum	20	8.6
Ascending colon	12	5.1
Hepatic flexure	9	3.8
Transverse colon	5	2.1
Splenic flexure	6	2.5
Descending colon	7	3.0
Sigmoid colon	55	23.7
Upper rectum	37	15.9
Mid rectum	16	6.89
Lower rectum	49	21.1
Anal canal	8	3.4
Not documented	8	3.4
Type of procedure done		
Colostomy	76	38.2
Segmental resection	36	18.1
APR	28	14.1
Rt hemicolectomy	22	11.1
LAR	20	10.1
Stoma reversal	17	8.5
Deferred	16	8.0
Ileostomy	15	7.5
Lt hemicolectomy	12	6.0
Rt extended hemicolectomy	8	4.0

	Not documented	4	2.0
	Lt extended hemicolectomy	2	1.0
	Total proctocolectomy	1	0.5
	Subtotal colectomy	1	0.5
	Transverse colectomy	1	0.5
	Total colectomy	0	0.0
If elective, lymph node dissection (N=134)			
	Yes	75	56.0
	No	45	33.6
	Not applicable	14	10.4
Intra-op accident			
	Yes	18	9.0
	No	176	88.4
	Not documented	5	2.5
Type of accident (N=18)			
	Tumor rupture	2	11.1
	Massive transfusion	3	16.7
	Injury to adjacent organ or serosa	11	61.1
	Faecal spillage	3	16.7
Intra-op Transfusion			
	Yes	14	7.0
	No	185	93.0
Number of blood units (N=14)			
	1	3	21.4
	2	10	71.4
	3	1	7.1
Intra-op death			
	Yes	1	0.5
	No	198	99.5

5.7.2 post-operative complications

Out of all 199 procedures performed, 61 patients (30.7%) experienced post-operative complications. Among these, the most common complication was surgical site infection, occurring in 20 patients (32.8%), followed by intra-abdominal collection in 12 patients (19.7%), anastomotic leak in 8 patients (13%), hospital-acquired infection (HAI) in 7 patients (11.5%), and deep vein thrombosis (DVT) in 3 patients (4.9%). Of these complications, 15 patients (7.5%) required reoperation.

The most common indications for reoperation were intra-abdominal collection in 8 patients (53.3%), anastomotic leak in 7 patients (46.7%), wound dehiscence in 2 patients, organ space infection in 1 patient, and stoma necrosis in 1 patient. The most common complications were observed in patients who underwent segmental resection, followed by those who had colostomy and then abdominoperineal resection (APR) and low anterior resection (LAR).

The median post-operative hospital stay was 8 days (inter-quartile range [IQR] = 7).

Table 15: post operative complication of all CRC related procedure done at ACSH(n=199)

Variable		Frequency (N=199)	Percent
Post-operative complication			
	Yes	61	30.7
	No	135	67.8
	Not documented	3	1.5
Type of post-operative complication (N=61)			
	Surgical site infection	20	32.8
	Intra-abdominal collection	12	19.7
	Anastomotic leak	8	13.1
	HAI	7	11.5
	DVT	3	4.9
	Dehiscence	5	8.2
	Adhesion	5	8.2
	Hernia	5	8.2
Re-operation			
	Yes	15	7.5
	No	184	92.5
Reason for re-operation			
	Deep surgical site infection	1	6.7
	Intra-abdominal collection	8	53.3
	Anastomotic leak	7	46.7
	Others (1 adhesion, 1 vesicocutaneous fistula, 1 biliary leak, 1 stomal necrosis; 2 dehiscence, 1 bowel necrosis)	7	46.7

5.7.3 Complication versus type of surgery

POST operative complication type and rate varied based on the type of procedure. surgical site infection was more see in those APR and colostomy was done 6 patients each. intra-Abdominal collection was seen on segmental resection, LAR, colostomy and ileostomy was done. Anastomotic leak was seen on patient LAR was done without ileostomy, and segmental resection with anastomosis. From the 51 colostomies and 10 ileostomies done both at elective and emergency basis 17 were reversed on subsequent surgeries. Sixteen cases (8%) were deferred intraoperatively despite their preoperative stage status.

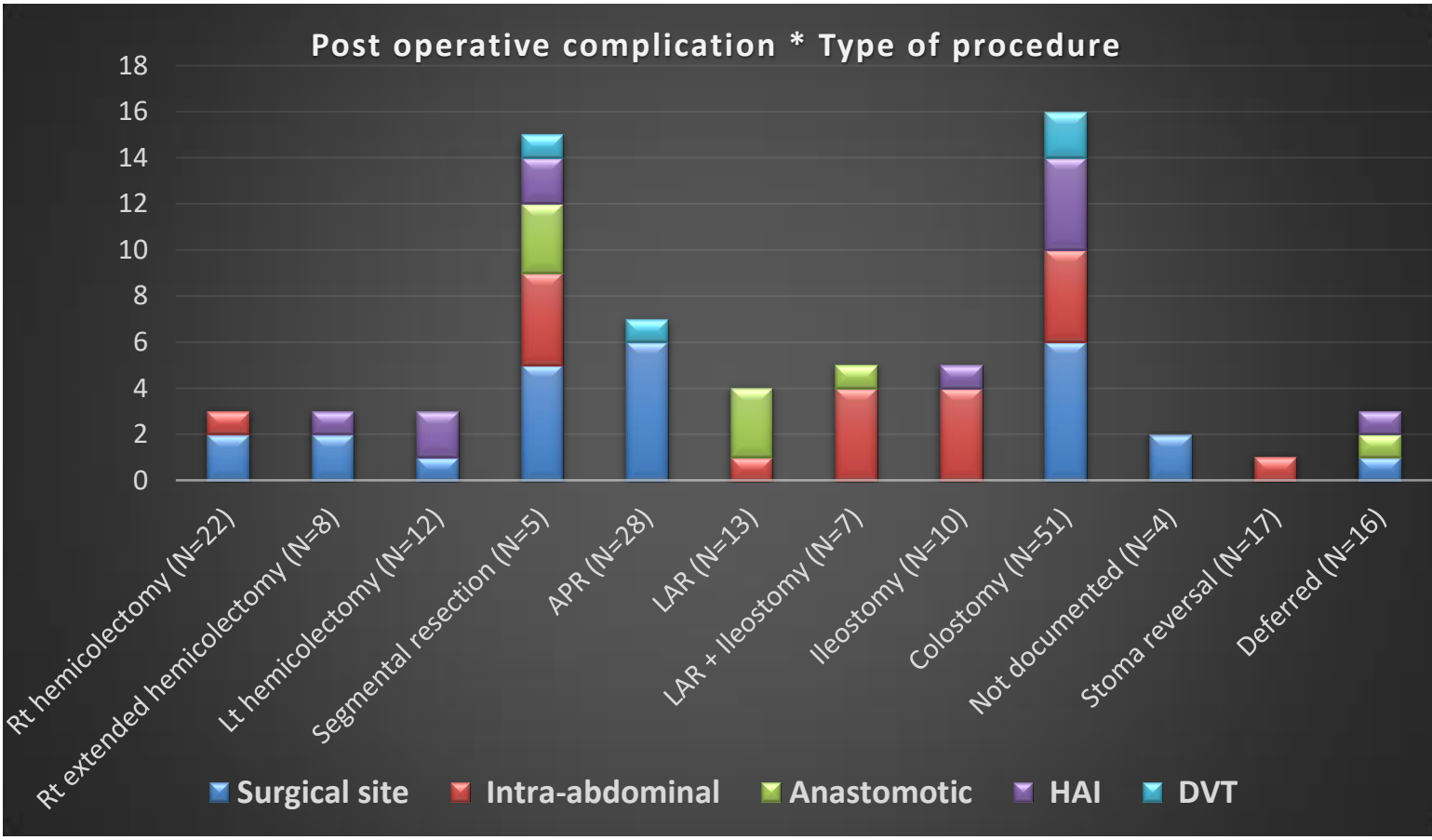

Figure 9:post operative complication in relation to type of procedure (n=199)

6.Discussion

6.1 EPIDEMOLOGY

colorectal cancer (CRC) is a malignant tumor that arises from the colon and rectum, spanning from the cecum to the dentate line. This study aimed to assess the clinicopathological patterns and treatment outcome of colorectal cancer (CRC) patients at ACSH. [13] Colorectal cancer (CRC) is a significant public health challenge globally, particularly in low- and middle-income countries (LMICs) such as Ethiopia.

Interestingly, In our study area, the mean age of colorectal cancer (CRC) presentation was 51.1 years (95% CI: 49.4 to 52.8), which is lower than the 54 years reported in Ghana by Francis et al. and slightly older than the 47.7 years observed in Ethiopia. [7] In this study, the male-to-female ratio was 1.01, showed no significant gender difference, consistent with findings by Teka et al. [13]. But rectal cancer was more common in female individuals above age of 40years, while colonic cancer was more prevalent in males. [2][5]

In this study, rectal cancer was found to be more prevalent than colonic cancer, accounting for 60% of cases. This aligns with global trends indicating a rising incidence of rectal cancer, especially in regions where

screening practices are limited. Notably, the sigmoid colon emerged as the most common primary site for Colonic Cancer, with 6% of cases, while the transverse colon had the lowest incidence at 2.1% [5].

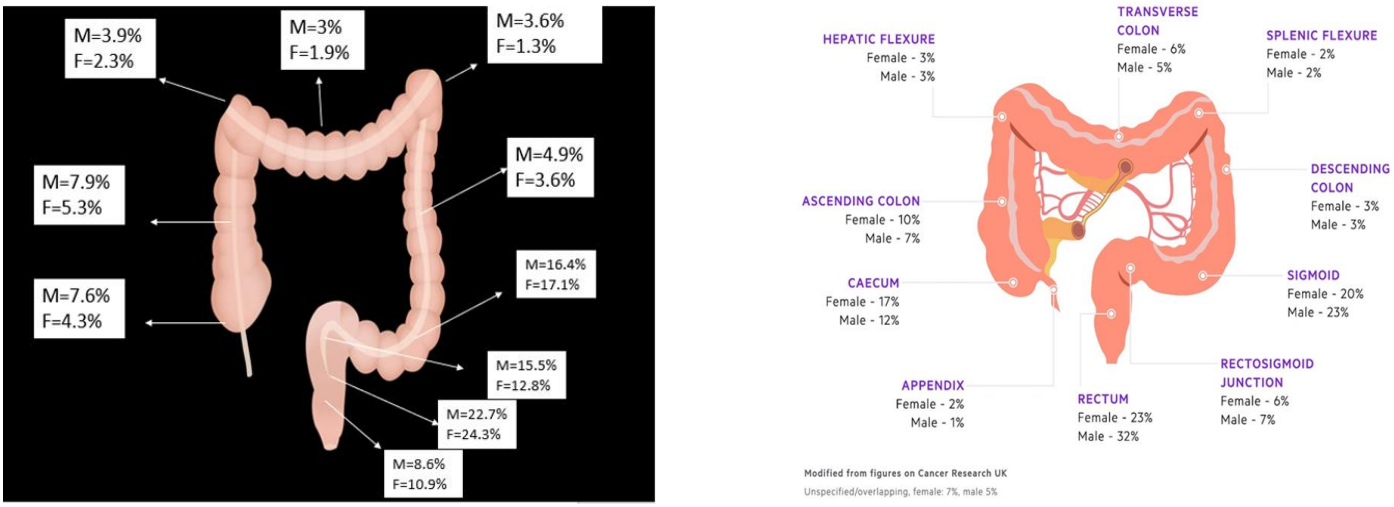

figure 10: comparison of CRC distribution based on imaging at ACSH vs HIC/UK

6.2 CLINCAL PRESENTATION

This study has unveiled rectal bleeding (33.9%), abdominal pain (23%), and obstructive symptoms (16.4%) as the top three chief complaints in patients with CRC. In our patient's Clinical presentation varied based on the anatomic location. Rectal bleeding was more associated with rectal cancer (82.7%), while abdominal pain was more common in right colon lesions and obstructive symptoms in left colon cancer. This is similar to the findings from an Ethiopian study by Zingeta et al 2023[5] and a study done in India [16]. In the Indian study, the most common presenting symptoms were abdominal pain (34%), obstructive symptoms (24%), and rectal bleeding (22.2%).[16]

Physical findings included pale conjunctiva in rectal and right colon cancers, peri-rectal masses in rectal cancer, and abdominal masses in right colon cancers, highlighting the importance of physical examination in diagnosis. The mean duration of complaints was 7 months and shorter than a report from Nigeria (14.5 months) and Tanzania (22 months) but similar to studies in the U.S. and India (6–6.2 months), suggesting potential delays in diagnosis in some regions[27].

6.3 HISTOLOPATHOLOGICAL PATTERN OF CRC

Colorectal cancer has different histologic variants, Adenocarcinoma (90%)has the highest incidence Among all CRC patients followed by signet ring cell carcinoma (3.9)% Globally. [16][2] In this study similarly (76.5%) of them had adenocarcinoma , but signet ring was the third common pathology . Based on their degree of Differentiation CRC Adenocarcinomas NOS (93.8%) are commonest followed by moderately differentiated (59.6%), poorly differentiated 18.5% .[4].in this study of 251 patient which biopsy was taken from

preoperatively 14 (5.6%) were poorly differentiated, 90.4% histologic grade were not documented in the preoperative pathology examination .From the 168 patients where surgery was done 120 specimen were collected , Adenocarcinoma followed by mucinous was common and (60.8%) were well differentiated. The difference in pathology grade of pre and post operative evaluation can be explained as due advanced stage of presentation and poor outcome of the poorly differentiated tumor, may not have been candidate for surgery.

Non-adenocarcinoma variants such as neuroendocrine tumors (NET) and squamous cell carcinoma (SCC) are generally uncommon in the western world, yet their prevalence is significant in other regions. For example, a study conducted in Addis Ababa reported these variants accounted for 6.8% of cases, while Soomin et al. found a 5% rate in Korea, where NET was the most frequently observed non-adenocarcinoma type (75.33%), followed by lymphoma (9.8%) and SCC (1.9%). The most common locations for these tumors were the low rectum and anus, typically affecting individuals in their 40s and 50s. In this study, the incidence of non-adenocarcinoma variants (16%) and higher than reported in India, Korea, and Ghana, with 8 patients (3.1%) having SCC identified in preoperative biopsies, all aged 40 and older, and originating from the lower rectum and anorectum. Four patients were diagnosed at an advanced stage and referred for palliative chemotherapy, while four underwent surgery, with two confirmed to have SCC postoperatively. NET was found in 0.3% of cases, aligning with findings from India, Korea, and the USA. Colon melanoma which is reported as extremely rare at 0.98%(only 14 case reports) in this study(0.7%) seen in cases advanced cases that were not amenable for surgery . This study highlights the varied histological patterns of colorectal cancer and indicates a need for further research in this field. [15]

6.4 INVESTIGATIONS

In our study, 76% of patients were diagnosed with anemia which is higher than the 70.1% reported in other Ethiopian studies. Only 5.9% of right colonic cancer patients had normal hemoglobin. Anemia can be present in 25-75 % of CRC patients.[28]but having high rate of anemia with severity is indirect indicator of local invasiveness and advanced stage of presentation as study done in Greece by Jocic et al 2022. [29]

6.5 TREATMENT AND OUTCOMES OF CRC PATIENTS

In our study of 304 CRC patients, surgical intervention was performed in 168 cases (55.3%), with 98 patients (32.2%) receiving adjuvant chemotherapy and only 2 (0.7%) undergoing radiotherapy. A concerning 74 patients (24.3%) did not receive any treatment due to financial constraints or the unavailability of services. Comparatively, Teka et al.[4] reported that surgery was the primary treatment in their study with 84.5% of patients operated, followed by 70.2% receiving adjuvant chemotherapy and only 8.1% undergoing radiotherapy. Eyob Kebede's study in Addis Ababa indicated that 70% of CRC patients received surgery, with minimal

radiotherapy access (2.7%).[3] In other study 56% of 209 patient at TASH, by Zingeta et al 26.8% had no any therapy. which is comparable to our study (24.3%).[30]

In this study segmental resection followed by stoma and anterior resection are the most commonly performed procedure while subtotal colectomy are the list performed unlike other LMIC, like NIGERIA Where right hemicolectomy (18.6%) followed by stoma and anterior resection (APR)(14.1%) and subtotal colectomy (13.8%)this can be due difference in tumor epidemiology .

In this study, 30.7% of patients experienced complications, with surgical site infections (SSIs) being the most common (32.8%),Anastomotic leak (12%). Emergency surgeries had notably higher complication rates (43.1%). When compared to other developing countries like India and Tanzania, the findings are consistent, with SSI rates ranging from 25-35% and anastomotic leaks occurring in 10-20% of cases. These high rates are attributed to limited surgical expertise, inadequate preoperative optimization, poor nutritional status and poor infection control. In contrast, developed countries report significantly lower complication rates, with SSIs at 5-10% and anastomotic leaks at 3-5%, due to advanced surgical techniques, standardized protocols, and comprehensive postoperative care. Additionally, in this study stoma reversal rates were (14.9%) lower than compared to in LMICs (20-30%) and developed nations (50-70%). Even though perioperative mortality is higher in LMICs (1-3%) than in developed countries; in our study it was (0.5%) which is comparable to HICs (0.5-1%). [7] [10]. Despite the challenges, In this study there were positive indicators for safe surgical practices in this study, such as negative surgical margins, low reoperation rates, and short hospital stays(8days). [20]

In this study 30 days mortality rate for the 168 patients operated, was 6.5%(11 patient) while 7 were lost to follow up .This is higher than studies in developed countries such as Norway (0-5%) ,USA(4.5%) [19]but comparative to study done at Nigeria (6.8%) by Ayandipol et al .[18] This both studies attribute this to presence comorbidities, unlike our study where more than half had none.

In our study of the patient recorded to have recurrence. more than half had elevated CEA value. According to the COLOFOL clinical trial which was conducted in 24 hospitals across Denmark, Sweden, and Uruguay higher preoperative CEA level indicating poor treatment response, high recurrence rate which is similar to studies done at other LMIC.[18] .anemia at presentation is also associated with increased morbidity and mortality.[29] Those with poorly differentiated histology had highest mortality rate than the others7(46.7%) were deceased at the last evaluation. indicating poorer outcome. This is similar to study done in Addis Ababa TASH by Atinafu et al. advanced stage of presentation (stage 3,4) associated with higher mortality in both LMIC.[31][27]

6.6 Limitation of the study

This study's retrospective design presents inherent limitations, including potential biases in data collection and patient recall. The reliance on existing medical records may result in incomplete data regarding subsequent management and long-term outcomes. Additionally, the study was conducted at a single center, which may limit the generalizability of the findings to other regions. The study period coincided with active conflict, resulting in missing charts, unavailable imaging, and incomplete records in the smart care system. The absence of a robust cancer registry system in Tigray hinders our ability to track patient outcomes effectively, leading to a significant number of patients being unreachable for follow-up assessments.

Future research should focus on prospective studies that can address these limitations and provide a more comprehensive understanding of CRC management in Ethiopia

7 Conclusion

The clinical presentation of the CRC patients was similar to other studies conducted in Ethiopia and other LMICs with rectal bleeding being the most common chief complaint. Rectal cancer is more common than colon cancer. Most patients present at advanced stages, often from rural areas outside Mekelle, indicating limited access to early diagnostic services. One-fifth of the patients were younger. The most common histological type is well-differentiated adenocarcinoma, aligning with global CRC pathology trends. Surgery remains the primary treatment. There were positive indicators for safe surgical practices including negative surgical margins and low reoperation rates. Operated patients show better follow-up rates, underscoring the importance of surgical intervention. Over half of the operated patients received chemotherapy, reflecting the advanced disease stage at presentation. However, radiotherapy was underutilized despite its potential benefits. Surgical intervention alone may not suffice for advanced-stage CRC. Additionally, more than two-thirds of patients were untraceable.

8 Recommendation

To address the high mortality associated with colorectal cancer (CRC), early screening should be prioritized, particularly for individuals with inflammatory bowel disease (IBD) or a family history of CRC, as the average age of diagnosis is decreasing. Screening protocols should include those under 50 years, utilizing affordable and effective tools like fecal occult blood tests (FOT) and endoscopic ultrasound (EUS).

Additionally, establishing a comprehensive cancer registry is vital for informed decision-making and future research. Health education and awareness programs are needed to bridge the knowledge gap in the community. Policymakers should create financial aid systems for oncology patients facing high treatment costs, while hospital administrators must enhance oncology units by investing in necessary equipment and infrastructure, including radiotherapy facilities, to improve patient outcomes.

9. References

[1] Aynalem ZB, Adal AB, Ayele TF, Bayeh GM. Mortality rate and predictors of colorectal cancer patients in Ethiopia : a systematic review and meta-analysis 2024:1–11.

[2] Deo SVS, Kumar S, Bhoriwal S, Shukla NK, Sharma A, Thulkar S. Colorectal Cancers in Low- and Middle-Income Countries — Demographic Pattern and Clinical Pro fi le of 970 Patients Treated at a Tertiary Care Cancer Center in India original reports abstract 2021.

[3] Etissa EK, Assefa M, Ayele BT. Prognosis of colorectal cancer in Tikur Anbessa Specialized Hospital, the only oncology center in Ethiopia. PLoS One 2021;16:e0246424. https://doi.org/10.1371/journal.pone.0246424.

[4] Teka MA, Yesuf A, Hussien FM, Hassen HY. Histological characteristics, survival pattern and prognostic determinants among colorectal cancer patients in Ethiopia: A retrospective cohort study. Heliyon 2021;7:e06366. https://doi.org/10.1016/j.heliyon.2021.e06366.

[5] Zingeta GT, Worku YT, Getachew A, Feyisa JD, Furgassa H, Belay W, et al. Clinical presentation, treatment patterns, and outcomes of colorectal cancer patients at Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia: A prospective cohort study. Cancer Rep 2023;6. https://doi.org/10.1002/cnr2.1869.

[6] Moul JW, Committee E. Principles of Colorectal Cancer Staging, CRC staging from AJCC. Ajcc 2018:1–21.

[7] Ahmed M, Yesuf A, Mohammed F, Yimam H. Heliyon Histological characteristics , survival pattern and prognostic determinants among colorectal cancer patients in Ethiopia : A retrospective cohort study. HLY 2021;7:e06366. https://doi.org/10.1016/j.heliyon.2021.e06366.

[8] Simon K. Colorectal cancer development and advances in screening. Clin Interv Aging 2016;11:967–76. https://doi.org/10.2147/CIA.S109285.

[9] Teka MA, Yesuf A, Hussien FM, Hassen HY. Histological characteristics, survival pattern and prognostic determinants among colorectal cancer patients in Ethiopia: A retrospective cohort study. Heliyon 2021;7. https://doi.org/10.1016/j.heliyon.2021.e06366.

[10] Pak H, Maghsoudi LH, Soltanian A, Gholami F. Surgical complications in colorectal cancer patients. Ann Med Surg 2020;55:13–8. https://doi.org/10.1016/j.amsu.2020.04.024.

[11] Collaborative G. Global variation in postoperative mortality and complications after cancer surgery : a multicentre , prospective cohort study in 82 countries n.d.:387–97. https://doi.org/10.1016/S0140-6736(21)00001-5.

[12] Agyemang-Yeboah F, Yorke J, Obirikorang C, Batu EN, Acheampong E, Frimpong EA, et al. Colorectal cancer survival rates in Ghana: A retrospective hospital-based study. PLoS One 2018;13:1–15. https://doi.org/10.1371/journal.pone.0209307.

[13] Liu Z. Gastrointestinal cancers. 2019. https://doi.org/10.1201/9781351208277-17.

[14] Teka MA, Yesuf A, Hussien FM, Hassen HY. Histological characteristics, survival pattern and prognostic determinants among colorectal cancer patients in Ethiopia: A retrospective cohort study. Heliyon 2021;7. https://doi.org/10.1016/j.heliyon.2021.e06366.

[15] Nam S, Kim D, Jung K, Choi YJ, Kang JG. Coloproctology Analysis of the Incidence and Clinical Features of Colorectal Nonadenocarcinoma in Korea : A National Cancer Registry-Based Study Coloproctology 2020;36:390–7.

[16] Sehrawat A, Khanna M, Kayal S, Sundriyal D, Tiwari S. Clinicopathologic Pro fi le and Treatment Outcomes of Colorectal Cancer in Young Adults : A Multicenter Study From India 2025:1–11. https://doi.org/10.1200/GO.23.00225.

[17] Lindholm S, Lindskogen S, Gamage B, Kurlberg G, Ljungman D. Measuring quality in colorectal cancer surgery in low- and middle-income countries : The Clavien-Dindo classification in a Sri Lankan cohort. Ann Med Surg 2022;79:104018. https://doi.org/10.1016/j.amsu.2022.104018.

[18] Ayandipo OO, Afuwape OO, Ojo AB, Egbuchulem IK, Irabor DO. Perioperative Morbidity and Mortality After Emergency and Elective Colon and Proximal Rectal Surgery in Ibadan. Ann Ibadan Postgrad Med 2020;18:24–30.

[19] van Eeghen EE, den Boer FC, Loffeld RJLF. Thirty days post-operative mortality after surgery for colorectal cancer: A descriptive study. J Gastrointest Oncol 2015;6:613–7. https://doi.org/10.3978/j.issn.2078-6891.2015.079.

[20] De Nes LCF, Hannink G, T'Lam-Boer J, Hugen N, Verhoeven RH. Postoperative mortality risk assessment in colorectal cancer: Development and validation of a clinical prediction model using data from the Dutch ColoRectal Audit. BJS Open 2022;6. https://doi.org/10.1093/bjsopen/zrac014.

[21] Id BB, Taylor L, Bogale N, Hailu D, Zerhouni YA. PLOS ONE Survival and predictors of mortality among colorectal cancer patients on follow-up in Hawassa University Comprehensive Specialized Hospital , Sidama region , Southern Ethiopia , 2022 . A 5-year retrospective cohort study 2024:1–16. https://doi.org/10.1371/journal.pone.0304820.

[22] Atinafu BT, Bulti FA, Demelew TM. Survival Status and Predictors of Mortality Among Colorectal Cancer Patients in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A Retrospective Follow-up Study. J Cancer Prev 2020;25. https://doi.org/10.15430/jcp.2020.25.1.38.

[23] Egenvall M, Martling A, Veres K, Wille-jørgensen P, Petersen SH, Laurberg S, et al. European Journal of Surgical Oncology No bene fi t of more intense follow-up after surgery for colorectal cancer in the risk group with elevated CEA levels e An analysis within the COLOFOL randomized clinical trial bet Horv a 2021;47. https://doi.org/10.1016/j.ejso.2021.03.235.

[24] Wassie M, Beshah DT, Tiruneh YM. Advanced stage presentation and its determinant factors among colorectal cancer patients in Amhara regional state Referral Hospitals, Northwest Ethiopia. PLoS One 2022;17:e0273692. https://doi.org/10.1371/journal.pone.0273692.

[25] Atinafu BT, Kebede WM, Demlew TM, Aynalem YA, Shiferaw WS, Tarekegn FN, et al. Mortality rate and its determinants among colorectal cancer patients in comprehensive specialized hospitals, Ethiopia: a retrospective cohort study. Pan African Med J One Heal 2022;7. https://doi.org/10.11604/pamj-oh.2022.7.26.29412.

[26] Dindo D, Demartines N, Clavien P. Classification of Surgical Complications 2004;240:205–13. https://doi.org/10.1097/01.sla.0000133083.54934.ae.

[27] Assefa GK, Kebede AG, Kebede T, Atnafu A. High Magnitude Advanced Colorectal Cancer at Diagnosis in Ethiopian Patients : Imaging Pattern and Associated Factors 2023.

[28] CHARDALIAS L, PAPACONSTANTINOU I, GKLAVAS A, POLITOU M, THEODOSOPOULOS T. Iron Deficiency Anemia in Colorectal Cancer Patients: Is Preoperative Intravenous Iron Infusion Indicated? A Narrative Review of the Literature. Cancer Diagnosis Progn 2023;3:163–8. https://doi.org/10.21873/cdp.10196.

[29] Jocic M, Arsenijevic N, Gajovic N, Jurisevic M, Jovanovic I, Jovanovic M, et al. Anemia of Inflammation in Patients With Colorectal Cancer: Correlation With Interleukin-1, Interleukin-33 and Galectin-1. J Med Biochem 2022;41:79–90. https://doi.org/10.5937/JOMB0-30135.

[30] Zingeta GT, Worku YT, Getachew A, Feyisa JD, Furgassa H, Belay W, Mengesha T, Jemal A, Assefa M. Clinical presentation, treatment patterns, and outcomes of colorectal cancer patients at Tikur Anbessa Specialized Hospital in Addis Ababa EA prospective cohort study. CR (Hoboken). 2023 S doi: 10. 1002/cnr2. 1869. E 2023 J 15. P 37452615; PP. No Title n.d.

[31] Park KS, Hong YK, Choi YJ, Kang JG. Clinicopathologic characteristics of early-onset colorectal cancer. Ann Coloproctol 2022;38:362–9. https://doi.org/10.3393/ac.2021.00976.0139.

10. ANNEXES

Annex -I . Information sheet

TABLE 1. Classification of Surgical Complications

Grade	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions
	Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications
	Blood transfusions and total parenteral nutrition are also included
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade IIIa	Intervention not under general anesthesia
Grade IIIb	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications)* requiring IC/ICU management
Grade IVa	Single organ dysfunction (including dialysis)
Grade IVb	Multiorgan dysfunction
Grade V	Death of a patient
Suffix "d"	If the patient suffers from a complication at the time of discharge (see examples in Table 2), the suffix "d" (for "disability") is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

*Brain hemorrhage, ischemic stroke, subarrachnoidal bleeding, but excluding transient ischemic attacks.

Annex II. Questionnaire

1.SOCIO DEMOGRAPHIC PATTERN

No	QUESTIONS	CODE	Remark
100	Card number	_____	
101	Sex	1. Male 2. Female	
102	Residence	1. Mekelle 2. Outside of Mekelle	
103	Age	…….yrs	
104	Date of confirmed colorectal cancer diagnosis	……..	
105	Family history of cancer	1.yes 2.No	
105.1	If yes	1.colrectal cancer 2.gastric cancer 3.ovarian cancer 4.skin cancer 5.cervical cancer 6.others	
106	Any previous hx of IBD dx	1.yes 2.No	
106	Comorbidities	1. NONE 2. DM 3. HTN	Multiple choice

		4. RVI 5. CKD 6. CLD	

3. Clinical presentation of CRC

No	QUESTIONS	CODE	remark
201	Chief complaint	1. Abdominal pain 2. Abdominal mass 3. Rectal bleeding 4. Obstructive symptom 5. Peri Rectal mass 6. Tenismus 7. Weigh t loss 8. Loss of appetite 9. Light headedness 10. Change in bowel habit	
202	Duration of chief complaint	……in days	
201	Presenting symptoms	1. Abdominal pain 2. Abdominal mass 3. Rectal bleeding 4. Obstructive symptom 5. Peri Rectal mass 6. Tenismus 7. Wt loss 8. Loss of appetii 9. Light headedness	Re select the chief complaint

		10. Change in bowel habit	
202	Metastatic symptoms	1.cough 2.chest pain 3.shortness of breath 4.ascites 5.jaundice 6.vx bleeding 7.back pain 8.long bone pain 9.Headache 10.others,specify	

No	QUESTIONS	CODE	Remark
301	General appearance	1. Well looking 2. Acute sick looking 3. Chronic sick looking 4. Acute on chronic sick looking	
301	Physical findings	nsion ny	

		itive finding	

4LABORATORY INVESTIGATIONS OF CRC PATEINTS

No	QUESTIONS	CODE	remark
401	Hgb		(g/dl).decimal
402	Albumin		Optional
	Total protein		Optional
403	FOT	1.Yes 2.No	
403.1	If yes	1.postive 2.negative	
404	CEA(ng/ml)		optional

5. RADIOLOGIC INVESTIGATIONS OF CRC

No	QUESTIONS	CODE	remark
501	Does the patient have **MRI /CT**	1. Yes 2. No	
501.1	If yes, where was the primary site of tumor	1.cecum 2.ascending colon 3.Transverse colon 4.Descending colon 5.Sigmoid colon 6.upper rectum	

		7.mid rectum 8.lower rectum 9.anal canal	
501.2	T stage of tumour	1.T1 2.T2 3.T3 4.T4 5.unspecified	
501.3	Nodal stage of tumour	1.Node positive 2.Node negative 3.nodal status unknown	
501.4	Metatstatic	1.Mx 2.M0 3.M1	
501.5	Clinical Stage	1. stage 0 2. stage 1 3. Stage 2a 4. Stage 2b 5. Stage 2c 6. Stage 3a 7. Stage 3b 8. stage 3c 9. stage 4	
502	Colonoscopy done	1. Yes 2. No	

502.1	If yes ,site of lesion	1.cecum 2.ascending colon 3.Transverse colon 4.Descending colon 5.Sigmoid colon 6.upper rectum 7.mid rectum 8.lower rectum 9.anal canal	
502.2	If yes appearance of lesion	1. polyp 2. flat 3.ulcerative 4.normal 5. inconclusive	
503	Abdominopelvic us done	1.yes 2.no	
503.1	If yes ,primary site	1.cecum 2.ascending colon 3.Transverse colon 4.Descending colon 5.Sigmoid colon 6.upper rectum	

		7.mid rectum 8.lower rectum 9.anal canal	
503.2	If yes , size of mass		Optional
503.3	If yes , findings	1.Ascites 2. Metastasis To Adjacent Structure 3.Distant Metastasis 4.Ln Involvement 5.Vascular Invasion 6.omental involvement 7. abdominal wall involment 8.others	
504	Chest x ray done	1.yes 2. no	
504.1	If yes	1.normal 2. pleural effussio 3.nodules ,mass 4.pathology not specified	
505	Endorectal us /EUS	1.yes 2.no	

6. COLONOSCOPY INVESTIGATION

No	QUESTIONS	CODE	Remark
601	Pre Op colonoscopy	1. Yes 2. No	
602	Pre op biopsy	1. Yes 2. No	
602.1	If yes , what was the pathologic result	1..Adenocarcinoma 2.mucinius 3.tubovillous 4.signet ring cell 5. non representative 6.others	
602.2	If yes ,histologic grade	1.well differentiated 2.Moderately differentiated 3..Poorly differentiated	
603	Pre Op chemotherapy	1. Yes 2. No	
602.1	What Regimen was used?	1.FOLFOX 2.CAPOX 3.FOLFIROX 4.not specified	
602	How many cycles were given?	…….Max 12 cycle	

.2			
602 .3	response	1.yes 2.No	
	If yes ,	1. clinical 2.radiologic 3.laboratorical /CEA	

7. Treatment modalities of CRC

701	What type of treatment given	1.surgery 2.chemotherapy 3.neo adjuvant 4.radio therapy 5.none	
701.1	If surgery , no of surgery		1-5

8. surgery for CRC

	QUESTIONS	CODE	Remark
801	Date of surgery		
802	Pre op staging CT done	1. Yes 2. No	
802.1	If yes , clinical staging ,dukes	1. Stage A: Limited to muscularis propria; nodes not involved 2. Stage B: Extending beyond muscularis propria; nodes not involved	

		3. Stage C: Nodes involved but highest (apical) node spared 4. Stage D: Distant metastatic spread	
803	Order of procedure	1. First 2. Second 3. Third 4. Fourth	
804	Scheduled	1.Emergency basis 2. Elective basis	
804.1	if elective, Bowel prep	1. Yes 2. No	
804.1.	If yes. type of bowel prep	1.mechanical 2,medical	
804.1.	If yes ,duration of prep in (max 3 days)	……..days	
804.1.	If on Elective ,procedure done	1.Deferred 2.RO resection 3.R1resection 4.other	
804.2	If on Emergency, procedure done	1.deferred 2.diversion stoma 3.stoma + biopsy	
805	Intra op finding	1.Mass 2.Perforation	

		3.adjacent structure invasion 4.vascular invasion 5.carcinomatosis 6.distal metastasis 7.others	
806	Primary Tumor Location …	1.cecum 2.ascending colon 3.Transverse colon 4.Descending colon 5.Sigmoid colon 6.upper rectum 7.mid rectum 8.lower rectum 9.anal canal	select multiple
805	types of Surgery	1. Rt hemicolectomy 2. Rt extended hemi colectomy 3. Lt hemi colectomy 4. Lt extended hemi colectomy 5. Total colectomy 6. Total procto colectomy 7. Subtotal colectomy 8. Transverse colectomy 9. Segmental resection 10. APR 11. LAR 12. Ileostomy 13. Colostomy	For both elective and emergen multiple choices
806	If elective Lymph node dissection?	1. Yes 2. No	
807	Intra op accident	Yes No	both
807.1	If yes, what was it?	1.Tumor rupture 2. Vascular injury 3. Massive transfusion 4. Removal of adjacent organ 5 specify	
808	Intra-op transfusion?	1. Yes 2. No	
808.1	If yes how many units	…….	decimals

809	Intra-op death	1.Yes 2.No	
809.1	If yes cause of death	…….	

9. Post operative complications of CRC patient

No	QUESTIONS	CODE	Remark
901	Did the patient develop post op complications?	1.Yes 2.NO	
901.1	If yes , specify	1. surgical site infection 2. intra abdominal collection 3. anastomotic leak 4.HAI 5.DVT 6.others	
902	How many days did the patient stay in hospital before discharge?	……..	
903	Reoperation on same admission	1.Yes 2.NO	
903.1	If yes, indication for reoperation	1. deep surgical site infection 2. intra-abdominal collection	

		3. anastomotic leak 5.others	

9.Condition up on discharge

No	QUESTIONS	CODE	
901	Condition up on discharge	1. Alive 2. Dead	
901.1	If dead , Timing of death		
901.2	cause of death		

10. Pathology diagnosis

No	QUESTIONS	CODE	
101	Location of tumor	1. cecum 2. ascending colon 3. descending colon 3. transverse colon 4.sigmoid colon 5.upper rectum 6 mid rectum 7 lower rectum	

		8.anus	
102	Pathologic Stage of tumor	……	
103	histological type	1.Adenocarcinoma 2.mucinius 3.tubovillous 4.signet ring cell 5. inconclusive 6.others	
104	Resection margin	1.Negative 2.Positive	

11 . follow up

No	QUESTIONS	CODE	Remark
111	Adjuvant Chemotherapy given	1.Yes 2.NO	
111.1	Date of adjuvant chemotherapy initiated		
111.2	If yes, Chemotherapy	1.FOLFOX 2.CAPOX 3.FOLFIROX 4.not specified	
111.3	No of cycles	…….	

112	Adjuvant Radiotherapy	1.Yes 2.NO 3.lost to follow up	
113	Post-op recurrence	1.Yes 2.NO	
113.1	If yes , interval between definitive surgery and recurrence	…..	
114	Day 7 status	1. Alive 2. Dead 3.Lost to follow up	1.
114.1	If dead , cause of death	……	
115	Day 30 status of the patient	3. Alive 4. Dead 5. Lost to follow up	
	If dead , cause of death		
116	Day 60 status	1. Alive 2. Dead 3. Lost to follow up	
	If dead , cause of death		
117	Day 90 status	1. Alive 2. Dead 3. Lost to follow up	
	If dead , cause of death		
118	Last registered patient visit		
Remark			

Phone no			