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Short report

Trends in organ preservation for early-onset rectal cancer: An analysis of the national cancer database

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Introduction

In 1998, Habr-Gama and colleagues described a case series of rectal cancer disappearance after neoadjuvant chemoradiation, introducing the watch-and-wait protocol for organ preservation (OP), which has since informed clinical guidelines.[1] Today, the National Comprehensive Cancer Network (NCCN) guidelines support a watch-and-wait approach for locally advanced rectal adenocarcinoma patients who have complete clinical response (cCR) after total neoadjuvant therapy (TNT).[2] Landmark trials such as Organ Preservation in Rectal Adenocarcinoma (OPRA) have shown disease-free survival outcomes of OP are comparable to total mesorectal excision (TME) after TNT.[3]

Early-onset rectal cancer (EoRC), defined as rectal cancer diagnosed in patients under 50 years of age, often presents with more advanced features, and the incidence of EoRC has risen in recent years.[4] These patients may derive significant quality-of-life benefit from OP, as the impact of surgical morbidity related to sexual, urinary, and bowel function may be greater with longer life expectancy.[5] Despite its proposed benefits, data on OP adoption in patients with EoRC remain sparse. This study aims to analyze trends in OP utilization among patients with EoRC. We hypothesize that OP utilization for EoRC patients has increased from 2014 to 2022 and mirrors trends in later-onset rectal cancer patients.

Methods

Study population

We utilized the National Cancer Database (NCDB) for this study. The NCDB is a national oncologic registry for programs across the US, capturing over 70% of newly diagnosed cancer cases.[6] Our population included patients from 2014 to 2022 under the age of 50 diagnosed with stage II/III rectal adenocarcinoma. Exclusion criteria were adapted from Loria et al.[7] and shown in Supplemental Fig 1. The NCDB does not have an OP variable and the OP cohort was derived from patients treated with systemic chemotherapy and radiation without definitive surgery, while patients undergoing low anterior resection, abdominoperineal resection, and pelvic exenteration composed the TME cohort (Supplemental Fig 1). This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and was IRB-exempt since NCDB uses de-identified data.

Statistical analysis

The primary outcome was treatment type (OP vs TME) by year from 2014 to 2022. Along with descriptive statistics, we compared continuous variables with Wilcoxon rank-sum tests and categorical

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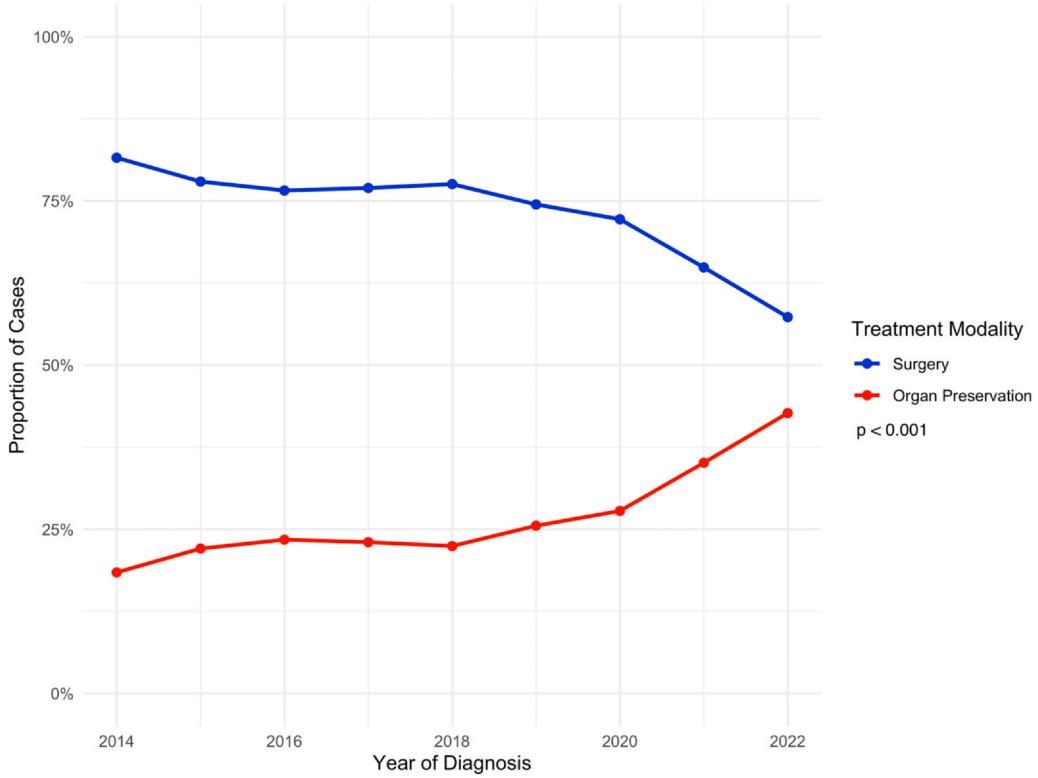

Fig. 1. Trends in treatment modalities for early-onset rectal cancer from 2004 to 2022.

variables using Chi-square or Fisher's exact tests. Treatment trend significance was assessed using a Cochrane-Armitage trend test. A p-value of < 0.05 was considered significant throughout.

Results

A total of 12,547 patients met the study criteria, of which 3426 (27.3%) underwent OP and 9121 (72.7%) underwent TME (Supplemental Fig 1). From 2014–2022, the proportion of patients managed with OP increased significantly, rising from 18.4% in 2014–42.7% in 2022, representing a 24.3% absolute increase. The trend in use of TME differed significantly over the study period, declining from 81.6% to 57.3% ($p < 0.001$; Fig. 1). Compared to TME patients, OP patients were more likely male (62.4% vs 59.7%, $p = 0.006$), Black (9.6% vs 8.2%, $p = 0.011$), had lower education (41.7% vs 37.8%, $p < 0.001$), were uninsured (5.3% vs 4.5%, $p < 0.001$), and more likely to present with cT4 (19.2% vs 15.2%, $p < 0.001$). Fewer OP patients exhibited high-risk histology (mucinous/signet cell; 2.8% vs 3.9%, $p < 0.001$), lymphovascular invasion (LVI; 5.4% vs 12.7%, $p < 0.001$), and perineural invasion (PNI; 4.0% vs 13.2%, $p < 0.001$; Table 1).

Discussion

The results of this study show that among patients with EoRC, OP increased significantly from 2014 to 2022, approaching half of the total cohort by 2022. This aligns with timelines of recent clinical trials leading to more widespread implementation of OP. Moreover, the OP and TME cohorts exhibited several demographic and oncologic differences. Demographic differences in sex, race, insurance status, education, and treatment facility may reflect socioeconomic and institutional factors that impact the utilization of OP. The OP cohort had less aggressive histology and fewer tumors with lymphovascular invasion or perineural invasion, accounting for 13.7% and 10.2% of all tumors positive for these features in the study, respectively. As these features are associated with poor prognosis in rectal cancer,[8] tumors with these characteristics may be less likely to have cCR, disqualifying patients from OP.

Previous NCDB studies have shown an increase in OP proportion from 2004 to 2020 in locally advanced rectal cancer, illustrating the changing landscape in rectal cancer management.[7] International data have yielded similar results, with a study in the Netherlands finding that OP utilization had reached over 40% in 2023.[9] Our study validates these results specifically in the EoRC population and shows that the trend in OP utilization continues through 2022. To our knowledge, this is the first study to use the NCDB to evaluate changes in OP implementation in EoRC patients.

This study has some limitations. One limitation is that the NCDB does not provide specific chemotherapy regimens, and we are unable to determine if the regimen is standard of care. As the NCDB does not provide a specific OP variable, OP was defined based on other NCDB variables. Another limitation is that the NCDB lacks granularity to capture the differences in OP protocol across institutions and whether patients were adherent. Additionally, we were unable to capture salvage surgery after OP; as there is no variable for recurrence, some patients in the TME group may have undergone OP initially. Finally, with a large database study, there may be missingness/discrepancies in patient coding, which we attempted to mitigate with strict exclusion criteria, though exclusion of these patients may alter the conclusion.

In conclusion, the current analysis demonstrated a significant increase in OP adoption over time, most notably in recent years. With rising EoRC incidence and the introduction of neoadjuvant immunotherapy as a treatment option for patients with dMMR/MSI-H rectal cancers,[10] further prospective studies should evaluate future trends and the safety and implementation of OP.

Table 1
Patient and tumor characteristics of patients with EoRC who underwent organ preservation versus surgery.

	Organ Preservation (n = 3426)	Surgery (n = 9121)	P value
Age, median [IQR]	45 [40 − 48]	45 [40 − 48]	.077
Sex			**.006**
Male	2138 (62.4%)	5447 (59.7%)	
Female	1288 (37.6%)	3674 (40.3%)	
Race			**.011**
White	2773 (80.9%)	7483 (82.0%)	
Black	330 (9.6%)	749 (8.2%)	
Other	270 (7.9%)	810 (8.9%)	
Insurance			< **.001**
Uninsured	182 (5.3%)	407 (4.5%)	
Private/Managed Care	2426 (70.8%)	6940 (76.1%)	
Medicaid, Medicare, or Other Government	763 (22.3%)	1674 (18.4%)	
Charlson comorbidity index			0.068
0	3040 (88.7%)	7954 (87.2%)	
1	312 (9.1%)	941 (10.3%)	
2 +	74 (2.2%)	226 (2.5%)	
Median household income			.400
0–47,9999	1123 (32.8%)	2885 (31.6%)	
> 48k	1830 (53.4%)	4881 (53.5%)	
Education below high school degree			< **.001**
≥ 10.9%	1429 (41.7%)	3444 (37.8%)	
< 10.8%	1530 (44.7%)	4329 (47.5%)	
Clinical T stage			< **.001**
cT1	35 (1.0%)	75 (0.82%)	
cT2	244 (7.1%)	629 (6.9%)	
cT3	2489 (72.7%)	7008 (76.8%)	
cT4	658 (19.2%)	1409 (15.4%)	
Clinical N stage			.582
cN0	833 (24.3%)	2162 (23.7%)	
cN1	1575 (46.0%)	4286 (47.0%)	
cN2	1018 (29.7%)	2673 (29.3%)	
AJCC Clinical Stage			.475
Stage 2	833 (24.3%)	2162 (23.7%)	
Stage 3	2593 (75.7%)	6959 (76.3%)	
Histology			< **.001**
Adenocarcinoma	3329 (97.2%)	8764 (96.1%)	
Mucinous	67 (2.0%)	310 (3.4%)	
Signet cell	30 (0.88%)	47 (0.52%)	
Lymph-vascular invasion	184 (5.4%)	1159 (12.7%)	< **.001**
Perineural invasion	137 (4.0%)	1208 (13.2%)	< **.001**
Facility type			
Community program	238 (6.9%)	208 (2.3%)	< **.001**
Comprehensive community	924 (27.0%)	2340 (25.7%)	
Integrated network program	498 (14.5%)	1475 (16.2%)	
Research/academic program	1015 (29.6%)	3094 (33.9%)	
Surgical Procedure			
Low anterior resection + coloanal pull through		6666 (73.1%)	NA
Abdominoperineal resection		2023 (22.2%)	NA
Pelvic exenteration		331 (3.6%)	NA

AJCC: American Joint Committee on Cancer; IQR: interquartile range; NA: not applicable

Ethics statement

None

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None.

Declaration of Competing Interest

Aimal Khan is an Editorial Board Member for this journal and was not involved in the editorial review or the decision to publish this article.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.soi.2026.100255.

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