DOI: 10.4274/tjcd.galenos.2026.2025-12-7
Turk J Colorectal Dis 2026;36(2):41-48

RESEARCH ARTICLE

Imaging-Guided Surgical Management of Retrorectal Tumors: A Single-Center Experience

Engin Ölçücüoğlu[1], Alpaslan Şahin[2]

[1]University of Health Science Türkiye, Ankara Etlik City Hospital, Clinic of Surgery, Ankara, Türkiye
[2]University of Health Science Türkiye, Konya City Hospital, Clinic of Surgery, Konya, Türkiye

ABSTRACT

Aim: Retrorectal tumors represent a rare and heterogeneous group of presacral lesions with diverse embryologic origins and pathologic features. Their deep pelvic location and often non-specific presentation pose challenges for both diagnosis and operative planning, and surgical decision-making is frequently guided by anatomy and imaging rather than robust comparative evidence.

Method: We retrospectively reviewed adult patients who underwent surgical resection for primary retrorectal tumors between 2016 and 2025 at a tertiary referral center. Preoperative assessment relied mainly on magnetic resonance imaging, with the choice of surgical approach determined by tumor extent in relation to the S3 vertebral level. Demographic data, operative details, histopathologic findings, and postoperative outcomes were evaluated.

Results: The study included 16 patients, with a mean age of 48.3±14.2 years and a predominance of female patients. Most tumors were located below the S3 level and were treated via a posterior approach, whereas anterior or combined approaches were selected for lesions with cranial extension. Congenital lesions were most common, whereas malignant tumors accounted for 31.2% of cases and consisted exclusively of chordomas. Macroscopically complete resection was achieved in all patients; one chordoma demonstrated microscopic margin involvement. Postoperative complications were generally low grade, no perioperative mortality occurred, and tumor recurrence was observed in a single patient during follow-up.

Conclusion: This single-center experience suggests that preoperative imaging and anatomical considerations may assist surgical planning and enable safe tumor resection in patients with retrorectal tumors.

Keywords: Pelvic neoplasms, magnetic resonance imaging, digestive system surgical procedures, chordoma, postoperative complications

Introduction

Retrorectal tumors, also referred to as presacral tumors, are rare and heterogeneous lesions arising in the potential space between the rectum and the sacrum. This anatomically concealed region contains remnants of several embryologic structures, including the tailgut and notochord, which explains the wide histopathologic spectrum ranging from benign congenital cysts to malignant neoplasms such as chordomas.[1-3] Owing to their deep pelvic location and frequently non-specific symptoms, these tumors may remain undetected for long periods, and their diagnosis and management can be challenging.[4] The rarity of the disease and the diversity of tumor types have limited the development of standardized management strategies, and most available evidence is derived from retrospective institutional series.[2,5]

Accurate preoperative evaluation plays a critical role in surgical planning. Magnetic resonance imaging (MRI) is considered the primary imaging modality for retrorectal tumors because it allows detailed assessment of tumor morphology, sacral involvement, and the relationship to surrounding pelvic structures.[6,7] These imaging findings are essential in

Address for Correspondence: Assoc. Prof.,Alpaslan Şahin, University of Health Science Türkiye, Konya City Hospital, Clinic of Surgery, Konya, Türkiye
E-mail: drasahin@gmail.com, alpaslan.sahin@sbu.edu.tr **ORCID ID:** orcid.org/0000-0001-5707-1203
Received: 13.01.2026 **Accepted:** 24.03.2026 **Publication Date:** 26.06.2026

Cite this article as: Ölçücüoğlu E, Şahin A. Imaging-guided surgical management of retrorectal tumors: a single-center experience. Turk J Colorectal Dis. 2026;36(2):41-48

determining the optimal surgical approach, particularly with regard to the tumor's relationship to the S3 vertebral level. Lesions located below S3 are generally amenable to a posterior approach, whereas tumors extending above this level may require anterior or combined surgical access.[3,8]

Given the rarity of retrorectal tumors and the continued reliance on institutional experience for clinical decision-making, well-documented case series remain valuable for guiding surgical management. The present study presents our single-center experience with surgically treated retrorectal tumors, with particular emphasis on the role of preoperative imaging in guiding the choice of surgical approach.

Materials and Methods

Study Design

This retrospective observational study was conducted between September 2016 and September 2025 in the department of general surgery of a tertiary referral hospital. The study protocol was approved by the institutional Ethics Committee of University of Health Science Türkiye, Ankara Etlik City Hospital (decision no: 2025-662, dated: 18.11.2025), and the requirement for written informed consent was waived. The conduct and reporting of this study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[9]

Patient Selection

Adult patients who underwent surgical treatment for a primary retrorectal tumor during the study period were included. Eligibility required radiologic suspicion of a retrorectal lesion and definitive surgical resection. Patients with secondary retrorectal involvement, tumors originating from non-presacral structures, or those managed without surgery were excluded. Consecutive cases were identified to ensure an unselected cohort. The patient selection process is illustrated in a STROBE flow diagram (Figure 1).

Bias

Given the retrospective design, selection bias is inherent. However, consecutive case inclusion and standardized imaging-based surgical planning were employed to minimize systematic bias.

Preoperative Assessment

All patients underwent standardized preoperative evaluation using cross-sectional imaging. MRI served as the primary modality for lesion characterization, enabling assessment of tumor size, morphology, and the relationship to adjacent pelvic structures. Computed tomography was used selectively when additional evaluation of bony anatomy was required. Endoanal ultrasound was performed selectively to assess the relationship between the lesion and the anal sphincter complex.

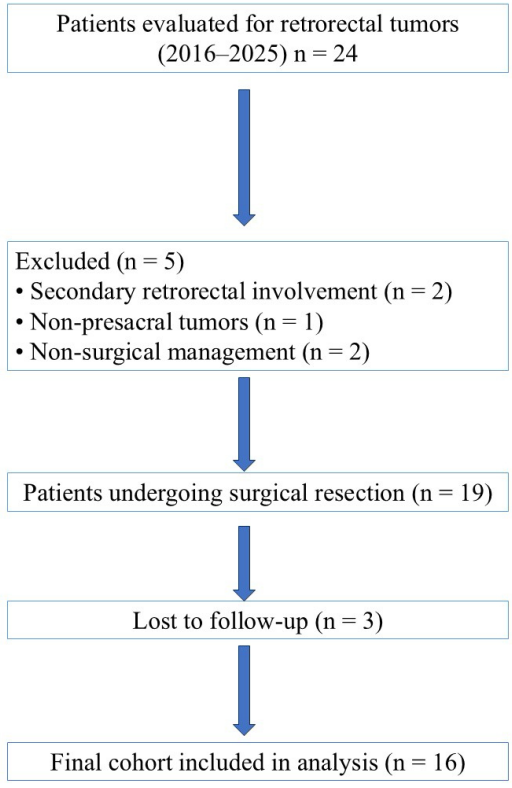

Figure 1. STROBE flow diagram of patient selection for the study cohort

Preoperative biopsy was not routinely performed because of its limited diagnostic yield in heterogeneous or cystic presacral lesions and the potential risks of infection or tumor seeding. None of the patients had undergone biopsy prior to referral to our institution. The final diagnosis was established by histopathologic examination of the resected specimens.

Surgical Management

The surgical approach was determined by tumor location and extent, with particular attention to its relationship to the S3 vertebral level. Lesions confined below this level were preferentially managed using a posterior approach, whereas tumors extending cranially were treated using anterior or combined approaches. In all cases, the operative goal was complete tumor excision while preserving neurologic function and pelvic organ integrity.

The anterior approach was performed using open or laparoscopic techniques at the surgeon's discretion. In laparoscopic procedures, the rectum was mobilized to expose the presacral space, and the lesion was dissected along embryologic planes with careful preservation of the pelvic vessels, ureters, and autonomic nerves.

For the posterior approach (Kraske procedure), patients were placed in the prone jackknife position to allow direct access to the retrorectal space. Coccygectomy was performed when

necessary to facilitate exposure. In combined procedures, anterior mobilization was followed by posterior resection to achieve en bloc tumor removal. When required for adequate exposure or complete resection, additional procedures such as partial sacrectomy and reconstruction were performed in collaboration with orthopedic spine surgeons.

Postoperative follow-up consisted of regular clinical assessment and radiologic surveillance. MRI was the primary modality used to detect recurrence when clinically indicated.

Outcome Measures and Data Collection

The primary outcome was complete tumor excision with negative histopathologic margins (R0 resection). Secondary outcomes included postoperative complications, length of hospital stay, operative time, final histopathologic diagnosis, and tumor recurrence during follow-up.

Clinical, radiologic, operative, and pathologic data were collected retrospectively from institutional medical records, operative reports, imaging archives, and pathology databases using a standardized data abstraction process. Postoperative follow-up consisted of regular clinical assessment and radiologic surveillance, primarily using MRI when clinically indicated.

Statistical Analysis

Statistical analysis was performed to provide a descriptive summary of patient demographics, tumor characteristics, surgical approaches, and clinical outcomes. Continuous variables were examined descriptively and are reported as means with standard deviations and ranges, reflecting the non-normal distribution typically observed in small retrospective cohorts. Categorical variables are presented as frequencies and percentages. Given the retrospective design and limited sample size, no formal hypothesis testing or multivariable modeling was pursued to avoid overinterpretation of the data. Analyses were conducted using available-case methodology, as missing data were infrequent and nonsystematic. All statistical analyses were performed using SPSS software (version 22.0; IBM Corp., Armonk, NY, USA).

Results

A total of 16 patients who underwent surgical treatment for retrorectal tumors during the study period were included in the analysis. The mean age was 48.3±14.2 years (range: 33-67 years), and the majority of patients were women (68.8%). Demographic characteristics, clinical presentation, and radiologic findings are summarized in Table 1.

Clinical presentation was variable. Pelvic or perineal pain was the most common symptom, reported in 43.8% of patients, whereas 25.0% of patients were asymptomatic at the time of diagnosis. Other presenting features included a perineal mass, constipation, and urinary dysfunction. MRI was performed in all patients as the primary diagnostic modality, whereas computed tomography and endoanal ultrasound were used selectively. A retrorectal mass was detected on digital rectal examination in 87.5% of patients (Table 1).

Tumor location, surgical approach, and perioperative outcomes are summarized in Table 2. Most tumors were located below the S3 vertebral level (68.8%). Accordingly, a posterior surgical approach was most frequently employed (56.3%), followed by anterior (25.0%) and combined approaches (18.7%). Lesions located below the S3 level were predominantly managed using a posterior approach, whereas tumors extending above this level more often required anterior or combined access. The median tumor size was 6 cm (range: 2-12 cm), and the mean operative time was 165±95 minutes (range: 70-360 minutes). Macroscopically complete tumor excision was achieved in all patients, with selective use of reconstructive techniques when required (Figure 2). Histopathologic examination demonstrated negative margins (R0 resection) in 15 patients, whereas one chordoma case had a microscopically positive margin (R1).

Table 1. Demographic characteristics and clinical-radiologic features of patients with retrorectal tumors

Variable	Value
Age (years)	48.3±14.2 (33-67)
Female/male ratio	11/5
Body mass index (kg/m^2)	29.5±4.4
ASA physical status class	
I-II	14 (87.5)
III-IV	2 (12.5)
Clinical presentation	
Pelvic or perineal pain	7 (43.8)
Perineal mass	3 (18.8)
Constipation	2 (12.5)
Urinary dysfunction	2 (12.5)
Asymptomatic	4 (25.0)
Radiologic evaluation	
MRI	16 (100)
CT	6 (37.5)
Endoanal ultrasound	2 (12.5)
Mass detected on digital rectal examination	14 (87.5)

Data are presented as mean ± standard deviation (range), number (%), or ratio

ASA: American Society of Anesthesiologists

Some patients experienced more than one perioperative complication. Complications were recorded on an event basis. Intraoperative complications occurred in seven patients, with cyst rupture being the most common intraoperative event (25.0%), followed by pelvic bleeding (12.5%) and rectal injury (6.3%). Cyst rupture was documented as an intraoperative event because of its potential impact on operative difficulty and postoperative management. Pelvic bleeding was controlled intraoperatively without the need for transfusion, and rectal injury was recognized during surgery and repaired primarily without subsequent leakage or major morbidity. Postoperative complications were observed in seven patients and were classified according to the Clavien-Dindo system as grade I in four patients, grade II in two patients, and grade III in one patient, which consisted of a postoperative pelvic collection requiring percutaneous drainage. The mean postoperative length of hospital stay was 8.6±9.4 days (range: 3-43 days). There was no postoperative 30-day mortality. Ninety-day readmission occurred in two patients (12.5%), and tumor recurrence was observed in one patient during follow-up (Table 2).

Histopathologic diagnoses and resection margin status are presented in Table 3. Congenital lesions constituted the majority of cases, including dermoid cysts, epidermoid cysts, tailgut cysts, and mature teratomas (Figure 3). Malignant tumors were identified in five patients (31.2%), all of which were chordomas (Figure 4). Negative histopathologic margins (R0 resection) were achieved in 15 patients. One patient with

Table 2. Tumor characteristics, surgical approach, and perioperative outcomes

Variable	Value
Tumor location	
Below S3	11 (68.8)
Above S3	5 (31.2)
Surgical approach	
Posterior	9 (56.3)
Anterior	4 (25.0)
Combined	3 (18.7)
Tumor size (cm)	6 (2-12)
Operative time (min)	165±95 (70-360)
Intraoperative complications	
Cyst rupture	4 (25.0)
Pelvic bleeding	2 (12.5)
Rectal injury	1 (6.3)
Postoperative complications (Clavien-Dindo)	
Grade I	4 (25.0)
Grade II	2 (12.5)
Grade III	1 (6.3)
Postoperative length of hospital stay (days)	8.6±9.4 (3-43)
Postoperative 30-day mortality	0
90-day readmission	2 (12.5)
Recurrence	1 (6.3)
Follow-up (months)	36 (12-96)

Data are presented as mean ± standard deviation (range), median (min-max), or number (%). Some patients experienced more than one complication

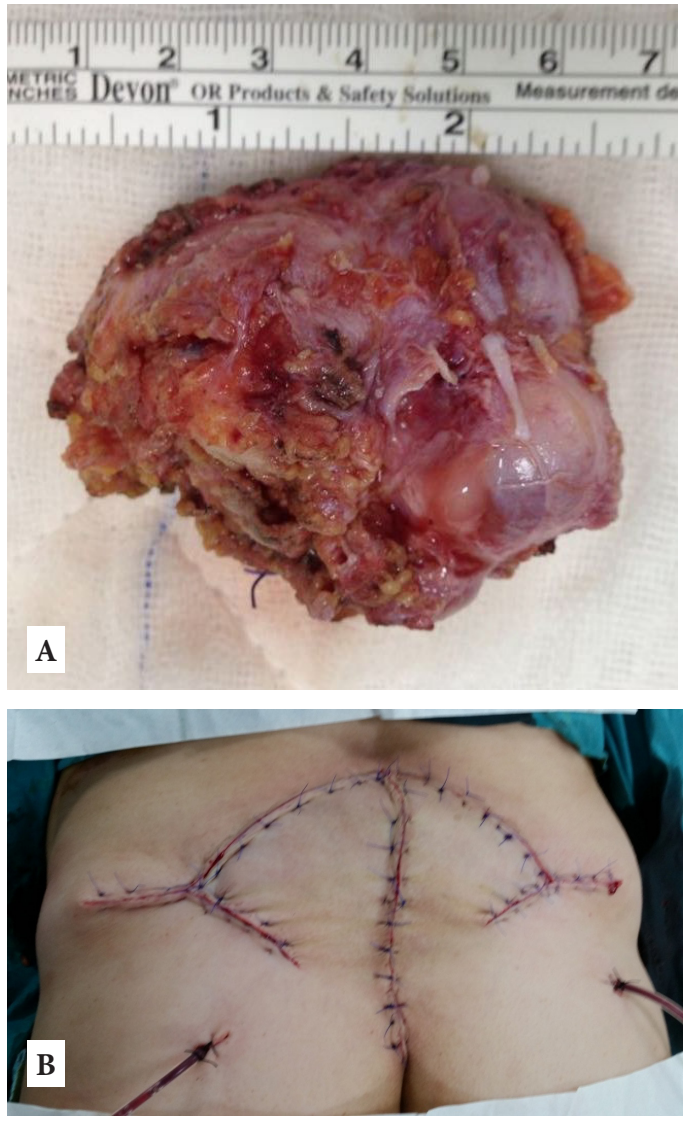

Figure 2. Surgical specimen and reconstruction following retrorectal tumor excision. Representative operative images showing (A) macroscopic specimen of a resected tailgut cyst and (B) postoperative reconstruction following en bloc chordoma excision using a V-Y advancement flap

chordoma had a microscopically positive margin (R1 resection) and subsequently underwent postoperative radiotherapy, later developing local recurrence during follow-up. The median follow-up duration was 36 months (range: 12-96 months).

Discussion

Retrorectal tumors remain among the most diagnostically and surgically demanding entities in colorectal surgery because of their rarity, embryologic heterogeneity, and anatomically concealed location. Although uncommon, these lesions carry substantial clinical significance, as delayed diagnosis or inadequate management may result in local invasion, malignant transformation, or long-term functional morbidity. In keeping with both early descriptions and contemporary series, the present cohort demonstrated a predominance of middle-aged female patients, confirming demographic patterns that have been consistently reported across different populations and healthcare systems.[1-4]

The histopathologic distribution observed in this study closely parallels that reported in large reviews and institutional series, in which congenital lesions account for the majority of retrorectal tumors.[2,5,6] Developmental cysts, including dermoid, epidermoid, and tailgut cysts, represented the most common benign entities in our cohort, consistent with findings from contemporary single-center and multicenter studies.[7,8,10,11] Notably, malignant tumors constituted nearly one-third of cases in the present series. Although this proportion exceeds that reported in several contemporary cohorts, it remains consistent with pooled estimates from systematic reviews and may reflect referral bias in tertiary centers managing more complex disease.[12,13] Recent evidence also suggests that the risk of malignant transformation in tailgut cysts may be

Table 3. Histopathologic findings and resection margin status

Histopathologic diagnosis	No. (%)	Benign/malignant	Negative margin (n)	Positive margin (n)
Congenital lesions				
Epidermoid cyst	2 (12.5)	Benign	2	0
Dermoid cyst	4 (25.0)	Benign	4	0
Tailgut cyst	2 (12.5)	Benign	2	0
Mature teratoma	3 (18.8)	Benign	3	0
Malignant tumors				
Chordoma	5 (31.2)	Malignant	4	1 (microscopic +)

Data are presented as number (%)

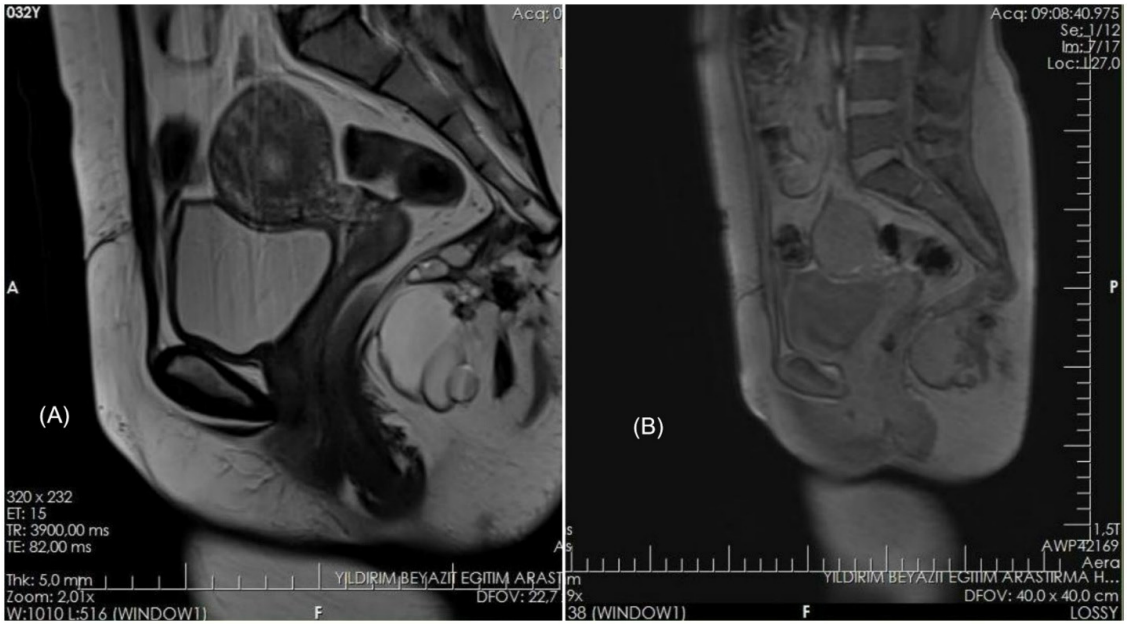

Figure 3. Magnetic resonance imaging features of a tailgut cyst. Representative sagittal MRI images demonstrating a retrorectal tailgut cyst. (A) T1-weighted image. (B) T2-weighted image
MRI: Magnetic resonance imaging

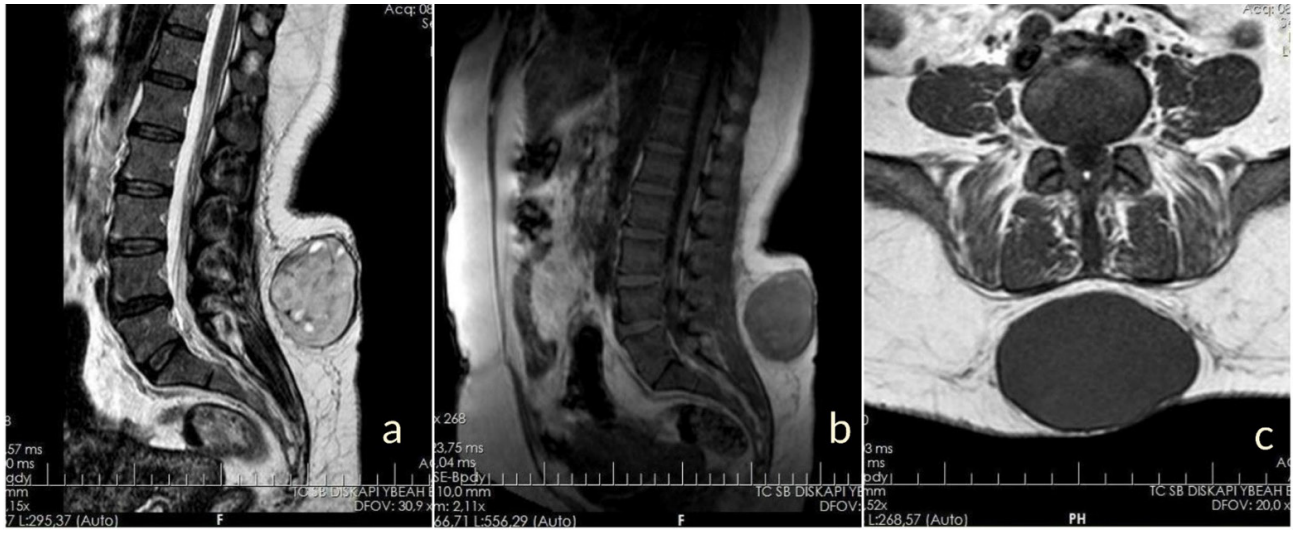

Figure 4. Magnetic resonance imaging features of a retrorectal chordoma. Representative pelvic MRI images demonstrating imaging characteristics of a retrorectal chordoma. (A) T1-weighted sagittal image. (B) T2-weighted sagittal image. (C) Axial image
MRI: Magnetic resonance imaging

higher than previously assumed, with rates exceeding 25% in systematic analyses, supporting the need for complete oncologic excision even in lesions presumed to be benign.[12] Although routine preoperative biopsy is generally discouraged because of the risks of infection, tumor seeding, and limited diagnostic yield in cystic lesions, some centers advocate a selective biopsy strategy in cases with radiologic suspicion of malignancy to guide multidisciplinary treatment planning. The relatively high proportion of malignant tumors in our cohort, together with the achievement of negative margins in most chordoma cases, likely reflects referral patterns to tertiary centers managing more complex retrorectal disease and provides additional insight into the surgical management of malignant retrorectal tumors.

Preoperative evaluation plays a pivotal role in guiding management strategies. In the present study, MRI served as the primary diagnostic modality, enabling accurate assessment of tumor extent, sacral involvement, and relationships with adjacent pelvic structures. This image-based approach is strongly supported by existing literature, which consistently identifies MRI as the most informative modality for preoperative planning.[4] In a dedicated analysis of preoperative assessment, Sagar et al.[14] demonstrated that cross-sectional imaging accurately discriminated benign from malignant retrorectal tumors in the vast majority of cases, whereas preoperative biopsy did not alter surgical strategy or clinical decision-making.[14] In contrast, the role of preoperative biopsy has progressively diminished. Multiple studies have demonstrated that biopsy provides limited diagnostic benefit in resectable retrorectal tumors and carries meaningful risks, including infection, fistula formation, and tumor seeding, particularly in cystic lesions.[2,3,7,10]

Selection of the surgical approach remains a central determinant of perioperative outcomes and long-term disease control. In our cohort, the operative strategy was primarily guided by tumor location relative to the S3 vertebral level, in accordance with well-established anatomical principles. Posterior approaches predominated, reflecting the high prevalence of lesions confined below S3, whereas anterior or combined approaches were reserved for tumors extending cranially or involving adjacent structures. This strategy aligns closely with operative paradigms described in major series and reviews, which emphasize posterior access for lesions located below the S3 level.[2,3,7,14-16] As summarized in Table 4, posterior access remains the most frequently employed approach across contemporary cohorts, although its utilization varies according to tumor characteristics and institutional expertise. The comparisons presented in Table 4 should be interpreted as descriptive rather than statistical, given the differences in study design, sample size, and tumor composition across the available series. Rather than proposing a novel surgical technique, the present study illustrates the practical application of established anatomical principles in surgical decision-making for retrorectal tumors and highlights the value of preoperative imaging in determining the most appropriate operative approach. The wide variation in operative time likely reflects differences in tumor size, anatomical extent, and the need for combined surgical approaches in selected cases.

When contextualized within the broader literature, the perioperative outcomes observed in the present study are largely comparable to those reported in modern series. Although the overall complication rate in our cohort appears higher than that reported in some larger studies, such as those by Gould et al.[15] and Broccard et al. [10], this difference

Table 4. Summary of published surgical series on retrorectal tumors

Study	Year	Study type	No. of patients	Malignant tumors (%)	Posterior approach (%)	Anterior or combined (%)	Complication rate (%)	Recurrence (%)	Follow-up (months)
Baek et al.[2]	2016	Systematic review	1,708	30	52	48	13.2	21.6	30
Yalav et al.[7]	2020	Retrospective	20	15	70	30	35	5	53.8±40
Carpelan-Holmström et al.[8]	2020	Retrospective	52	8	85	15	21	27	39.6
Li and Lu[11]	2021	Retrospective	31*	25.8	83.9	16.1	22.6	37.5	25
Gould et al.[15]	2021	Retrospective	107*	15.9	60	40	6	7	12
Broccard et al.[10]	2022	Retrospective	73	8.2	76.7	23.3	17.8	5	40.8
Present study	2025	Retrospective	16	31.2	56.3	43.7	43.8	6.3	36

Data are presented as number, percentage, mean ± standard deviation, or median as reported in the original studies. NR: not reported. Complication rates may vary across studies due to differing definitions. *Calculated based on surgically treated patients only.

likely reflects the inclusion of minor (Clavien-Dindo grades I-II) events, variations in complication definitions, and the limited sample size.[8] Importantly, most complications were low grade and did not result in prolonged morbidity. In addition, events such as cyst rupture were recorded as intraoperative complications in this study, which may contribute to a higher overall rate than that observed in series using different reporting criteria. The relatively high complication rate may also reflect referral patterns of a tertiary center managing more complex retrorectal tumors. Postoperative outcomes and recurrence were assessed through routine clinical evaluation and radiologic follow-up, primarily using MRI when clinically indicated.

Long-term outcomes following retrorectal tumor resection are closely linked to the achievement of complete excision with negative margins, particularly in malignant disease. In the present cohort, margin positivity was limited to a single case of chordoma, a tumor type well recognized for its locally aggressive behavior and propensity for recurrence despite technically adequate surgery.[3,10] Across published series, recurrence rates vary widely, ranging from <5% to >30%, with higher rates typically observed in cohorts enriched with malignant tumors or multiloculated cystic lesions.[8-10] As illustrated in Table 4, the relatively low recurrence rate observed in this study compares favorably with those reported in similar single-center cohorts and supports the importance of careful surgical planning and en bloc excision.

The role of minimally invasive techniques in the management of retrorectal tumors continues to evolve. Although open surgery constituted the predominant approach in our cohort, accumulating evidence suggests that laparoscopic and robotic techniques may achieve comparable oncologic outcomes with reduced hospital stays in carefully selected patients.[13,15] Nevertheless, given the rarity and heterogeneity of these tumors, minimally invasive approaches should be reserved for centers with advanced expertise and should never compromise the fundamental objective of complete tumor excision.

Study Limitations

Several limitations of this study should be acknowledged. First, the retrospective design and relatively small sample size reflect the inherent rarity of retrorectal tumors and are consistent with most published series. The extended study period may also introduce variability related to advances in imaging, surgical techniques, and perioperative care. Second, the histopathologic heterogeneity of retrorectal tumors should be considered when interpreting the findings. These lesions encompass a wide spectrum of congenital, benign, and malignant entities with distinct biological behaviors and recurrence patterns. In the present study, different tumor subtypes were analyzed together because the primary objective was to describe surgical management and approach selection based on anatomical considerations rather than to compare oncologic outcomes between specific tumor types. In addition, functional outcomes such as bowel, urinary, and sexual function were not systematically documented in the medical records; therefore, they could not be evaluated. Furthermore, the median follow-up duration of 36 months may be insufficient to fully capture late recurrences, particularly for malignant tumors such as chordomas. Future prospective studies with standardized data collection may allow for a more comprehensive characterization of patients and postoperative recovery.

Conclusion

In conclusion, retrorectal tumors require a tailored, anatomy-driven surgical strategy supported by high-quality imaging and multidisciplinary expertise. Complete surgical excision remains the cornerstone of management for both benign and malignant lesions. Viewed alongside contemporary evidence, these findings further support anatomy-based surgical decision-making in specialized centers.

Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee of Ankara Etlik City Hospital (decision no: 2025-662, date: 18.11.2025).

Informed Consent: The requirement for written informed consent was waived due to the retrospective use of de-identified patient data.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.Ö., Concept: E.Ö., A.Ş., Design: E.Ö., A.Ş., Data Collection or Processing: E.Ö., Analysis or Interpretation: E.Ö., A.Ş., Literature Search: E.Ö., A.Ş., Writing: E.Ö., A.Ş.

Conflict of Interest: The authors declare no conflict of interest.

Financial Disclosure: The authors declare that no financial support was received for this study.

REFERENCES

1. Jackman RJ, Clark PL, Smith ND. Retrorectal tumors. JAMA. 1951;145:956-961.
2. Baek SK, Hwang GS, Vinci A, Jafari MD, Jafari F, Moghadamyeghaneh Z, Pigazzi A. Retrorectal tumors: a comprehensive literature review. World J Surg. 2016;40:2001-2015.
3. Hobson KG, Ghaemmaghami V, Roe JP, Goodnight JE, Khatri VP. Tumors of the retrorectal space. Dis Colon Rectum. 2005;48:1964-1974.
4. Neale JA. Retrorectal tumors. Clin Colon Rectal Surg. 2011;24:149-160.
5. Toh JWT, Morgan M. Management approach and surgical strategies for retrorectal tumours: a systematic review. Colorectal Dis. 2015;18:337-350.
6. Otote J, Butnari V, Ravichandran PS, Mansuri A, Ahmed M, Pestrin O, Rajendran N, Kaul S. Presacral tumors: a systematic review of literature. J Clin Imaging Sci. 2024;14:17.
7. Yalav O, Topal U, Eray İC, Deveci MA, Gencel E, Rencuzogullari A. Retrorectal tumor: a single-center 10-years' experience. Ann Surg Treat Res. 2020;99:110-117.
8. Carpelan-Holmström M, Koskenvuo L, Haapamäki C, Renkonen-Sinisalo L, Lepistö A. Clinical management of 52 consecutive retro-rectal tumours treated at a tertiary referral centre. Colorectal Dis. 2020;22:1279-1285.
9. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370:1453-1457.
10. Broccard SP, Colibaseanu DT, Behm KT, Mishra N, Davis P, Maimone KL, Mathis KL, Stocchi L, Dozois EJ, Merchea A. Risk of malignancy and outcomes of surgically resected presacral tailgut cysts: a current review of the Mayo Clinic experience. Colorectal Dis. 2022;24:422-427.
11. Li Z, Lu M. Presacral tumor: insights from a decade's experience of this rare and diverse disease. Front Oncol. 2021;11:639028.
12. Nicoll K, Bartrop C, Walsh S, Foster R, Duncan G, Payne C, Carden C. Malignant transformation of tailgut cysts is significantly higher than previously reported: systematic review of cases in the literature. Colorectal Dis. 2019;21:869-878.
13. Mullaney TG, Lightner AL, Johnston M, Kelley SR, Larson DW, Dozois EJ. A systematic review of minimally invasive surgery for retrorectal tumors. Tech Coloproctol. 2018;22:255-263.
14. Sagar AJ, Koshy A, Hyland R, Rotimi O, Sagar PM. Preoperative assessment of retrorectal tumours. Br J Surg. 2014;101:573-577.
15. Gould LE, Pring ET, Corr A, Fletcher J, Warusavitarne J, Burling D, Northover JMA, Jenkins JT; St. Mark's Retrorectal Study Group, St Mark's Hospital. Evolution of the management of retrorectal masses: a retrospective cohort study. Colorectal Dis. 2021;23:2988-2998.
16. Chéreau N, Lefevre JH, Meurette G, Mourra N, Shields C, Parc Y, Tiret E. Surgical resection of retrorectal tumours in adults: long-term results in 47 patients. Colorectal Dis. 2013;15:e476-e482.