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METASTATIC PARATESTICULAR EMBRYONAL RHABDOMYOSARCOMA WITH DELAYED OSSEOUS RELAPSE IN AN ADOLESCENT: A CASE REPORT AND LITERATURE REVIEW

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ABSTRACT

Paratesticular embryonal rhabdomyosarcoma (PT-RMS) is an uncommon pediatric soft-tissue sarcoma that typically presents as a painless scrotal or inguinal mass. We report a 15-year-old boy with a progressively enlarging painless right paratesticular mass and normal serum alpha-fetoprotein, beta-human chorionic gonadotropin, and lactate dehydrogenase levels. Doppler ultrasonography demonstrated a heterogeneous, hypervascular, 7.5-cm extratesticular lesion, while staging computed tomography (CT) identified retroperitoneal lymphadenopathy and bilateral pulmonary nodules.

Core biopsies of the primary lesion and a retroperitoneal node showed embryonal rhabdomyosarcoma (ERMS) with myxoid stroma, rhabdomyoblasts, brisk mitotic activity, and strong myogenic immunophenotype (Desmin, MyoD1, and focal Myogenin). Molecular testing was negative for PAX3/7: FOXO1 fusions, supporting a fusion-negative molecular profile. Given metastatic disease at presentation, the multidisciplinary team prioritized tissue diagnosis and neoadjuvant high-risk chemotherapy over immediate definitive surgery. Marked radiologic regression after three cycles permitted radical inguinal orchiectomy, which showed extensive treatment effect with only microscopic residual viable tumors. Despite completion of chemotherapy and an 18-month disease-free interval, surveillance imaging at 22 months revealed biopsy-proven solitary iliac osseous relapse.

This case illustrates that adolescent age, nodal and pulmonary dissemination, and later skeletal recurrence may outweigh the otherwise favorable implications of embryonal histology and fusion-negative status. It emphasizes early imaging, expert pathology, molecular characterization, multidisciplinary planning, and sustained surveillance in high-risk paratesticular rhabdomyosarcoma.

Keywords: Rhabdomyosarcoma; Embryonal; Paratesticular; PAX3/7: FOXO1 Fusions; Fusion-Negative Molecular Profile; Radical Inguinal Orchiectomy; Osseous Relapse

1 INTRODUCTION

Rhabdomyosarcoma is a malignant mesenchymal neoplasm showing skeletal-muscle differentiation and is the most common soft-tissue sarcoma of childhood. Paratesticular tumors account for approximately 7% of rhabdomyosarcomas and arise from mesenchymal elements of the spermatic cord, epididymis, or testicular envelopes rather than from the testicular parenchyma itself. [1,2] The usual presentation is a painless, enlarging intrascrotal or inguinal mass; therefore, the lesion may be incorrectly attributed to trauma, hydrocele, infection, or another benign scrotal condition.

Scrotal ultrasonography is central to determining whether the mass is intra- or extratesticular, whereas cross-sectional imaging defines regional nodal and distant involvement. Histopathologic confirmation with skeletal-muscle markers, including Desmin, Myogenin, and MyoD1, together with molecular assessment of PAX: FOXO1 fusion status, supports accurate diagnosis and risk stratification. [1,2] Treatment is risk-adapted and multidisciplinary, integrating systemic chemotherapy with appropriate local control by radical inguinal orchiectomy and, when indicated, radiotherapy or delayed resection after induction therapy. [1,2,3] Although localized paratesticular disease often has excellent outcomes, adolescents and patients with retroperitoneal nodal or distant metastatic disease have a substantially less favorable prognosis. [1,2] We report this case to highlight the diagnostic and management challenges posed by metastatic fusion-negative embryonal rhabdomyosarcoma in an adolescent and the importance of surveillance despite an initially excellent treatment response.

2 CASE PRESENTATION

2.1 Clinical Presentation

A 15-year-old male presented with a several-week history of a progressively enlarging, painless right scrotal mass. He reported no associated urinary symptoms, fever, or weight loss. The patient had initially attributed the swelling to a minor injury and had not sought prior medical attention. He sought evaluation due to increasing discomfort and the noticeable growth of the mass. His past medical history was unremarkable, and there was no significant family history of malignancy.

2.2 Physical Examination, Lab Work, Imaging, and Differential Diagnosis

Physical examination showed a firm, non-tender right paratesticular mass separate from the testis. The ipsilateral spermatic cord was not thickened, and no inguinal lymphadenopathy was detected. The contralateral testis and scrotal contents were normal. Serum tumor markers, including alpha-fetoprotein (AFP), beta-human chorionic gonadotropin (β-hCG), and lactate dehydrogenase (LDH), were within normal limits, making a germ cell tumor unlikely.

Doppler scrotal ultrasonography demonstrated a solid, heterogeneous, hypervascular 7.5 cm paratesticular mass distinct from the testis. Contrast-enhanced CT of the chest, abdomen, and pelvis identified an intrascrotal mass suggestive of metastatic disease, including multiple small bilateral pulmonary nodules and enlarged retroperitoneal lymph nodes, particularly along the para-aortic chain. The clinical and radiologic differential diagnosis included malignant paratesticular tumors, such as liposarcoma and leiomyosarcoma, as well as benign conditions, including adenomatoid tumors, fibrous pseudotumor, complicated hydrocele, and epididymitis.

2.3 Multidisciplinary Tumor Board Discussion and Management Plan

The case was presented at the multidisciplinary tumor board, which included specialists from pediatric oncology, urology, interventional radiology, and pathology. The central discussion focused on the patient's advanced stage, with radiologic evidence of both retroperitoneal nodal and pulmonary metastatic disease, and the implications of his adolescent age, which is known to confer a higher-risk profile compared to younger children.

The team reached a consensus that obtaining diagnostic tissue prior to any definitive surgical intervention was paramount to avoid unnecessary radical surgery and to guide upfront systemic therapy. Consequently, the recommended next steps were a core biopsy of the paratesticular mass under ultrasound guidance, combined with a

concurrent CT-guided biopsy of one of the enlarged retroperitoneal lymph nodes to confirm metastatic spread and provide sufficient tissue for comprehensive molecular characterization.

The tumor board deferred the radical inguinal orchiectomy, planning instead for it to be performed after several cycles of neoadjuvant chemotherapy, should the tumor demonstrate a favorable response. This approach aimed to reduce surgical morbidity, achieve better local control, and enable an immediate start of risk-adapted systemic therapy based on the complete pathologic and molecular profiles obtained from both biopsy sites.

2.4 Special Studies, Testing, Pathology, Immunohistochemistry (IHC), and Molecular Studies

The core biopsy of the paratesticular mass revealed a moderately cellular solid tumor with loose myxoid stroma. The tumor cells ranged from spindle-shaped with scant cytoplasm to scattered globoid cells with abundant eosinophilic cytoplasm, and occasional elongated cells with cross-striation (rhabdomyoblasts). Brisk mitotic activity was noted. Embryonal and alveolar rhabdomyosarcoma differ structurally in their cellular arrangement and tissue pattern: embryonal, as seen in our case, shows alternating loose myxoid and dense cellular areas with variable spindle cells (Figure 1A, B, C, D). In contrast, alveolar rhabdomyosarcoma is characterized by small round blue cells separated by fibrous septa, creating alveolar-like spaces; these features were not identified in the biopsy. Concurrent biopsy of the retroperitoneal lymph node demonstrated identical histologic features, confirming the presence of metastatic disease. IHC performed on both specimens showed diffuse, strong nuclear positivity for Myogenin and MyoD1, with cytoplasmic positivity for Desmin, and negativity for S-100, CD34, CD45, and cytokeratins, establishing the diagnosis of rhabdomyosarcoma. A bone marrow biopsy was negative for malignancy.

Given the patient's adolescent age, molecular studies were urgently performed on the biopsy material to refine risk stratification. Fluorescence in situ hybridization (FISH) and reverse transcriptase-polymerase chain reaction (RT-PCR) were negative for the PAX3/FOXO1 and PAX7/FOXO1 gene fusions, classifying the tumor as a fusion-negative rhabdomyosarcoma, a finding associated with a more favorable prognosis within the high-risk group and guiding the selection of a chemotherapy regimen tailored to this biological subtype. The tumor was staged as Stage 4 (T1b N1 M1) under the Children’s Oncology Group (COG) TNM staging system, and Clinical Group IV under the Intergroup Rhabdomyosarcoma Study (IRS) grouping system due to the presence of distant metastases at diagnosis

2.5 Treatment, Outcome, and Follow-up

The patient started on neoadjuvant systemic chemotherapy according to a high-risk protocol, consisting of vincristine, actinomycin-D, and ifosfamide (VAIA). No initial radiotherapy was given. After three cycles, a restaging CT scan demonstrated a significant reduction in the size of the primary paratesticular tumor, retroperitoneal lymph nodes, and pulmonary metastases, indicating a favorable response to induction therapy. The patient then underwent a radical inguinal orchiectomy with high ligation of the spermatic cord, which was well-tolerated with no postoperative complications. Pathologic examination of the resected specimen revealed extensive necrosis with only microscopic residual viable tumor, consistent with a good response to neoadjuvant therapy. He completed the planned total of nine cycles of chemotherapy.

At an 18-month follow-up, the patient remained clinically well with no evidence of recurrent or progressive disease on surveillance imaging, and his tumor markers remained negative. However, at 22 months, a routine surveillance PET-CT scan revealed new solitary osseous metastases in the right iliac bone. A biopsy confirmed recurrent rhabdomyosarcoma. He started second-line chemotherapy with a vincristine and irinotecan regimen, and the bone lesion was treated with palliative radiotherapy. The patient continued to receive salvage therapy, but his disease demonstrated a mixed response, with progression in some sites and stability in others.

His case was rediscussed at the tumor board, and a decision was made to enroll him in a clinical trial of a novel targeted agent (details not available), with continued supportive care and close monitoring for quality of life.

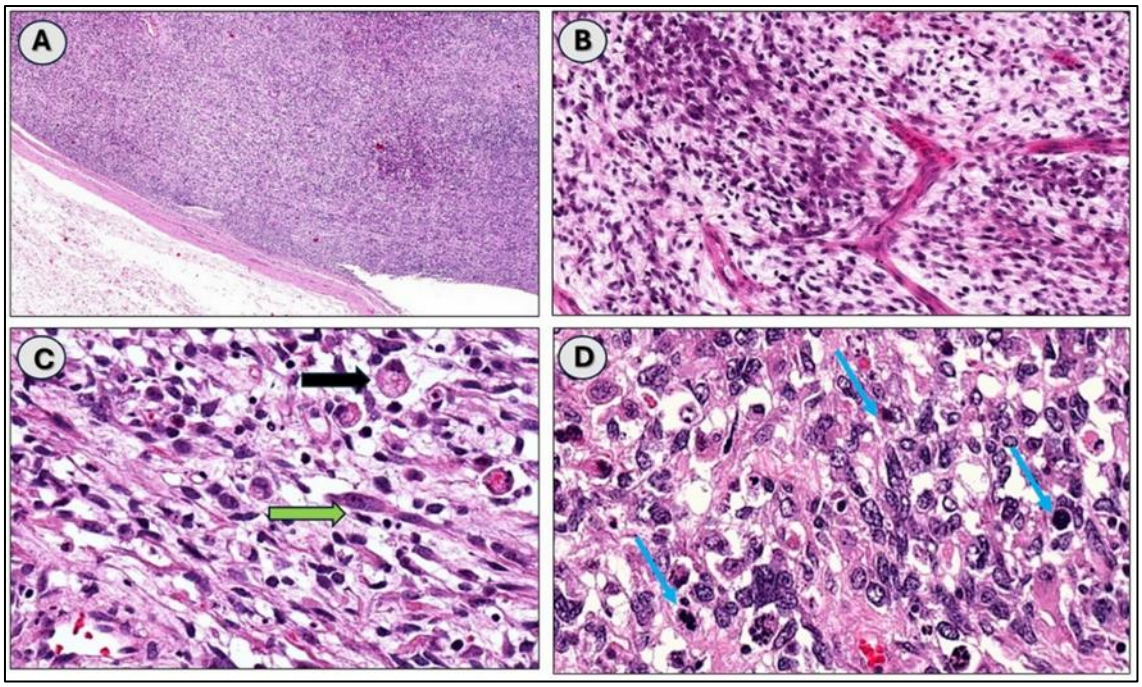

Figure 1: Microscopic features of paratesticular embryonal rhabdomyosarcoma (RMS)

- 1A**:** Low-power view showing a moderately cellular solid tumor with loose myxoid stroma (H&E X20)
- 1B**:** Intermediate-power view showing vascular myxoid background (H&E X40)
- 1C**:** High-power view showing tumor cells ranging from spindle-shaped with scant cytoplasm to scattered globoid cells with abundant eosinophilic cytoplasm (black arrow), and occasional elongated cells with cross-striation (green arrow) indicating rhabdomyoblasts (H&E X40)
- 1D: High-power showing brisk mitotic activity (blue arrows) (H&E X60)

3 DISCUSSION

Rhabdomyosarcoma was first recognized in the nineteenth century, with embryonal rhabdomyosarcoma described by Bérard and the foundational four-pattern morphologic classification subsequently proposed by Horn and Enterline in 1958. [4] The 2020 World Health Organization classification retains four major histologic subtypes: embryonal, alveolar, spindle cell/sclerosing, and pleomorphic rhabdomyosarcoma. [1,4,5] Embryonal rhabdomyosarcoma is the most frequent pediatric subtype and most often involves the head and neck or genitourinary tract; paratesticular soft tissues are a characteristic genitourinary location. [1,2,4]

Rhabdomyosarcoma occurs at an estimated rate of 4.6 cases per million individuals younger than 20 years. Embryonal tumors show a male predominance and peak in children aged 0–4 years, whereas paratesticular rhabdomyosarcoma has a reported median presentation age of approximately 5–8 years. [1,2] Thus, presentation at 15 years is relatively uncommon and clinically important. In paratesticular disease, patients aged at least 10 years more often harbor tumors larger than 5 cm and have higher rates of radiologically apparent or occult retroperitoneal nodal involvement than younger children. [2]

Most cases are sporadic. Nevertheless, embryonal and other fusion-negative rhabdomyosarcomas can occur in association with cancer-predisposition syndromes, including Li–Fraumeni, DICER1, neurofibromatosis type 1, Costello, Beckwith–Wiedemann, and Noonan syndromes. [1,6,7] The absence of a pertinent personal or family history in the present patient was reassuring but did not exclude a sporadic molecularly driven tumor. Clinically, a painless but rapidly enlarging paratesticular mass with normal germ-cell markers remains a critical red flag requiring urgent imaging and oncologic evaluation.

3.1 Pathogenesis, Pathophysiology

Embryonal rhabdomyosarcoma is thought to recapitulate arrested or dysregulated embryonic skeletal-muscle differentiation. Histologically, it may contain primitive oval or spindle cells and scattered differentiating rhabdomyoblasts with eosinophilic cytoplasm in a loose myxoid or more cellular background, as observed in this case. [4] Desmin confirms myogenic differentiation, while nuclear Myogenin and MyoD1 support rhabdomyoblastic lineage and help exclude many morphologic mimics. [4,8]

Unlike fusion-positive alveolar rhabdomyosarcoma, embryonal rhabdomyosarcoma is generally PAX3/7:FOXO1 fusion-negative. Fusion status must complement, not replace, morphologic classification. [1,4,9] Fusion-negative embryonal tumors commonly show copy-number abnormalities and dysregulation of the imprinted 11p15.5 region, which contains growth-control genes including IGF2, H19, and CDKN1C. Somatic alterations affecting RAS-pathway signaling, including HRAS, KRAS, NRAS, NF1, and FGFR4, are also recurrent. [4,8,9]

The clinical behavior reflects both tumor biology and anatomic drainage. Paratesticular tumors may spread through retroperitoneal lymphatic pathways and, in advanced disease, hematogenously to the lungs, bone, or marrow. [1,2] In this patient, synchronous retroperitoneal nodal and pulmonary involvement established high-risk metastatic behavior at diagnosis. At the same time, the later iliac lesion demonstrated that profound induction response did not eliminate the potential for skeletal relapses.

3.2 Comparative Analysis of Our Case with Existing Literature.

Published reports from adolescents and young adults similarly describe painless, enlarging paratesticular masses, normal germ-cell markers, hypervascular extratesticular lesions, and myogenic immunoreactivity. Shazly et al. reported a 16-year-old with an 8-cm embryonal tumor and no nodal or distant metastases, managed with immediate high inguinal orchiectomy and chemotherapy. [10] Sinha likewise described a 17-year-old without metastatic disease on postoperative staging who completed multimodal treatment after surgical resection. [11]

In contrast, the present patient had biopsy-proven retroperitoneal nodal disease and pulmonary metastases at diagnosis. This more advanced stage, together with age 15 years, justified obtaining tissue before definitive surgery and initiating systemic therapy. Marked induction response enabled delayed radical inguinal orchiectomy with only microscopic residual tumor, illustrating response-adapted local control in a complex presentation. This differs from the immediately resected localized cases above and should not be read as a replacement for standard inguinal local control when primary complete resection is feasible. [2]

Zhu et al. reported two young adults with embryonal paratesticular rhabdomyosarcoma; both had normal markers and myogenic immunohistochemistry, while one developed local recurrence after initial surgery without adjuvant therapy. [12] Their report reinforces the importance of accurate initial diagnosis, multidisciplinary planning, and protocol-directed systemic treatment. A recent report of a 16-year-old with Group IV paratesticular rhabdomyosarcoma and retroperitoneal and pulmonary metastases documented rapid progression despite intensive therapy. [13] Compared with that patient, our case achieved an early major response and an 18-month disease-free interval, but subsequent isolated iliac relapse underscores the persistent recurrence risk in metastatic adolescent disease.

4 WHAT HAVE WE LEARNED FROM THIS CASE?

This case reinforces that a painless enlarging scrotal or inguinal mass in an adolescent warrants prompt evaluation even when the patient reports antecedent minor trauma and serum germ-cell markers are normal. The clinically important red flags were rapid enlargement, a solid, hypervascular extratesticular mass, normal alpha-fetoprotein and beta-human chorionic gonadotropin levels, and radiologic evidence of retroperitoneal nodes and pulmonary nodules. Normal germ-cell markers made a germ-cell tumor less likely but did not establish a benign diagnosis or exclude a sarcoma. Early ultrasonography followed by cross-sectional staging was therefore pivotal. [1,2]

A second lesson is that expert tissue diagnosis should direct treatment in advanced or management-complex presentations. The paired primary and nodal biopsies established both the rhabdomyosarcoma diagnosis and the presence of metastatic involvement, while testing for Myogenin, MyoD1, Desmin, and PAX3/7: FOXO1 refined the pathologic and molecular assessment. Molecular findings should be interpreted alongside histology and stage: fusion-negative status was favorable relative to fusion-positive disease, but it did not negate the adverse implications of adolescence, nodal involvement, and pulmonary metastases. [1,2,4]

Third, the course illustrates the value of multidisciplinary sequencing. Upfront systemic therapy achieved substantial regression and facilitated delayed radical inguinal orchiectomy with near-complete pathologic response. [14] However, the later biopsy-proven iliac recurrence demonstrates that early radiologic and pathologic response is not synonymous with cure in metastatic rhabdomyosarcoma. Surveillance should remain risk-conscious and include careful assessment for distant relapses, particularly in the lungs, bone, and nodal basins. Decisions concerning salvage chemotherapy, radiotherapy, molecularly guided trials, supportive care, fertility preservation, and quality-of-life monitoring should be individualized within a specialist multidisciplinary team. [1,2]

Abbreviations

- Rhabdomyosarcoma (PT-RMS)
- Embryonal rhabdomyosarcoma (PT-RMS)
- Paratesticular embryonal rhabdomyosarcoma (PT-RMS)

5 CONCLUSION

We report this case because it documents the uncommon convergence of adolescent age, paratesticular embryonal rhabdomyosarcoma, fusion-negative molecular testing, retroperitoneal nodal and pulmonary metastases at presentation, substantial response to induction chemotherapy, and delayed solitary osseous relapse. The case expands the limited literature on metastatic paratesticular rhabdomyosarcoma by showing that favorable histology and the absence of PAX3/7:FOXO1 fusions may coexist with clinically aggressive behavior when adverse stage- and age-related factors are present.

Its principal value lies in translating a complicated clinical course into practical diagnostic and management awareness. A painless scrotal mass should not be dismissed as trauma or benign scrotal disease, particularly when ultrasonography identifies a solid hypervascular paratesticular lesion. Prompt staging, expert pathology with myogenic immunohistochemistry, appropriate molecular testing, and multidisciplinary treatment planning are essential. This patient's initial major response and subsequent skeletal relapse further emphasize that response-adapted local control and prolonged, risk-conscious surveillance are both necessary components of care. Reporting such cases may help clinicians recognize high-risk presentations earlier and counsel families realistically about both the potential for treatment response and the continuing risk of recurrence.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

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- Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might be interested in the submitted work.

Statement of ethical approval

The present research work does not contain any studies conducted on animal or human subjects by any of the authors. This study was conducted as a retrospective review of archival pathology material collected during routine clinical care. All data were fully de-identified prior to analysis.

Statement of informed consent

Informed consent was obtained from the patient's family for publication of this case.

Data access statement

All relevant data are included in the paper.

Author contributions

All authors contributed equally to producing this manuscript.

REFERENCES

[1] PDQPTE B. Childhood Rhabdomyosarcoma Treatment (PDQ®): health professional version. PDQ Cancer Information Summaries. Bethesda (MD): National Cancer Institute (US). 2002. Last accessed at https://www.ncbi.nlm.nih.gov/books/NBK65802/

[2] Rogers TN, Seitz G, Fuchs J, Martelli H, Dasgupta R, Routh JC, Hawkins DS, Koscielniak E, Bisogno G, Rodeberg DA. Surgical management of paratesticular rhabdomyosarcoma: A consensus opinion from the Children's Oncology Group, European Pediatric Soft Tissue Sarcoma Study Group, and the Cooperative Weichteilsarkom Studiengruppe. Pediatric blood & cancer. 2021 Apr;68(4):e28938.

[3] Rodeberg DA, Wharam MD, Lyden ER, et al.: Delayed primary excision with subsequent modification of radiotherapy dose for intermediate-risk rhabdomyosarcoma: a report from the Children's Oncology Group Soft Tissue Sarcoma Committee. Int J Cancer 137 (1): 204-11, 2015.

[4] Agaram NP. Evolving classification of rhabdomyosarcoma. Histopathology. 2022 Jan;80(1):98-108.

[5] WHO Classification of Tumors Editorial Board: WHO Classification of Tumors. Volume 3: Soft Tissue and Bone Tumors. 5th ed., IARC Press, 2020.

[6] Li H, Sisoudiya SD, Martin-Giacalone BA, et al.: Germline Cancer Predisposition Variants in Pediatric Rhabdomyosarcoma: A Report from the Children's Oncology Group. J Natl Cancer Inst 113 (7): 875-883, 2021.

[7] Shern JF, Chen L, Chmielecki J, et al.: Comprehensive genomic analysis of rhabdomyosarcoma reveals a landscape of alterations affecting a common genetic axis in fusion-positive and fusion-negative tumors—Cancer Discov 4 (2): 216-31, 2014.

[8] Glembocki A, Siddaway R, Arnoldo A, Somers GR. Fusion-negative rhabdomyosarcoma: clinical application of targeted RNA sequencing. Pediatric and Developmental Pathology. 2025 Nov;28(6):480-8.

[9] Martin-Giacalone BA, Li H, Scheurer ME, et al.: Germline Genetic Testing and Survival Outcomes Among Children with Rhabdomyosarcoma: A Report from the Children's Oncology Group. JAMA Netw Open 7 (3): e244170, 2024.

[10] Shazly AR, Abd M, Shazly MU. A Case Report of Paratesticular Rhabdomyosarcoma in an Adolescent. Journal of Surgical Case Reports. 2017;2017(4):rjx064.

[11] Sinha NK. Paratesticular rhabdomyosarcoma in young adult-a case report. Journal of Clinical and Diagnostic Research: JCDR. 2015 Apr 1;9(4):ED01.

[12] Zhu Y, Zhu Z, Xiao Y, Zhu Z. Case report: paratesticular rhabdomyosarcoma. Frontiers in Oncology. 2021 Mar 17;11:629878.

[13] Alami RO, Diallo M, Hammas N, Elfatmi H, Chbani L, Mellas S, El Ammari J, Tazi F, El Fassi J. Paratesticular Rhabdomyosarcoma in Adolescents: Challenging Diagnosis and Poor Prognosis of a Rare Entity. Urology Case Reports. 2026 Apr 29:103467.

[14] Lautz TB, Chi YY, Li M, et al.: Benefit of delayed primary excision in rhabdomyosarcoma: A report from the Children's Oncology Group. Cancer 127 (2): 275-283, 2021