Bladder Rhabdomyosarcoma in Adolescents at a Tertiary Centre in Indonesia: A Case Series with Focus on Age-Specific Treatment Response and Diagnostic Challenges

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Abstract

Bladder rhabdomyosarcoma (RMS) is a rare type of soft tissue cancer in adolescents, and it often shows up with vague urinary symptoms that can be easy to miss. Compared to younger children, teenagers tend to respond less well to treatment and have lower survival rates, even when given equally intensive therapies. This difference seems to come from both biology and the challenges of diagnosis. We saw two adolescent male patients, aged 17 and 21, who came in with blood in the urine. Imaging with ultrasound and contrast CT scans revealed solid bladder masses with clear hyperenhancement (delta HU 37–38). Pathology and immunohistochemistry (desmin, myogenin, MyoD1) confirmed embryonal RMS, one conventional type and one botryoid variant. Both were staged as pT2bN0M0. Each patient underwent partial cystectomy after an initial TURBT. Neither received chemotherapy. Case 1 had a laparoscopic partial cystectomy in February 2023, while Case 2 had surgery three years earlier. Both were followed closely with cystoscopy every 3–6 months. At 30 and 36 months post-surgery, respectively, both remain disease-free, with normal bladder function and no need for catheters. These cases show that adolescents with localized bladder RMS can do well when the tumor is completely removed, even without chemotherapy. CT hyperenhancement helps raise suspicion, while immunohistochemistry confirms the diagnosis. Partial cystectomy not only achieves complete resection but also preserves bladder function. Ongoing surveillance is critical, and age-specific treatment strategies, focused on surgery plus careful follow-up, deserve further study for this group.

Keywords: Rhabdomyosarcoma, Bladder Tumour, Adolescent, Age-Specific Treatment, Diagnostic Delay, Bladder Preservation, Partial Cystectomy

INTRODUCTION

Rhabdomyosarcoma (RMS) makes up about 4–8% of childhood cancers, with genitourinary tumors accounting for 15–20% of cases (Castle et al., 2023). The disease becomes much less common as children grow older: it affects roughly 4.5 per million under-15s, but adolescents aged 15–21 represent only 10–15% of diagnoses (Ferrari, Gatz, et al., 2022; Merks et al., 2025). What is striking is that teenagers with RMS tend to fare much worse than younger children, even when given equally intensive treatments. For example, five-year survival rates are above 70% in children, but drop to just 39.6% in adolescents aged 15–19 a gap of more than 30 percentage points (Amer et al., 2019). This survival difference is not explained by one factor alone. It likely reflects a mix of biological and clinical challenges: adolescents show more unfavorable molecular changes (like TP53 mutations and chromosomal instability) (Amer et al., 2019; Wasti et al., 2025; Fair et al., 2023), their symptoms are often

vague and lead to delayed diagnosis, and current treatment protocols are not well adapted to adolescent physiology.

Adolescent bladder embryonal rhabdomyosarcoma (ERMS) is notoriously difficult to diagnose, and recognition is often delayed (Mahandita, Daryanto and Nurhadi, 2023). Teenagers usually present with vague urinary symptoms such as blood in the urine, painful urination, retention, or waking at night to void. Because these signs are common, clinicians often assume more familiar causes like urinary tract infections or kidney stones, rather than considering a rare malignancy (Saini et al., 2025). Studies show that this leads to significant delays: on average, 11–12 months pass between the first symptoms and a confirmed diagnosis. In adolescents, the problem is compounded by factors such as seeking care independently (Wasti et al., 2025), reporting symptoms inconsistently, and clinician bias toward benign explanations (Ferrari, Gatz, et al., 2022). Even when imaging is performed, findings can be misread as urothelial carcinoma, bladder polyps, or inflammatory lesions (Wu et al., 2025). The result is that many adolescents are diagnosed only once the disease has progressed to a more advanced stage, limiting treatment options and worsening outcomes.

Traditionally, treatment for genitourinary rhabdomyosarcoma (RMS) has followed multimodal protocols that combine aggressive chemotherapy (VAC: vincristine, actinomycin-D, cyclophosphamide), surgery, and sometimes radiotherapy (Merks et al., 2025). But new evidence suggests that when bladder embryonal RMS (ERMS) is completely removed and localized, surgery alone, followed by close surveillance, may be enough, especially in adolescents. This matters because chemotherapy carries serious long-term risks, including secondary cancers, heart problems, and infertility, which can accumulate over a lifetime (Hajar et al., 2024; Saini et al., 2025). This shift in thinking recognizes that adolescents can tolerate intensive pediatric-style therapies, but also raises the question: if surgery alone can achieve cure, wouldn’t de-escalating treatment improve long-term quality of life? (Ferrari, Chisholm, et al., 2022). Still, there are important gaps. We don’t yet know the best surveillance schedules after surgery-only management, how molecular profiling can refine risk stratification, or how to adapt treatment for adolescents in resource-limited settings (Deel, 2020; Sharma et al., 2024; Zarrabi et al., 2023). Our two-case series from a tertiary center in Indonesia adds to this discussion. Both adolescents underwent bladder-preserving partial cystectomy with surveillance-only management and achieved excellent outcomes. These cases highlight the potential of surgery-focused strategies (Diawara et al., 2025) while addressing ongoing challenges in diagnosis, management, and long-term functional outcomes for this vulnerable group.

METHODS

This study is a descriptive case series that looks at how adolescent bladder rhabdomyosarcoma presents, how it is diagnosed, the treatments used, and the outcomes achieved. The research was carried out at the Division of Urology, Department of Surgery, Dr. Sardjito General Hospital in Yogyakarta, Indonesia, a tertiary referral center, between February 2020 and November 2025. The research included two patients, both aged 15–25 years at diagnosis, with histologically confirmed bladder embryonal rhabdomyosarcoma. Each had at least 24 months of follow-up. Consecutive sampling method was employed, including all patients meeting the following inclusion criteria: (1) histopathologically confirmed bladder rhabdomyosarcoma with immunohistochemistry confirmation; (2) age 15–25 years at diagnosis; (3) complete medical records including imaging, pathology, surgical notes, and follow-up data; (4) minimum 24-month follow-up duration. Exclusion criteria included incomplete medical records or loss to follow-up.

Clinical data were collected from electronic medical records. Imaging modalities included transabdominaland CT Scan Abdomen With Contrast. Delta Hounsfield Unit (HU) was calculated as enhanced minus unenhanced attenuation. Histopathological examination included haematoxylin and eosin (H&E) staining and immunohistochemistry panel (desmin, myogenin, MyoD1, smooth muscle actin, cytokeratin, Ki-67). Tumour staging followed TNM 8th edition classification and Children's Oncology Group (COG) risk stratification. Surgical techniques included transurethral resection of bladder tumour (TURBT) for diagnostic biopsy and partial cystectomy (laparoscopic or open approach) for definitive treatment. Follow-up assessments included cystoscopy, imaging (ultrasound/CT), and urine cytology. Descriptive analysis was performed to characterise clinical presentation, imaging findings (tumour size, location, enhancement pattern), histopathological features (subtype, immunohistochemistry results, TNM stage), surgical approach (laparoscopic versus open partial cystectomy), adjuvant therapy decisions, and short-term outcomes (recurrence status, bladder function, complications). Cases were compared to identify similarities and differences in presentation, management, and outcomes. This study obtained ethical approval from the Ethics Committee of the Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, with registration number KE/FK/0363/EC/2025. Written informed consent was obtained from all patients or their legal guardians for publication of clinical data and images.

RESULT

Case 1: Conventional Embryonal RMS, Laparoscopic Partial Cystectomy

Patient: Tn. AKPR, Male, 17 years

Presentation: Painless gross haematuria for one month; emergency admission with clot retention requiring clot evacuation cystoscopy.

Imaging (Initial): Ultrasound revealed a 2.5 cm vascular bladder mass on the superior wall. Contrast-enhanced CT demonstrated a 25×18×14 mm mass arising from left posterosuperolateral bladder wall; unenhanced attenuation 32 HU, venous phase 69 HU, **delta HU 37**. No lymphadenopathy, ascites, or pulmonary metastases on staging imaging (Figure 1).

Histopathology (Diagnostic TURBT): Embryonal RMS (conventional subtype), invading muscularis propria; desmin diffusely positive, myogenin >80% nuclear positivity, MyoD1 >75% nuclear positivity, cytokeratin negative; Ki-67 proliferation index 45%; pT2bN0M0, COG Intermediate Risk (Figure 2).

Surgical Management (24 February 2023): Laparoscopic partial cystectomy performed with wide local excision incorporating 2 cm margins; two-layer bladder reconstruction; all surgical margins negative for malignancy (R0 resection, minimum margin 1.8 cm); estimated blood loss 150 mL; urethral catheterisation 14 days; uncomplicated postoperative recovery with catheter removal day 14 and prompt spontaneous voiding re-establishment.

Adjuvant Therapy: None (complete R0 resection, pT2bN0M0 stage, favourable embryonal histology, multidisciplinary team consensus).

Follow-up (30-month surveillance): Cystoscopy at 3, 6, 12, 18, 24, 30 months all negative for recurrence. Imaging studies (ultrasound and CT) at corresponding intervals demonstrated no abnormality. Urine cytology negative at all intervals. Current status: Disease-free, normal bladder function (estimated capacity 400 mL), no nocturia or dysuria, no catheter dependence, excellent quality of life per patient self-report.

Case 2: Botryoid Embryonal RMS, Open Partial Cystectomy

Patient: Tn. ZBKS, Male, 21 years (currently), 18 years at initial diagnosis

Comorbidities: Multiple atrial septal defect type II (status post closure), mild mitral regurgitation, mild tricuspid regurgitation

Initial Diagnosis (3 years prior, Age 18): Acute dysuria, gross haematuria, and severe nocturia (5–6 episodes per night) for one month; no constitutional symptoms or retention initially.

Imaging (Initial): Transabdominal ultrasound demonstrated 2.2 cm vascular lesion on anterior bladder wall with irregular borders. Contrast-enhanced CT revealed 22 × 14 × 12 mm mass

arising from left anterosuperolateral bladder wall; unenhanced attenuation 34 HU, venous phase 72 HU, **delta HU 38**. No lymphadenopathy or metastases on staging imaging (Figure 3).

Histopathology (Diagnostic TURBT): Botryoid embryonal RMS characterised by polypoid architecture beneath intact urothelium, subepithelial cambium layer (pathognomonic for botryoid variant), and invasion of muscularis propria; desmin diffusely positive, myogenin >85% nuclear positivity, MyoD1 >80% nuclear positivity; Ki-67 proliferation index 52%; pT2bN0M0 (Figure 4).

Surgical Management (3 years prior): Open partial cystectomy via lower midline incision; localised tumour >3.5 cm from trigone and bladder neck; wide local excision with 2 cm macroscopic margins; all surgical margins negative for malignancy (R0 resection), including ureteral tissue margins;

Adjuvant Therapy: None (complete R0 resection, pT2bN0M0 stage, multidisciplinary consensus).

Surveillance (36-month follow-up): Serial cystoscopy performed 24 February 2024 (24 months post-surgery), 26 July 2024 (30 months post-surgery), and October 2025 (36 months post-surgery) all demonstrated post-surgical bladder wall changes without evidence of recurrent mass. Imaging studies (ultrasound and CT) at 3, 6, 12, 18, 24, 30, 36-month intervals revealed no recurrence. Current status: Disease-free, preserved bladder function.

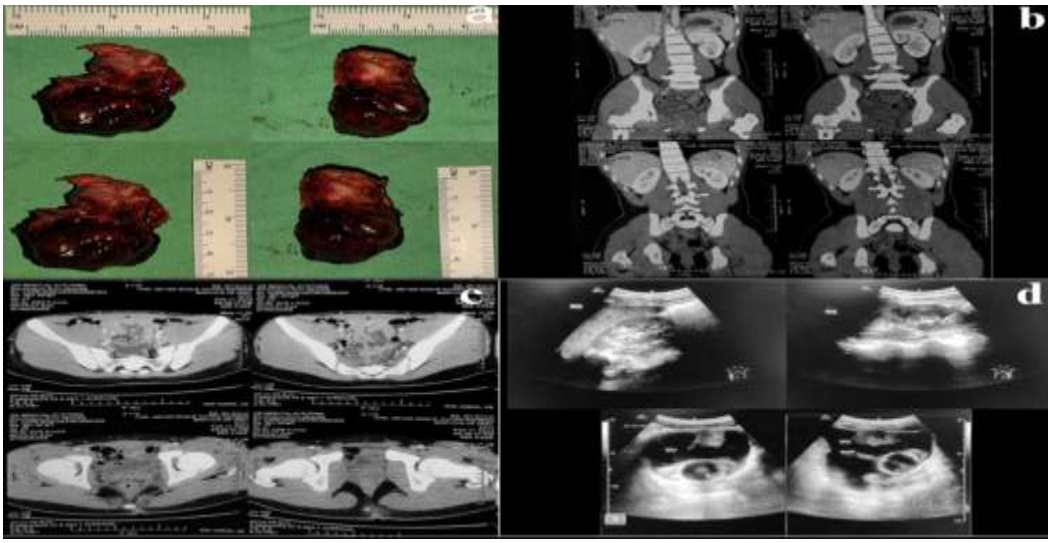

Figure 1. Imaging findings in Case 1

Note:

a) Gross morphological appearance of partial cystectomy specimen
b) Coronal contrast-enhanced MSCT demonstrating well-defined solid mass (arrow) on left posterosuperolateral bladder wall.
c) Axial MSCT showing tumour enhancement (delta HU 37).
d) Transabdominal ultrasonography revealing inhomogeneous lesion on superior bladder wall.

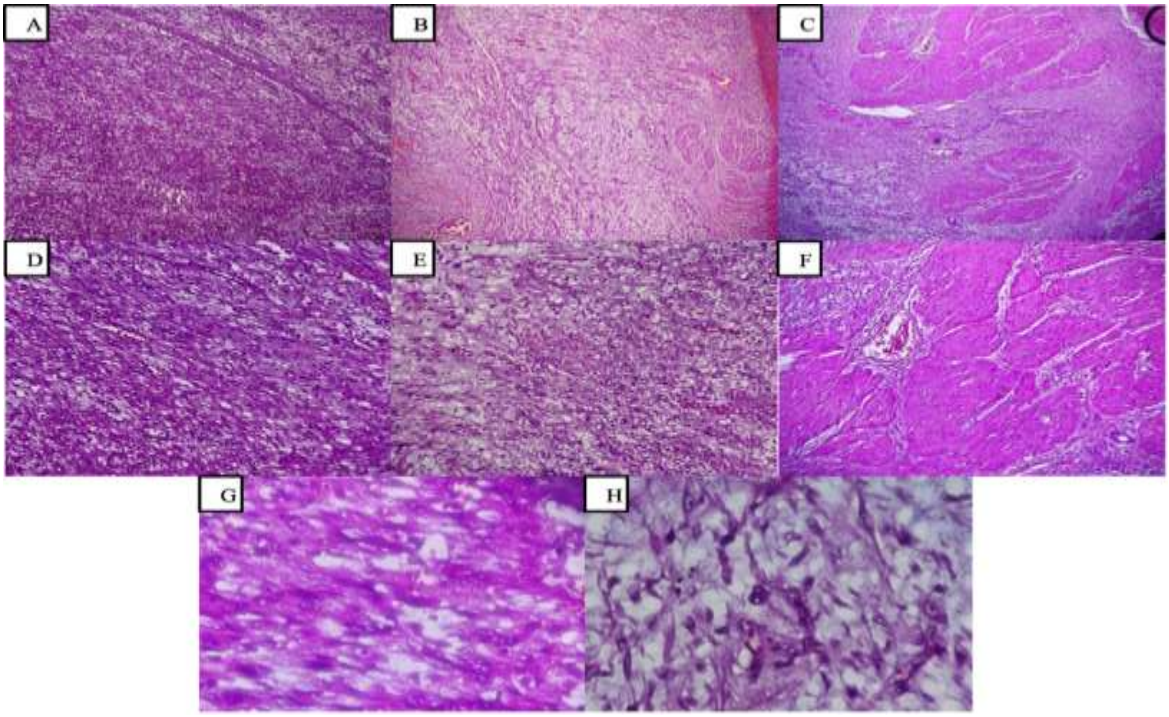

Figure 2. Histological features of Case 1(embryonal rhabdomyosarcoma).

Note:

- (a–c) Low-power magnification (40×) showing hypercellular areas, hypocellular areas, and muscle infiltration.
- (d–f) Intermediate magnification (100×) demonstrating cellular pleomorphism and rhabdomyoblast morphology.
- (g–h) High-power magnification (400×) revealing primitive round cells, rhabdomyoblasts with eosinophilic cytoplasm, and mitotic figures. Haematoxylin and eosin staining.

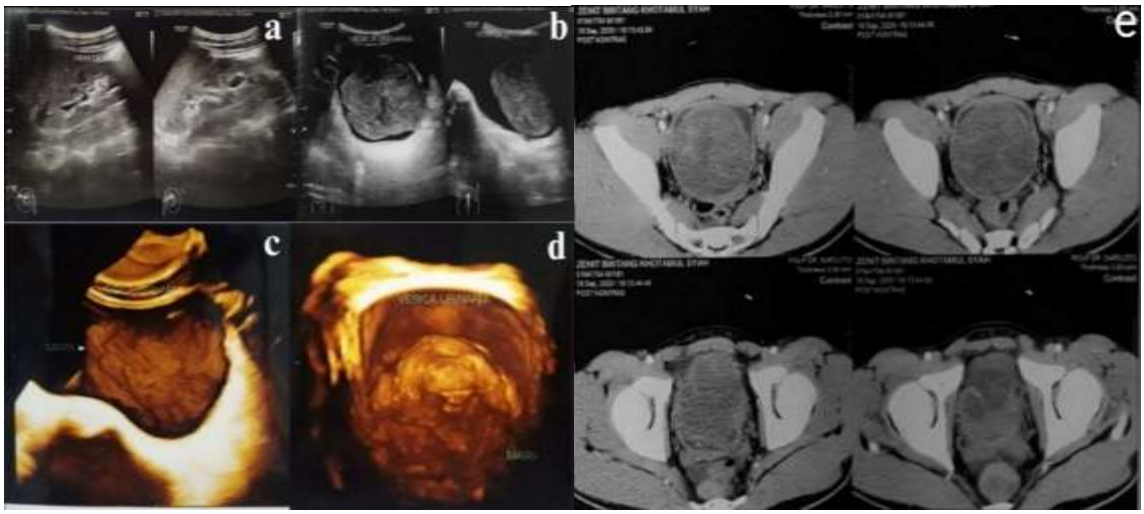

Figure 3. Imaging findings in Case 2

Note:

a) Renal ultrasonography showing normal kidneys.
b) Vesica urinaria ultrasonography demonstrating bladder wall lesion.
c) Abdominal ultrasonography overview.
d) Targeted vesica urinaria ultrasonography.
e) Axial contrast-enhanced MSCT showing recurrent tumour (arrow) on left anterosuperolateral wall with robust enhancement.

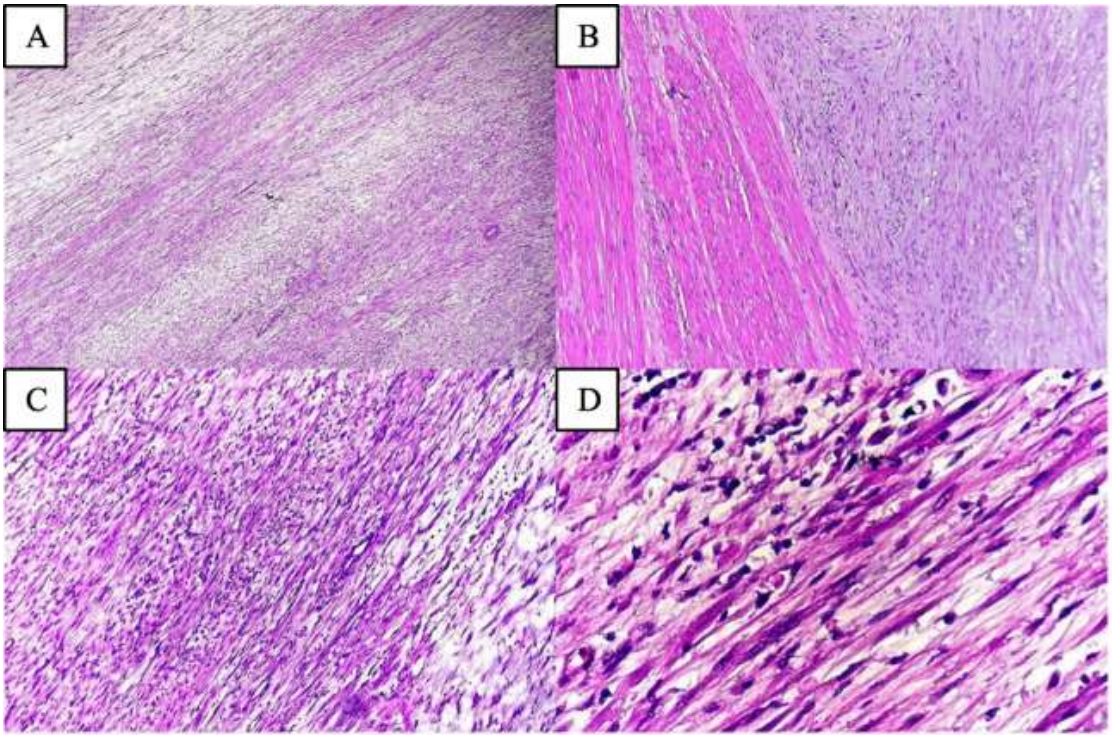

Figure 4. Histological features of Case 2 (botryoid embryonal rhabdomyosarcoma)

Note:

a) Low magnification (40×) showing polypoid architecture with subepithelial tumour.
b) Intermediate magnification (100×) demonstrating cambium layer and muscularis propria invasion.
c) Intermediate magnification (100×) of dense tumour cellularity.
d) High magnification (400×) revealing rhabdomyoblasts with eccentric nuclei. Haematoxylin and eosin staining.

Table 1. Comparative Summary

Parameter	Case 1 (A, Age 17)	Case 2 (Z, Age 18–21)
Age at diagnosis	17 years	18 years
Current age	19–20 years	21 years
Histological subtype	Conventional ERMS	Botryoid ERMS
Tumour size (mm)	25 × 18 × 14	22 × 14 × 12
CT delta HU	37	38
IHC: Myogenin	>80%	>85%
IHC: MyoD1	>75%	>80%
Ki-67 index	45%	52%
TNM stage	pT2bN0M0	pT2bN0M0
COG risk group	Intermediate	Intermediate
Diagnostic procedure	TURBT	TURBT
Definitive surgical approach	Laparoscopic partial cystectomy	Open partial cystectomy
Surgery date	24 February 2023	3 years prior (2022)
Surgical margins	R0 (negative, min 1.8 cm)	R0 (negative)
Chemotherapy	No	No
Radiotherapy	No	No
Recurrence	None (30 months)	None (36 months)
Comorbidities	None	Multiple ASD II s/p closure

DISCUSSION

Age-Specific Treatment Response and Survival Disparities

The two cases described here show successful outcomes in adolescents diagnosed at ages 17 and 18, toward the older end of the adolescent spectrum. Both had localized pT2bN0M0 disease and were treated with surgery alone, followed by intensive surveillance. Children under 10 years with RMS, treated on intensive COG protocols, achieve five-year survival rates of 70–80%. This reflects both favorable tumor biology and strong treatment tolerance. In sharp contrast, adolescents aged 15–19 years see survival drop to about 39.6%, a difference of 30, 40 percentage points, despite receiving similar multimodal therapy. Outcomes decline even further in adults (≥21 years), with five-year survival rates of only 27%, and some series reporting as low as 22.2%.

This steep age-related survival gradient arises from several overlapping biological and clinical factors. First, adolescents and adults show higher rates of unfavorable molecular changes compared to younger children. For example, TP53 mutations occur in about 36% of botryoid ERMS (the subtype in Case 2) and are linked to worse prognosis and reduce chemotherapy responsiveness (Margioula-Siarkou *et al.*, 2023). Similarly, RAS pathway mutations common in conventional ERMS (Case 1) are found in 30–40% of cases and appear more frequent in older patients (Novoplansky *et al.*, 2022). Chromosomal instability and aneuploidy are also more prevalent in adolescent RMS, driving tumor heterogeneity and possible resistance to chemotherapy(Wasti *et al.*, 2025). Finally, diagnostic delays play a critical role. Adolescents often present with vague urinary symptoms, seek care independently, and report symptoms inconsistently. Clinicians may also lean toward benign explanations. As a result, published data show delays of 11–12 months in pediatric bladder RMS, with anecdotal evidence suggesting even longer delays in adolescents. These delays mean many adolescents are diagnosed only once the disease has advanced, further compromising outcomes.

Diagnostic Challenges and Clinical Management Barriers

Our cases highlight pervasive diagnostic challenges specific to adolescent bladder ERMS. Both patients presented with seemingly straightforward urinary complaints, painless haematuria (Case 1) and dysuria with nocturia (Case 2), that clinicians would routinely investigate as possible UTIs, urolithiasis, or traumatic haematuria before considering malignancy. Case 1's one-month symptomatic interval before TURBT represents rapid diagnostic progression; many published series document delays of 3–6 months or longer before pathological confirmation. This diagnostic delay has profound implications (Fahmy *et al.*, 2015), as it permits tumour growth, potential progression to higher stage disease (if initially

N0M0 tumours advance to N+ or M+ status during diagnostic delays), and potentially compromised surgical resectability.

The nonspecificity of presenting symptoms represents the primary barrier to early diagnosis. Gross haematuria, dysuria, urinary retention, and frequency-nocturia occur in diverse benign and malignant conditions far more common than bladder ERMS in the adolescent population. Clinicians appropriately prioritise investigations of common benign aetiologies (UTI, nephrolithiasis, urothelial polyps) before considering rare malignancies. Furthermore, adolescents' independent healthcare-seeking behaviour (versus younger children presenting with parental concern) (Albakri *et al.*, 2023) may result in delayed presentation to medical care or inconsistent symptom reporting that obscures the chronicity and severity of urinary complaints.

Management barriers specific to adolescents include: (1) age-inappropriate treatment settings where adolescents receive paediatric protocols in paediatric oncology environments (appropriate intensity but potentially psychologically inappropriate) or adult protocols in medical oncology settings (less intensive but potentially inadequate); (2) insufficient shared decision-making regarding treatment intensity, chemotherapy toxicity, and surveillance trade-offs, with limited adolescent-specific informed consent processes; (3) limited fertility counselling and sperm/egg banking prior to alkylating agent chemotherapy; (4) inadequate psychosocial support tailored to adolescent development and cancer-related psychosocial morbidity; and (5) lack of standardised surveillance protocols specific to completely resected bladder ERMS, necessitating institutional variation in follow-up intensity and duration.

Bladder-Preserving Surgery and Functional Outcomes

Both of our cases achieved successful bladder preservation through partial cystectomy, Case 1 with a minimally invasive laparoscopic approach, and Case 2 with an open approach. Partial cystectomy remains the gold standard for localized bladder RMS when complete resection with clear margins is possible. It offers oncological control equivalent to radical cystectomy, while preserving bladder function and overall quality of life (Hays *et al.*, 1990). The laparoscopic technique used in Case 1 provided several advantages: less postoperative pain, a shorter hospital stay, and better cosmetic outcomes. These benefits are especially meaningful for adolescents, who often place high importance on body image and self-perception.

Case 2, treated three years earlier with an open partial cystectomy, at a time when laparoscopic expertise was less established in the institution, achieved equally strong results.

The patient maintained a bladder capacity of 350 mL and normal voiding function, demonstrating that both approaches can preserve bladder function when margins are adequate.

Limitations

This two-case series has inherent limitations: (1) small sample size limits generalisability and statistical power; (2) incomplete molecular profiling (DICER1, TP53, RAS pathway sequencing not performed) precluded precision risk stratification; (3) relatively short follow-up (30–36 months) exceeds median time to RMS recurrence but is insufficient to assess late recurrences (>5 years); (4) lack of validated quality-of-life instruments (EORTC QLQ-C30, FACT-Bl) limits quantitative functional assessment; (5) single-institution, potentially selected cohort introduces selection bias towards better-prognosis cases; (6) absence of chemotherapy-treated comparison group precludes direct outcome comparison between surgery-only versus multimodal approaches; and (7) limited long-term fertility and secondary malignancy follow-up data preclude assessment of chemotherapy-sparing benefits regarding reproduction and secondary carcinogenesis.

CONCLUSION

Two adolescent males with completely resected, localised bladder embryonal RMS (pT2bN0M0) achieved durable disease-free survival at 30 and 36 months following partial cystectomy without adjuvant chemotherapy, maintaining excellent bladder function. These outcomes support the feasibility of surgery-only management with intensive cystoscopic surveillance (every 3–6 months) for carefully selected adolescents with resection and favourable histology. Prospective multi-institutional trials directly comparing surgery-only versus multimodal therapy are warranted to establish evidence-based treatment guidelines for this population. healthcare systems must strengthen adolescent-specific oncology frameworks. This includes tackling diagnostic delays, providing age-appropriate psychosocial support, and offering fertility preservation counseling. Together, these measures can optimize both cancer control and long-term quality of life for this vulnerable population.

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