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Clinical Staging, Management Strategies, and Outcomes of Colorectal Cancer among Patients in the West Bank: A Retrospective Evaluation

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Abstract

Colorectal cancer (CRC) represents the second most prevalent malignancy among Palestinian patients. Although cancer care services in West Bank hospitals have advanced in recent years, specialized interventions—such as palliative care, targeted therapy, bone marrow transplantation, and personalized treatment—remain limited. This study aimed to evaluate the stages at diagnosis, treatment protocols, and survival outcomes of CRC patients in the West Bank. This retrospective study utilized medical records from An-Najah National University Hospital (NNUH), a major oncology center in the region. Patients with histologically confirmed CRC (stages I–IV) who received surgical and/or medical treatment were included. Data were systematically extracted using a standardized collection form. Statistical analyses were conducted using SPSS version 27, and survival analysis was performed via regression modeling, examining the relationship between survival duration (from diagnosis to last follow-up) and treatment modalities (surgery, chemotherapy, radiotherapy). Data were analyzed for 252 CRC patients from NNUH, comprising 143 males and 109 females aged 27–86 years (mean 60.6 ± 11.4 years). Among them, 183 (72.6%) had colon cancer, 29 (11.5%) had rectal cancer, and 40 (15.9%) presented with both. At diagnosis, 3 patients (1.2%) were in stage I, 33 (13.1%) in stage II, 57 (22.6%) in stage III, and 159 (63.1%) in stage IV. Surgery was the most common treatment (230 patients, 91.3%), followed by chemotherapy (227 patients, 90.1%) and radiotherapy (38 patients, 15.1%). Regarding chemotherapy regimens, 40 patients (15.8%) received FOLFOX (folinic acid, fluorouracil, oxaliplatin), 25 (9.9%) received FOLFIRI (folinic acid, fluorouracil, irinotecan), and 187 (74.2%) were treated with agents such as capecitabine, oxaliplatin, bevacizumab, cetuximab, regorafenib, cisplatin, etoposide, or gemcitabine, alone or in combination. Patient outcomes were categorized into six groups: death, cure, disease progression, recurrence, under-treatment, and unknown. Mortality was substantial, with 104 patients (41.3%) dying within a short period post-diagnosis, likely due to late presentation. Surgical intervention significantly improved survival ($p = 0.033$). The majority of patients were diagnosed at advanced stages of CRC. Although treatment followed international guidelines, survival outcomes remained poor, reflecting high mortality and low cure rates. Further research is warranted to evaluate the implementation and optimization of chemotherapy protocols. Enhanced survival may be achieved through the active participation of clinical pharmacists in chemotherapy selection, dosing, and monitoring. This study underscores the importance of public education and the pivotal role of primary care–based CRC screening in achieving earlier detection and improved prognosis.

Keywords: Colon cancer, Colorectal cancer, Rectal cancer, West Bank, Healthcare

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Introduction

Colorectal cancer (CRC) is among the most common malignancies worldwide [1]. Over recent decades, its incidence has risen markedly, making it no longer the third but one of the leading cancers globally, after breast and lung cancers [2]. In 2000, approximately 945,000 new CRC cases were diagnosed, accounting for 9.4% of all cancers and 492,000 related deaths [3]. By 2007, CRC had become the second most common cause of cancer-related mortality among both men and women, with an annual global incidence of about one million cases and more than half a million deaths [4]. In 2008, over one million new diagnoses were reported, confirming CRC as the second leading cause of cancer death, following lung cancer [5].

CRC occurs most frequently in high-income and industrialized countries such as those in North America and Western Europe, as well as parts of Asia including Japan and Singapore [6]. In contrast, it remains less prevalent in certain African and Asian nations, though males are generally more affected than females [7]. Nevertheless, in the past few decades, Asian countries have seen a rapid increase in CRC incidence, approaching rates observed in Western populations, particularly among higher-income groups [8].

The etiology of CRC is multifactorial and not yet fully understood. The disease typically develops over an extended period and involves a combination of genetic, environmental, and lifestyle factors. The risk of CRC differs across countries and populations, largely influenced by dietary habits, lifestyle, and hereditary predispositions. Studies have shown that migrants from low-incidence to high-incidence countries experience an elevated CRC risk within one or two generations, emphasizing the role of environmental and lifestyle factors [9]. Diets low in fiber but high in fat, red meat, and alcohol, along with physical inactivity and smoking, are key modifiable contributors. Additional risk factors include advanced age (over 50 years), family or personal history of CRC or adenomas, hereditary non-polyposis colorectal cancer syndromes, and inflammatory bowel diseases such as ulcerative colitis and Crohn's disease [9]. Notably, hereditary syndromes account for only about 5% of all CRC cases.

The progression of CRC follows a multistep sequence in which normal epithelial cells undergo genetic mutations leading to abnormal proliferation. Over time, these cells acquire malignant properties, including invasiveness and metastatic potential [10].

The American Cancer Society recommends CRC screening beginning at age 45, as most sporadic cases occur in individuals older than this in developed countries. Early screening facilitates the timely detection and management of premalignant or early-stage lesions, offering a cost-effective preventive strategy. Routine fecal occult blood testing significantly reduces CRC mortality [11,12], and further benefits are achieved through sigmoidoscopy, colonoscopy, and the removal of precancerous polyps. However, barriers to widespread screening include limited public awareness, embarrassment surrounding the procedure, and insufficient physician recommendations [13].

In the West Bank, breast, lung, colon, leukemia, and brain cancers account for 58.6% of cancer-related deaths, representing more than half of all cancer fatalities among Palestinians, according to the National Cancer Registry of the Health Information Center [14]. Colon cancer ranks first among cancers affecting men (11.2%) and second overall across both sexes (9.4%), followed by lung cancer (8.7%) [15]. Official statistics from the Palestinian Ministry of Health indicate that 3,174 cancer cases were recorded in the West Bank in 2019—an increase of 2.2% compared to 2,102 cases in 2018—corresponding to an incidence rate of 117.8 per 100,000 population. Of these, 52.4% (1,664 cases) were females and 47.6% (1,510 cases) males. Approximately 34.5% of cases (1,095 patients) occurred among individuals aged over 64 years, a group that constitutes only 3.3% of the population. Meanwhile, 61.0% of cases (1,936 patients) were reported in the 15–64 age group, and 4.5% (143 patients) among those younger than 15 years, who represent 38.4% of the total population [16].

In the West Bank, cancer treatment is primarily delivered in Ministry of Health hospitals, notably Al-Hussein Hospital in Beit Jala and Al-Watani Hospital in Nablus, which serve as the main oncology centers. Despite this, epidemiological data remain limited, and there is a lack of studies assessing treatment adherence, risk factors, and survival outcomes among CRC patients in this region. To the best of our knowledge, no comprehensive study has yet evaluated the survival of CRC patients or adherence to international treatment guidelines in the West Bank. Therefore, this study aims to investigate the epidemiology, treatment protocols, survival rates, and risk factors of CRC among Palestinian patients in the West Bank. Such research is crucial for providing evidence-based insights that can guide healthcare providers in optimizing cancer care delivery.

Since the 1994 Oslo Agreement, the Palestinian Authority has assumed responsibility for healthcare management in the West Bank and Gaza Strip, with support from the World Health Organization and international donors, including the U.S. government. These collaborations underscore the growing importance of strengthening the Palestinian healthcare system to meet rising cancer care demands.

Despite facing substantial economic and social challenges, the West Bank's healthcare system performs relatively

well compared with other Arab countries, with comparatively high life expectancy and low rates of maternal, infant, and child mortality [17]. Nevertheless, access to specialized cancer care remains highly restricted. For instance, radiation therapy and personalized oncology services are available only at Augusta Victoria Hospital in Jerusalem, while bone marrow transplantation is offered solely at An-Najah University Hospital in Nablus. Patients requiring advanced diagnostic or therapeutic interventions, such as PET-CT scans, often need referral to hospitals outside the West Bank, including facilities in Israel, Jordan, or Egypt [18].

Although the provision of cancer care has gradually improved, several key services—such as palliative care, targeted therapy, individualized treatment plans, and bone marrow transplantation—remain limited due to shortages of trained specialists, insufficient medication availability, and other systemic challenges. As the population continues to grow, the incidence and burden of cancer are expected to increase, placing additional pressure on the healthcare system's financial and technical capacities [15]. A recent evaluation of death certificates in the West Bank revealed cancer mortality trends in the region, showing lung cancer as the leading cause of death among men (22.8%) and breast cancer as the most common among women (21.5%). Other notable causes included prostate cancer in men (9.5%) and colorectal cancer in women (11.4%). These findings also suggest that the Palestinian mortality registry has become increasingly reliable over time [19].

The current study focuses on colorectal cancer (CRC) in the West Bank, aiming to characterize patient survival and treatment practices. It examines CRC distribution by age, gender, and disease stage, outlines the main treatment strategies employed by clinicians, and identifies factors that influence patient prognosis. By documenting treatment outcomes and survival patterns, this research provides a foundation for improving CRC management, guiding clinical practice, and informing policy development in the region.

Methods

Study design

This research employed a retrospective design, utilizing patient records from a specialized oncology center. Medical charts of colorectal cancer (CRC) patients treated at An-Najah National University Hospital (NUH) in Nablus were reviewed between January and February 2021, covering treatments administered from January 2014 to February 2021. NUH functions as a tertiary referral facility for cancer care in the northern West Bank. Only patients with pathologically confirmed CRC (stages I–IV) who had received surgical or medical treatment were included.

Eligibility criteria

Patients were eligible if they were aged 18 years or older, of either sex, had a confirmed CRC diagnosis, and had undergone surgery (e.g., colectomy, laparotomy, or tumor resection), chemotherapy, or radiotherapy. Patients younger than 18, pregnant women, or those who had not received any form of treatment were excluded. Based on Ministry of Health statistics, 300–400 new CRC cases are reported annually in the West Bank; this study captured all eligible cases treated at NUH within the specified period.

Data extraction

To ensure consistency, a standardized data collection form (Supplementary Table S1) was used. Information retrieved from patient charts included demographics (age, sex, marital status), tumor characteristics (primary site, histology, grade, lymphovascular invasion, depth of invasion, lymph node involvement), clinical presentation, surgical and adjuvant treatment details, complications, recurrence data (dates and causes), follow-up duration, and mortality information (dates and causes).

Ethical approval

The study was reviewed and approved by NUH's Institutional Review Board (IRB Permit No. Mas Sep/2020/3). Patient confidentiality was strictly maintained, with data anonymized and only aggregate findings reported. Objectivity in data collection, analysis, and interpretation was rigorously upheld.

Statistical analysis

SPSS version 21 was used for all analyses. Continuous variables were summarized using means and standard deviations, while categorical data were expressed as counts and percentages. Associations between categorical variables were assessed using χ-square or Fisher's exact tests as appropriate. Statistical significance was defined as $p < 0.05$.

Results

Patient characteristics

A total of 252 CRC patient records from NUH were included. The majority were male, with a male-to-female ratio of 1.31:1. Patient ages ranged from 27 to 86 years, with an average of 60.6 ± 11.4 years. Most patients were married and reported no history of alcohol consumption or smoking. Interestingly, 18% (46 patients) were under 50 years old, highlighting a concerning trend of early-onset CRC [20].

Certain socio-demographic information, such as weight, height, blood type, educational background, dietary habits, and occupation, was inconsistently recorded, limiting the ability to draw conclusions from these variables. Consequently, the analysis focused on key demographic

factors and clinical features reliably captured in the medical records.

Table 1. Demographic information of patients

Category	Subcategory	Count	(%)	Total
Gender	Male	143	(56.7)	
	Female	109	(43.3)	
Age (years)	Mean (SD)	60.64 (±11.4)		
	Minimum	27		
	Maximum	86		
Marital Status	Single	67	(26.6)	252
	Married	173	(68.7)	
	Widowed	10	(4.0)	
	Divorced	2	(0.8)	
Smoking	Never	187	(74.2)	
	Former	28	(11.1)	
	Current	37	(14.7)	
Alcohol Use	No	251	(99.6)	
	Yes	1	(0.4)	
Height (cm)	Mean (SD)	167.4 (±12.4)		83
	Minimum	150		
	Maximum	185		
Weight (kg)	Mean (SD)	74.3 (±3.1)		
	Minimum	33		95
	Maximum	120		

Approximately half of the 252 patients had no documented history of comorbid conditions beyond colorectal cancer. The limited comorbidity data that were available are summarized in **Table 2**. In several cases, patients presented with multiple concurrent conditions, resulting in a diverse range of medical histories. It is important to note that key clinical details, such as histories of inflammatory bowel disease, allergies, or other relevant conditions, were frequently missing from the records.

Table 2. Medical histories of patients

Comorbid Disease	N
None reported	128
Hypertension	73
Diabetes Mellitus	64
Hypothyroidism	15
Ischemic Heart Disease	13
Asthma	5
Chronic Kidney Disease	4
Heart Failure	3
End Stage Renal Disease	3

Colorectal cancer characteristics

Among the 252 patients, 183 (72.6%) were diagnosed with colon cancer alone, 29 (11.5%) with rectal cancer only, and 40 patients (15.9%) had tumors involving both the colon and rectum, or located at the recto-colonic junction. Disease staging, assessed using both the I–IV and TNM classification systems, is summarized in **Tables 3 and 4**. Alarmingly, a majority of patients (63.1%) were diagnosed at stage IV, reflecting a substantial proportion presenting with advanced disease. Consistently, a significant number of cases exhibited extensive primary tumor involvement accompanied by lymph node metastasis or distant metastases at the time of diagnosis.

Table 3. Stages of colorectal cancer at diagnosis

	N	(%)
Stage I	3	(1.2)
Stage II	33	(13.1)
Stage III	57	(22.6)
Stage IV	159	(63.1)
Total	252	(100)

Table 4. TNM stages of colorectal cancer at diagnosis

	N
T1	1
T2	40
T3	133
T4	43
M0	87
M1	161
N0	61
N1	125
N2	36
N3	2

Chi-square analysis indicated no statistically significant relationship between patient gender and CRC stage ($p = 0.553$). Similarly, gender was not significantly associated with the type of colorectal cancer, whether colon or rectal, with p-values of 0.539 and 0.965, respectively **(Table 5)**.

Table 5. Association between gender and colorectal cancer and stages

Gender	Colon Cancer		Rectal Cancer		Stage			
	No (N)	Yes (N)	No (N)	Yes (N)	I (N)	II (N)	III (N)	IV (N)
Female	11	98	79	30	1	13	21	74
Male	18	125	104	39	2	20	36	84
p-value*	0.53		0.96					0.55

* χ-square test.

Treatment strategies

The data collection form captured detailed information regarding colorectal cancer treatment, beginning with the general treatment approach (surgery, chemotherapy, or radiotherapy), as summarized in **Table 6**. It also recorded the specific chemotherapy regimens used and the number of cycles administered. Most patients received combination therapy, typically involving both surgery and chemotherapy, whereas a smaller proportion underwent radiotherapy. Specifically, surgical intervention was performed in 91.3% of cases, chemotherapy was administered to 90.1%, and radiotherapy to 15.1% of patients **(Table 6)**. In several instances, the precise type of

surgical procedure was not documented, potentially encompassing palliative resection of the primary tumor, curative-intent resection of hepatic metastases, or other surgical interventions. Similarly, the medical records often lacked details regarding the chemotherapy regimen and did not differentiate between neoadjuvant and adjuvant therapy.

Table 6. Treatment strategies of colorectal cancer (CRC) patients

Gender	Colon Cancer		Rectal Cancer		Stage			
	No (N)	Yes (N)	No (N)	Yes (N)	I (N)	II (N)	III (N)	IV (N)
Female	11	98	79	30	1	13	21	74
Male	18	125	104	39	2	20	36	84
p-value*	0.53		0.96					0.55

Chemotherapy regimens

Among the 252 patients, four individuals receiving FOLFOX appeared to have been undertreated, a situation that could potentially have been avoided with input from a clinical pharmacologist. The cohort received a variety of chemotherapy approaches, summarized in **Table 7**. FOLFOX—a regimen combining folinic acid, fluorouracil, and oxaliplatin—was the most frequently prescribed protocol. FOLFIRI, consisting of folinic acid, fluorouracil, and irinotecan, was used less often. Other patients were treated with alternative chemotherapy agents, including small-molecule drugs and targeted therapies using monoclonal antibodies such as cetuximab, bevacizumab, and capecitabine. Overall, FOLFOX emerged as the regimen of choice among clinicians, reflecting its broader acceptance in practice compared with FOLFIRI.

Table 7. Chemotherapy drugs of colorectal cancer (CRC) patients

Treatment Regimen	N	(%)
FOLFOX	35	(13.8)
FOLFOX + mAb	4	(1.5)
FOLFOX + Zoledronic acid	1	(0.4)
FantasyIRI	17	(6.7)
FOLFIRI + mAb	8	(3.1)
Capecitabine	28	(11.1)
Capecitabine + Oxaliplatin	68	(26.9)
Bevacizumab	18	(7.1)
Cetuximab	6	(2.3)
Regorafenib	1	(0.4)
Cisplatin + Etoposide	1	(0.4)
Gemcitabine + Oxaliplatin	1	(0.4)
Other combination	43	(17.1)
Unknown	21	(8.3)
Total	**252**	**(100)**

[a] FOLFOX: folinic acid ("FOL"), fluorouracil ("F"), and oxaliplatin ("OX"). [b] FOLFIRI: folinic acid ("FOL"), fluorouracil ("F"), and irinotecan ("IRI"). [c] mAb: monoclonal antibody drug.

Treatment outcomes

Post-treatment disease status was classified into six categories: death, cure, disease progression, disease recurrence, undertreatment, and unknown outcomes **(Table 8)**. The mean follow-up duration, calculated from initial diagnosis to the most recent visit, was 3.25 ± 2.64 years, ranging from a minimum of 30 days to a maximum of 13 years. Mortality was notably high, with 41.3% of patients succumbing to the disease during the follow-up period.

Table 8. Outcomes of all treatments

Outcome	N	(%)
Death	104	(41.3)
Cure	30	(11.9)
Disease progression	96	(38.1)
Disease recurrence	7	(2.8)
Undertreatment	6	(2.4)
Unknown	9	(3.6)
Total	**252**	**(100)**

Impact of treatment on disease outcomes

Regression analysis evaluating the relationship between therapy type and disease outcomes—including death, cure, progression, recurrence, and undertreatment—revealed a statistically significant correlation ($p = 0.001$). Patients who underwent surgical procedures generally experienced better curative outcomes compared to those receiving only chemotherapy or radiotherapy.

However, neither the FOLFOX nor FOLFIRI chemotherapy regimens showed a significant effect on outcomes, with p-values of 0.70 and 0.13, respectively. The lack of clarity regarding whether these treatments were administered as adjuvant therapy to enhance cure rates or as palliative interventions limits the interpretation of these results. For instance, among patients receiving FOLFOX, 58 died, 44 experienced disease progression, 3 had recurrences, 8 achieved cure, and 4 had unreported outcomes. Similarly, FOLFIRI was associated with 60 deaths, 41 progressions, 2 recurrences, and 2 cures. The addition of monoclonal antibodies also did not appear to significantly influence outcomes. The number of chemotherapy cycles varied widely from 1 to 28, yet no meaningful association was observed between cycle count and survival or treatment success. Notably, four patients on FOLFOX were undertreated—a situation that could have been mitigated with clinical pharmacist input. Collectively, these factors hinder any definitive assessment of chemotherapy effectiveness in this cohort.

Survival duration

Patient survival was determined either from explicit documentation in the medical records or calculated as the interval between diagnosis and the most recent follow-up. The mean survival across the cohort was 1,062 ± 974 days. Further regression analysis assessing the relationship between treatment modality (surgery, chemotherapy, radiotherapy) and survival duration showed a statistically significant effect, with a p-value of 0.033 **(Table 9)**, indicating that treatment type plays a measurable role in patient longevity.

Table 9. Regression analysis of colorectal treatment and years of survival

Analysis of Variance (ANOVA)					
Source	**Sum of Squares**	**df**	**Mean Square**	**F**	**p-value**
Regression	8,212,897	3	2,737,632.33	2.954	0.033
Regression Coefficients	**Unstandardized B**	**Std. Error**	**Standardized Beta**	**t**	**p-value**
Surgery	500.6	215.6	0.147	2.323	0.021
Radiotherapy	142.0	170.8	0.053	0.831	0.407
Chemotherapy	347.9	208.4	0.106	1.670	0.096

Effect of treatment modalities and disease stage on survival

Regression analysis indicated that surgical intervention significantly improved patient survival, with a positive impact on the number of survival days ($p = 0.021$). Radiotherapy also contributed to increased survival, although its effect was less pronounced than that of surgery and did not reach statistical significance ($p = 0.407$). Chemotherapy showed the smallest positive effect on survival among the three treatment modalities and was not statistically significant ($p = 0.096$). **Table 9** summarizes the regression analysis evaluating the relationship between treatment type and survival duration.

Further analysis using the χ-square test revealed a significant association between disease stage at diagnosis and treatment outcomes ($p < 0.05$, **Table 10**). Notably, the observed cure rates were lower than expected; only 23% of patients with stage III disease were documented as cured. By comparison, survival rates reported in the literature using the AJCC staging system are typically >90% for stage I, 70–85% for stage II, 25–80% for stage III, and <10% for stage IV [21]. The discrepancy between these published survival rates and the outcomes observed in this cohort raises concerns regarding the accuracy of staging or other factors influencing prognosis.

Table 10. Outcomes after treatment according to stage at diagnosis

	Stage I		**Stage II**		**Stage III**		**Stage IV**		
	N	**(%)**	**N**	**(%)**	**N**	**(%)**	**N**	**(%)**	**N**
Death	0	0	5	−4.8	6	−5.8	93	−89.4	104
Cure	3	−10	19	−63.3	7	−23.3	1	−3.3	30
Disease Progression	0	0	4	−4.2	35	−36.8	56	−58.9	95
Disease Recurrence	0	0	2	−28.6	4	−57.1	1	−14.3	7
Undertreatment	0	0	3	−50	3	−50	0	0	6
Unknown	0	0	0	0	2	−22.2	8	−88	10
Total	3	−1.2	33	−13.1	57	−22.6	159	−63.1	252

Discussion

This study aimed to provide a comprehensive overview of colorectal cancer (CRC) in the West Bank, focusing on disease distribution, treatment practices, and patient outcomes. We examined CRC stages among Palestinian patients, analyzed prevailing management strategies, evaluated chemotherapy protocols and cycles, and assessed post-treatment outcomes in relation to clinical decision-making. The study included a retrospective review of 252 patient records from An-Najah University Hospital (NUH), a tertiary care center in Nablus, to capture relevant clinical data.

Colorectal cancer in the west bank

The analysis revealed that CRC predominantly affects male patients, with a mean age of 60.6 ± 11.4 years. Although the data were limited to a single hospital in one city, these findings align with global trends and with regional patterns observed in the Arab world [22]. Older patients in the cohort also frequently presented with comorbidities, such as hypertension and diabetes mellitus, reflecting the high prevalence of chronic diseases in the West Bank [23].

Disease stage at diagnosis

Survival in CRC is strongly influenced by disease stage at the time of diagnosis. Alarmingly, the majority of patients in this study (63%) were diagnosed at stage IV, highlighting the need to increase awareness and implement effective screening programs. Delayed diagnosis significantly contributes to higher mortality, a

pattern documented in multiple studies [24–26]. It is important to note, however, that NUH functions as a tertiary referral center, often receiving advanced cases from other hospitals in the West Bank or the Gaza Strip, which likely inflates the proportion of late-stage diagnoses observed.

While the Palestinian Ministry of Health publishes annual cancer statistics, these reports do not include detailed information on disease stage, treatment patterns, or survival outcomes. In this study, 41.3% of patients died despite treatment, 38.1% experienced disease progression, and only 11.9% achieved a documented cure. These findings underscore the urgent need for a national CRC screening program, which could facilitate earlier diagnosis, reduce the proportion of late-stage cases, and improve survival rates. Screening interventions, including fecal occult blood testing, Cologuard, or colonoscopy for high-risk populations, have the potential to significantly reduce mortality by detecting cancer at an earlier, more treatable stage [27].

Management and treatment approaches

CRC management varies depending on tumor location. In this cohort, 27.3% of patients had rectal cancer, which requires distinct treatment considerations due to anatomical differences and the higher risk of local recurrence, impacting morbidity and quality of life. Surgical intervention was the most frequently employed treatment modality, closely followed by chemotherapy, indicating that most patients receiving chemotherapy either underwent surgery beforehand or subsequently.

Chemotherapy regimens observed in the cohort included FOLFOX, FOLFIRI, and combinations of their components, often supplemented with monoclonal antibodies such as cetuximab or bevacizumab. Other treatment protocols involved capecitabine, irinotecan, or various combinations of small-molecule agents. Despite adherence to internationally recommended guidelines, treatment outcomes were less favorable than anticipated, likely reflecting the high proportion of advanced-stage disease at presentation.

These findings highlight the importance of specialized oncology centers with multidisciplinary teams, including highly trained physicians, clinical pharmacists, and support staff, to ensure optimal adherence to treatment protocols. Improved training and oversight could enhance treatment personalization, dosing accuracy, and follow-up, ultimately improving patient outcomes.

Numerous studies have demonstrated the significant role of clinical pharmacists in hematology and oncology, showing that their involvement can improve treatment outcomes and reduce morbidity and mortality rates. In the West Bank, however, the participation of clinical pharmacists in cancer care is minimal. Incorporating them into colorectal cancer healthcare teams could enhance patient management, optimize therapeutic regimens, and potentially increase survival rates. This underscores the importance of refining treatment strategies for CRC patients in the region, particularly in light of limited adherence to international guidelines and the need for specialized centers with multidisciplinary healthcare teams.

In this study, disease outcomes following treatment were categorized into death, cure, disease progression, disease recurrence, undertreatment, and unknown outcomes. Despite the study being based on retrospective chart reviews over a single year, mortality was high at 41.3%. Cancer is the second leading cause of death in the West Bank, following cardiovascular diseases, with approximately 15.5% of deaths attributed to cancer. Regression analysis of disease outcomes in relation to therapy type revealed a significant association, with surgical treatment correlating with better outcomes than chemotherapy or radiotherapy. Comparisons between FOLFOX and FOLFIRI chemotherapy regimens indicated that FOLFIRI was associated with higher mortality, whereas FOLFOX showed higher cure rates, though the differences were not statistically significant.

Cancer survival is a key indicator of the effectiveness of a healthcare system in early detection and treatment. Survival in CRC is highly dependent on the stage at diagnosis, with later diagnoses generally resulting in poorer outcomes. Previous research has shown that delayed diagnosis of rectal cancer is linked to reduced survival, whereas delayed detection of colon cancer may not have the same impact, suggesting that other factors also influence survival. In this study, regression analysis examining the interval between diagnosis and the last follow-up in relation to treatment type was statistically significant ($R^2 = 0.035$, $p = 0.033$). Moreover, χ-square analysis indicated a significant relationship between stage at diagnosis and patient prognosis ($p < 0.05$). Surgical intervention was associated with a significant increase in survival days ($p = 0.021$), whereas radiotherapy and chemotherapy showed smaller, non-significant improvements ($p = 0.407$ and $p = 0.096$, respectively). These results likely reflect that patients eligible for surgery had operable tumors representing less advanced disease, whereas many stage IV patients were not candidates for surgical intervention.

The observed survival gaps may also be influenced by differences in management practices compared to other countries. The absence of uniform national guidelines for CRC care and insufficient development of infrastructure to address increasing demands for diagnostics, treatment, and follow-up could contribute to lower survival rates in the West Bank.

Genetic counseling is another critical aspect of CRC management, particularly given that 40 patients in the

cohort presented with both colon and rectal cancer, suggesting a potential hereditary component. Although genetic counseling services exist in the region, there is a need to expand molecular diagnostics, such as reflex testing for mismatch repair proteins, to better understand the genetic underpinnings of CRC and enable more proactive prevention and management strategies.

This study represents the first report from the West Bank to evaluate CRC stages, treatment protocols, and patient outcomes. As with all retrospective studies, limitations include incomplete documentation, such as missing data on weight, height, and laboratory tests. Additionally, the study draws from a single hospital, limiting generalizability. National-level studies are needed to provide more representative data.

In conclusion, a large proportion of patients were diagnosed at advanced stages. While treatment approaches generally followed international guidelines, cure rates remained low and mortality was high. The findings emphasize the urgent need for improved early detection programs, better adherence to treatment protocols, and multidisciplinary care that incorporates clinical pharmacists. Greater public awareness and preventive screening through primary care services, comprehensive evaluation of chemotherapy application, and active involvement of clinical pharmacists in drug selection, dosing, and monitoring could substantially improve outcomes for CRC patients in the West Bank.

Abbreviations

ANOVA—analysis of variance; BMT—bone marrow transplantation; CI—confidence interval; CKD—chronic kidney disease; CRC—colorectal cancer; CRP—C-reactive protein; CT—computed tomography, DM—diabetes mellitus; ESRD—end-stage renal disease; FOLFIRI—5-fluorouracil, leucovorin, irinotecan; FOLFOX—5-fluorouracil, leucovorin, oxaliplatin; HF—Heart Failure; HTN—hypertension; IHD—ischemic heart disease; IRB—institution review board; mAb—monoclonal antibody; MCV—Mean Corpuscular Volume; MRI—magnetic resonance imaging; NNU—Najah National University; NUH—Najah University Hospital; PA—Palestinian Authority; PL—Platelet; SPSS—Statistical Package for Social Sciences; TNM stage—Classification of Malignant Tumors; WBCs—white blood cells; WHO—World Health Organization.

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