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ORIGINAL ARTICLE

Long-term outcome after curative anterior resection for rectal cancer, single centre experience

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ABSTRACT

Aim : To assess the rates of survival and local recurrence following curative therapy for rectal cancer (RC) provided by a specialized unit at "Care Medical Hospital- Riyadh, Saudi Arabia", over the previous 10 years.

Methods and Population: The records at "Care Medical Hospital–Riyadh" of the patients who received a significant curative therapy for RC between 01 January 2015 and 31 December 2024 were retrospectively examined. Radical operation was carried out by a specialized surgeon. The data of the patients were retrieved.

Results: A total of 241 performed anterior resection. The ratio of male-to-female was 1.2:1 (134 male versus 107 female), with a median age at surgery of 57 years. 58% and 30% of subjects received total neoadjuvant therapy (TNT) and neoadjuvant radiation, respectively. Adjuvant chemotherapy was provided to 46% of the cases. The median follow-up was 63 months, and 96.3% achieved total resection with negative margins. The rate of local recurrence was 2%, whereas that of total recurrence was 17%. The rate of 5-year overall survival was 89.2% and that of the 5-year DFS was 80%. Positivity of lymph nodes and tumor invasion depth had a considerable effect on overall and DFS rates (P. value < 0.001, 0.008, versus 0.003, 0.032, respectively) based on multivariate analysis. The rate of clinical and radiological leak and stenosis was 2% and 1.7% respectively.

Conclusion: Curative therapy for RC at Care Medical Hospital Arrawabi in Saudi Arabia has a long-term outcome comparable to international results.

Keywords: Outcomes, curative resection, rectal cancer.

Introduction

Colorectal cancer (CRC) is a potential global health issue; it is the third frequently diagnosed malignancy and the second leading reason of malignancy-related mortality globally. Based on "the Global Cancer Observatory (GLOBOCAN 2020)", more than 1.9 million new cases and 900,000 deaths were reported globally [1,2].

In Saudi Arabia, CRC represents one of the most prevalent cancers, being the most frequent malignancy among males and the third among females, as per the most recent Saudi Cancer Registry report [3]. Despite improvements in screening and treatment strategies, CRC incidence continues to rise in younger populations and in regions with rapidly developing healthcare systems.

Surgical resection remains the cornerstone of curative therapy for rectal cancer (RC) [4]. The selection of surgical procedure depends largely on tumor location and clinical presentation, whether elective or emergent

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[5,6]. In RC, long-term survival is closely associated with the stage at diagnosis and the quality of surgical resection, particularly the completeness of total mesorectal excision (TME) and negative circumferential resection margins (CRM) [7,8].

Local recurrence after rectal surgery remains a major challenge and serves as an indicator of the quality of surgical care [9]. Advanced tumor stage is associated with higher local recurrence rates [10-12]. Outcomes following abdominoperineal resection are generally inferior to those following low anterior resection, owing to greater technical complexity and margin-related factors [13,14].

The introduction of TME has markedly reduced local recurrence and improved survival outcomes in RC management [15]. Nonetheless, significant variations in oncologic outcomes persist among centers and surgeons. Studies consistently demonstrate that high case volume, subspecialized colorectal surgery, and greater surgeon experience are associated with superior oncologic outcomes [16-19].

Over the past two decades, total neoadjuvant therapy (TNT) followed by interval surgery has become the standard of care for locally advanced RC [20]. More recently, TNT - which delivers both systemic chemotherapy and chemoradiation preoperatively - has shown improved pathological response rates and disease control [21]. Reported local recurrence rates following curative operation for locally advanced RC vary between 5.6% and 30%, while 5-year overall survival (OS) ranges between 39% and 80%, depending on stage, treatment response, and follow-up duration.

In Saudi Arabia, there remains a paucity of long-term data evaluating the impact of specialized colorectal surgery - including minimally invasive approaches - on survival and local recurrence following RC excision. This research aims to address this gap by assessing long-term oncologic outcomes in patients treated at a specialized colorectal surgery center.

Methods

Study design and settings

This retrospective cohort was established at Care Medical Hospital, Arrawabi, Riyadh, Saudi Arabia, and included all cases who underwent anterior resection for RC between January 2015 and December 2024. Institutional ethical approval was obtained prior to data collection, and the study adhered to the Declaration of Helsinki and local research ethics guidelines.

Study population

A total of 241 consecutive patients with biopsy-confirmed primary rectal adenocarcinoma were included. Data were collected from the medical records, the colorectal surgery database, and, when necessary, through telephone follow-up.

RC was defined as a tumor located below the level of the sacral promontory and within 15 cm from the upper part of the anal canal as measured by rigid proctosigmoidoscopy. All rectal resections were performed by specialized colorectal surgeons following the total mesorectal excision (TME) technique originally described by Li et al. [22].

Exclusion criteria

Patients were excluded if they:

Had distant metastases at the operative time,

Underwent re-operative rectal excision for recurrent disease,

Required emergency rectal surgery, or

Had non-adenocarcinoma rectal malignancies.

Preoperative evaluation

Clinical staging was performed using contrast-enhanced computed tomography (CT) of the chest, abdomen, and pelvis (oral, intravenous, and rectal contrast), magnetic resonance imaging of the abdomen and pelvis with gadolinium enhancement, and whole-body Positron Emission Tomography/Computed Tomography when indicated.

Patients with locally advanced RC (≥T3 or node-positive) received TNT. The median dose of radiation was 50.4 Gy (39.6-54 Gy). Chemotherapy regimens included either:

5-fluorouracil (5-FU) 350 mg/m^2 and leucovorin 20 mg/m^2 daily for 5 days during the first and last week of radiotherapy, or Capecitabine 850 mg/m^2 twice daily throughout radiotherapy. Surgery was scheduled 6-8 weeks following completion of TNT.

Adjuvant therapy

Postoperatively, patients received adjuvant chemotherapy 6 weeks after surgery using one of the following regimens:

5-FU 350 mg/m^2 and leucovorin 20 mg/m^2 for 5 days every 3 weeks (4-6 cycles), or Capecitabine 1,250 mg/m^2 twice daily for 14 days followed by a 7-day rest (6 cycles). The total number of chemotherapy cycles, including those administered concurrently with radiotherapy, ranged from 6 to 8.

Pathologic evaluation

All surgical specimens underwent standardized pathologic examination according to the AJCC Cancer Staging Manual (8th Edition) [23]. Parameters assessed included tumor grade, size, total and positive lymph nodes, lymphovascular invasion (LVI), perineural invasion (PNI), distal and CRM, and doughnut (anastomotic ring) involvement, as described by Quirke and Dixon [24].

Follow-up and surveillance

Postoperative follow-up included clinical examination and serum carcinoembryonic antigen (CEA) testing every 3 months during the first year, then annually. CT scans of the chest, abdomen, and pelvis with oral,

intravenous, and rectal contrast were performed annually for the first 4 years, and subsequently every 2 years or as clinically indicated.

Surveillance colonoscopy was conducted 6 months after surgery and repeated every 3 years thereafter.

Patients with stomas were followed regularly by a specialized colorectal and wound care nurse.

Recurrence was determined as clinical, radiologic, or pathologic evidence of tumor return. Patients with rising CEA levels and no detectable recurrence on imaging or endoscopy were provisionally classified as having distant recurrence until proven otherwise.

Statistical analysis

Data analysis was done using the "SAS statistical software package (SAS Institute, Cary, NC)".

Categorical parameters were compared using the chi-square test. Univariate and multivariate analyses were implemented using the log-rank test. Kaplan–Meier survival analysis was used to estimate OS and local recurrence-free survival. A *p*-value < 0.05 was deemed significant.

Results

A total of 241 underwent anterior resection. The male-to-female ratio was 1.2:1 (134 male *vs.* 107 female), with a median age at surgery of 57 years, and a 30-day mortality rate of 0.4% (*n* = 1). A significant number of patients had comorbidities (**Table 1**).

TNT and neoadjuvant radiation were provided to 58% and 30% of patients, respectively. Adjuvant chemotherapy was provided to 46% of the patients (**Table 2**). The median follow-up was 63 months, and full resection with negative margins was achieved in 96.3 %.

Local recurrence rate was 2% *n* = 5. Total recurrence rate was 17% *n* = 41 (**Table 3**). Overall, the 5-year survival rate was 89.2% and the 5-year disease-free survival (DFS) rate was 80% (Figures 1 and 2). The rate of clinical and radiological leak and stenosis in our patients was 2.1% *n* = 5 and 1.7% *n* = 4, respectively.

In univariate analysis; PNI, grade of the tumor, neoadjuvant chemoradiation, depth of tumor invasion (T), adjuvant chemotherapy, radiation dose and positive lymph node significantly impacted the OS while number of retrieved lymph node more than 12, PNI, tumor grade, type of operation, neoadjuvant chemoradiation, depth of tumor invasion (T), radiation dose and positive lymph nodes significantly impacted the DFS (**Table 4**).

In the multivariate model, positivity of lymph nodes and tumor invasion depth (T) had a potential influence on OS and DFS rates (*p*. value < 0.001, 0.008, *vs.* 0.003, 0.032, respectively) (**Table 5**).

Table 1. Demographic data.

Data	Description (*n* = 241)
Sex	
Male	134 (55.6)
Female	107 (44.4)
Median age	57
Median age male	60
Median age female	54
Nationality	
Non-Saudi	228 (94.6)
Saudi	13 (5.4)
DM	
No	169 (70.1)
Yes	72 (29.9)
HTN	
No	171 (71)
Yes	70 (29)
IHD	
No	232 (96.3)
Yes	9 (3.7)
Renal disease	
No	236 (97.9)
Yes	5 (2.1)
Liver disease	
No	239 (99.2)
Yes	2 (0.8)
COPD	
No	231 (95.9)
Yes	10 (4.1)

Discussion

This research represents one of the largest single-institution analyses from the Saudi private healthcare sector evaluating long-term oncologic outcomes in rectal adenocarcinoma managed with neoadjuvant treatment followed by curative anterior resection. The median age of our cohort was 57 years, notably younger than that reported in most international studies, where the median age typically ranges between 65 and 66 years [22,23]. This aligns with regional data suggesting that CRC in Saudi Arabia presents at a younger age compared with Western populations [16,24].

We achieved an R0 resection rate of 96.3%, reflecting meticulous adherence to TME principles and the

benefits of specialized colorectal surgery. Comparable high-volume centers report R0 rates between 90% and 97% [5,10]. Meta-analyses confirm that high surgeon and hospital volumes correlate with superior resection margins, reduced recurrence, and improved survival [11,19].

Our 5-year OS and DFS rates (89.2% and 80%, respectively) compare favorably with global benchmarks (OS 70%-85%, DFS 65%-80%) [21,25]. These outcomes underscore the value of multidisciplinary collaboration and standardized surgical practice. Achieving a "textbook oncologic outcome" – including R0 resection, adequate lymph-node harvest, and minimal postoperative complications – has been associated with improved long-term survival [26].

The local recurrence rate of 2% observed in this study falls within the 3%–6% range reported internationally following TME and nCRT [10,16,21]. Although our pathologic complete response (pCR) rate of 8% was lower than Western reports (15%–25%) [17,18], similar findings have been reported in populations presenting with advanced disease or delayed referral. Moreover, recent analyses indicate that pCR alone may not reliably predict OS, reinforcing the importance of comprehensive multimodal management [4].

Although 96.3% of patients achieved margin-negative resection, 20% had fewer than 12 lymph nodes retrieved, below AJCC and CAP recommendations. Similar observations in regional studies highlight the influence of specimen handling and pathology techniques on nodal yield [16]. Standardized pathology protocols and continuous quality auditing remain essential to ensure accurate staging and prognostic assessment.

Table 2. Treatment regimen.

Neoadjuvant radiotherapy	73	30%
Total neoadjuvant therapy (TNT)	140	58%
Adjuvant chemotherapy	111	46%
5-FU	51	46%
Capecitabine	60	54%

Table 3. Recurrence rate as per site.

Recurrence	AR
Local-pelvic	5 (2%)
Distant	22 (9.1%)
Both	14 (5.8%)
Total	41 (17%)

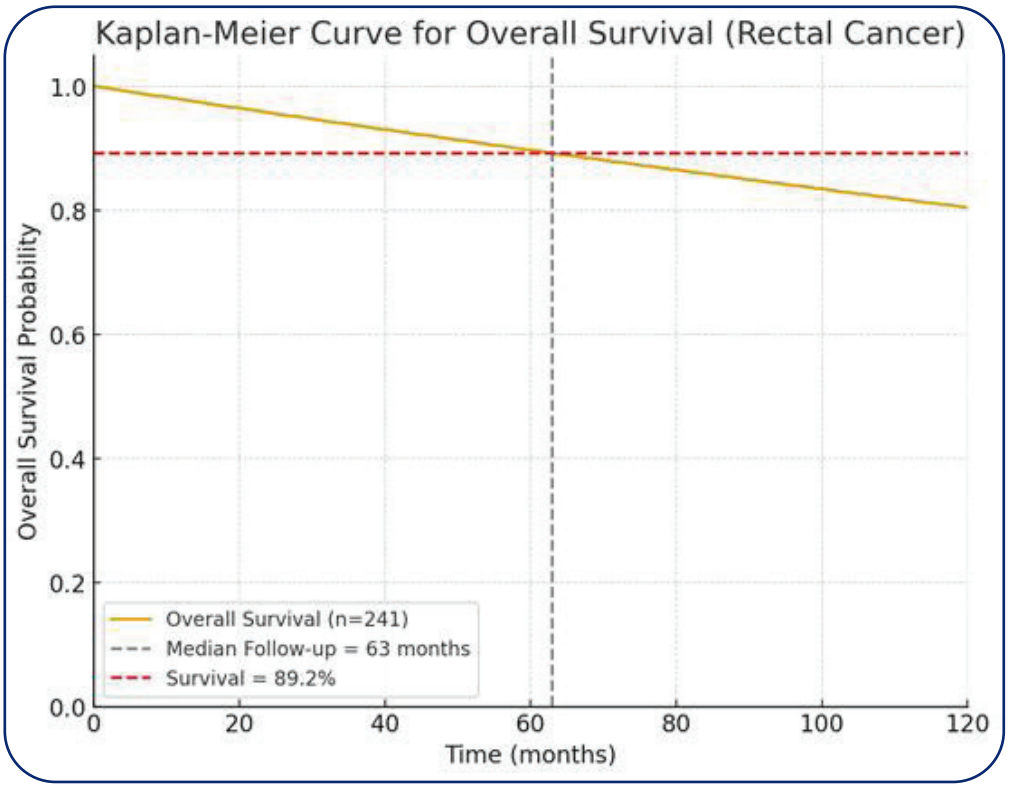

Figure 1. The overall 5-year survival.

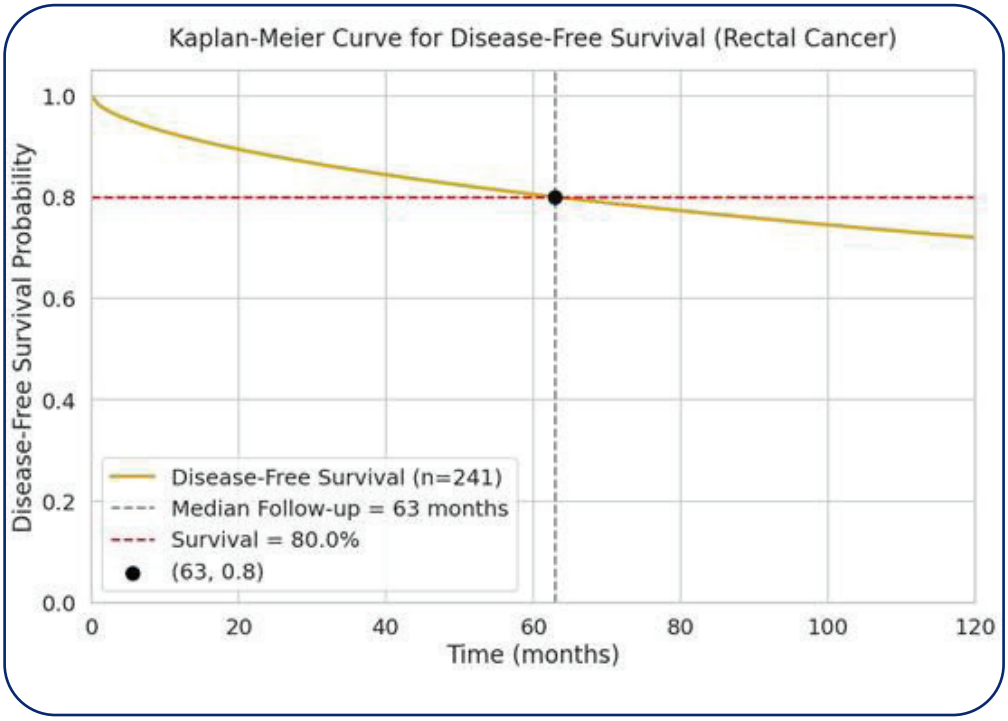

Figure 2. The 5-year disease free survival.

Table 4. Univariate analysis of prognostic factors for RC.

Parameters	OS (*p*-value)	DFS (*p*-value)
Clinical stage	0.31	0.51
Retrieved lymph node	0.14	0.008
Distance	0.85	0.24
Grade	0.018	0.03
Age	0.47	0.47
Radio-surg-dura.	0.98	0.98
Adjuvant chemotherapy	0.01	0.29
T. Path	0.003	0.002
Radiation dose	0.0001	0.001
Neoadj. chemoradiation	0.0001	0.001
Gender	0.24	0.87
Operation-method	0.27	0.02
CEA Pre RX level	0.34	0.12
LVI	0.27	0.11
PNI	0.02	0.0007
Lymph node status	0.0003	0.0001
Resection margin	0.18	0.08

Strengths and limitations

The major strengths of this work include a large consecutive cohort, uniform surgical technique, and long-term follow-up (median 63 months). Additionally, all operations were carried out by subspecialized colorectal surgeons, ensuring consistency in technique and postoperative care.

Table 5. Multivariate analysis of prognostic factors for RC.

Parameters	OS (*p*-value)	DFS (*p*-value)
Radiation dose	0.48	0.32
Neoadj. chemoradiation	0.66	0.80
Adjuvant chemotherapy	0.001	
Retrieved lymph node	0.06	0.0008
LVI		0.66
CEA Pre. Rx		0.20
PNI	0.18	0.01
Grade	0.02	0.18
Op. method		0.04
T. Path	0.008	0.032
Node status	0.001	0.0037
Resection margin	0.76	0.40

Limitations include the retrospective design, and the single-center setting, which may limit external generalizability.

Clinical Implications

Our findings confirm that specialized colorectal surgical practice, integrated with multidisciplinary team management and adherence to guideline-based neoadjuvant protocols, yields excellent long-term oncologic outcomes comparable to international benchmarks. These data also reinforce the importance of establishing centralized CRC units in Saudi Arabia to ensure quality control, enhance survival outcomes, and promote structured follow-up programs.

Further national multicenter prospective studies are warranted to validate these findings and evaluate the role of minimally invasive and robotic techniques in optimizing surgical and functional outcomes.

Conclusion

Curative therapy for RC at Care Medical Hospital Arrawabi in Saudi Arabia has a long-term outcome comparable to international results.

List of Abbreviations

CRC	Colorectal cancer
CRM	Circumferential resection margins
CT	Computed tomography
DFS	Disease-free survival
GLOBOCAN 2020	Global Cancer Observatory
MRI	Magnetic resonance imaging
PET-CT	Positron Emission Tomography/ Computed Tomography
RC	Rectal cancer
TME	Total mesorectal excision
TNT	Total neoadjuvant therapy

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent to participate

Not applicable

Ethical approval

Ethical approval was granted by Institutional Review Board at Care Medical via reference # IRB-002/28072 dated: 28/July/2025

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