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CASE REPORT

# Metastatic Primary Intratesticular Rhabdomyosarcoma in an Adolescent with Rapid Early Response to VAC Chemotherapy: A Case Report and Literature Review of 99 Cases

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**Background:** Primary intratesticular rhabdomyosarcoma (PTRMS) is an exceptionally rare malignancy and may be clinically indistinguishable from more common scrotal conditions or germ cell tumors prior to orchiectomy. Evidence to guide management is limited, and treatment is typically extrapolated from pediatric and adolescent/young adult rhabdomyosarcoma protocols.

**Case Presentation:** A 17-year-old male presented with progressive, painless enlargement of the right testis. Cross-sectional imaging demonstrated a large intratesticular mass with extensive retroperitoneal and pelvic lymphadenopathy causing grade II hydronephrosis due to ureteral compression, bilateral pulmonary nodules, and axillary lymphadenopathy. He underwent radical inguinal orchiectomy. Histopathology showed a high-grade malignant neoplasm involving the testis, epididymis, and spermatic cord with focal vascular invasion; immunohistochemistry was strongly positive for SMA, desmin, and MyoD1, supporting rhabdomyosarcoma. A double-J ureteral stent was placed, and systemic therapy with vincristine, actinomycin D, and cyclophosphamide (VAC) was initiated. After three cycles, follow-up imaging demonstrated complete radiologic resolution of pulmonary metastases, marked regression of nodal disease (including axillary involvement), and resolution of hydronephrosis with ongoing clinical improvement.

**Literature Review:** In a PubMed-based review of 87 eligible articles comprising 99 individual cases of primary testicular or paratesticular rhabdomyosarcoma, the mean age at presentation was 19.76 years (SD 14.44). Tumors were predominantly paratesticular (80.8%) rather than intratesticular (19.2%). Among cases reporting staging data, nodal involvement at presentation was observed in 31.5% and distant metastasis in 25.6%. Treatment most commonly included surgery plus chemotherapy (54.5%) or trimodality therapy with surgery, chemotherapy, and radiotherapy (24.2%).

**Conclusion:** PTRMS can present with advanced nodal and distant metastases yet remain chemosensitive. This case highlights a brisk response of disseminated intratesticular rhabdomyosarcoma to VAC chemotherapy and supports comprehensive staging and response-adapted multidisciplinary management. The complete case-level extraction and full citations are provided in the Supplementary material.

**Keywords:** primary intratesticular rhabdomyosarcoma, testis neoplasms, adolescent, pulmonary metastases, VAC chemotherapy

## Introduction

Primary Testicular Rhabdomyosarcoma (PTRMS) is an exceptionally rare and aggressive neoplasm arising within the testis, classified as a non-germ cell tumor and forming part of the minority 5% of testicular malignancies that fall outside the germ cell category.[1] While testicular tumors account for less than 1% of all cancers in males, they predominantly affect individuals between the ages of 15 and 35 years.[1] RMS itself is a malignant tumor of mesenchymal origin, most frequently observed in the pediatric age group and exhibiting a slight predominance in males.[2] It represents the most commonly diagnosed soft tissue sarcoma in children and adolescents, with an incidence of approximately 4.5 per million.[3] According to the 2013 World Health Organization classification, rhabdomyosarcoma is divided into four histological

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variants: embryonal, alveolar, pleomorphic, and spindle cell or sclerosing subtypes.[4] However, PTRMS is difficult to identify clinically prior to surgery, and a definitive diagnosis usually relies on postoperative pathological analysis.[1] The precise origin of PTRMS remains uncertain; however, one possible explanation suggests it may arise due to sarcomatous overgrowth within a teratomatous element.[5] Although extremely rare, primary intratesticular rhabdomyosarcoma remains a recognized entity within this group of sarcomas.[6] Here, we present a 17-year-old male with primary intratesticular rhabdomyosarcoma presenting with nodal and pulmonary metastases.

## Case Presentation

A 17-year-old Arab male presented with progressive, painless right testicular enlargement over several weeks. He had undergone a prior surgical intervention for a right-sided hydrocele but denied any history of trauma, systemic symptoms, or family history of malignancy. He was otherwise healthy, with a noted history of active smoking. On clinical examination, the right testis was significantly enlarged, firm, and non-transilluminating, measuring approximately 12 cm in its greatest dimension. Scrotal ultrasonography revealed a large solid mass [Figures 1 and 2]. Further evaluation with computed tomography (CT) and magnetic resonance imaging (MRI) of the chest, abdomen, and pelvis demonstrated a well-defined right testicular mass associated with extensive retroperitoneal and pelvic lymphadenopathy [Figures 3–7]. A para-aortic lymph node mass was compressing the right ureter, resulting in secondary grade II hydronephrosis. Additionally, multiple bilateral pulmonary nodules and axillary lymphadenopathy were identified, highly suggestive of metastatic dissemination [Figures 8 and 9]. The patient underwent a radical right orchiectomy. Gross pathological examination of the specimen revealed a beige multinodular tumor occupying the entire testis and extending into the epididymis and spermatic cord. The specimen weighed 400 grams and measured 11×8 × 6 cm, with the spermatic cord measuring 12 cm in length and 2 cm in diameter. The largest tumor nodule measured 12 cm, and multiple smaller nodules up to 3 cm were seen in the spermatic cord. Areas of necrosis were extensive. Histopathological analysis revealed a high-grade undifferentiated malignant neoplasm involving the testis, epididymis, and spermatic cord, with focal vascular invasion. Surgical margins were free of tumor. Immunohistochemical staining showed strong positivity for SMA, Desmin, and MyoD1, consistent with Rhabdomyosarcoma (RMS). Given the extent of disease and presence of distant metastases, the patient was started on systemic chemotherapy using the VAC regimen (Vincristine, Actinomycin D, Cyclophosphamide). A double-J (DJ) stent was inserted to relieve the ureteral obstruction. Follow-up imaging after three cycles of chemotherapy revealed complete resolution of the pulmonary metastases and significant regression of para-

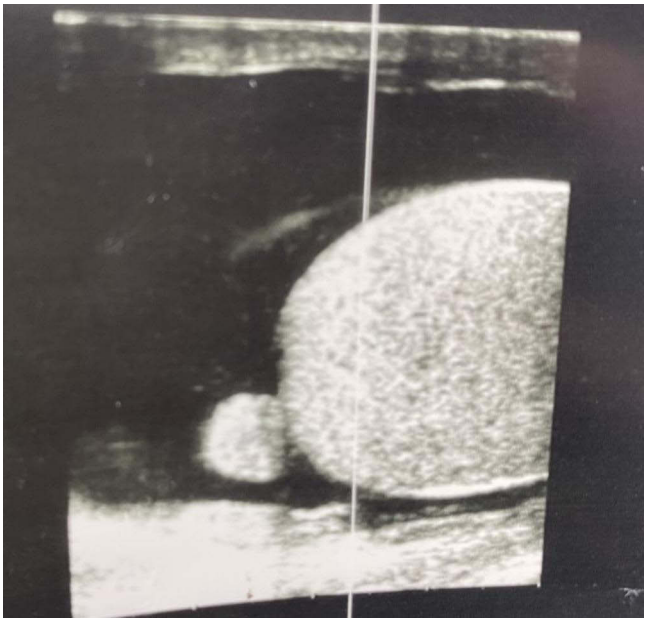


**Figure 1** Grayscale scrotal ultrasonography of the right hemiscrotum demonstrating a markedly enlarged testis largely replaced by a well-circumscribed, heterogeneous solid intratesticular mass.

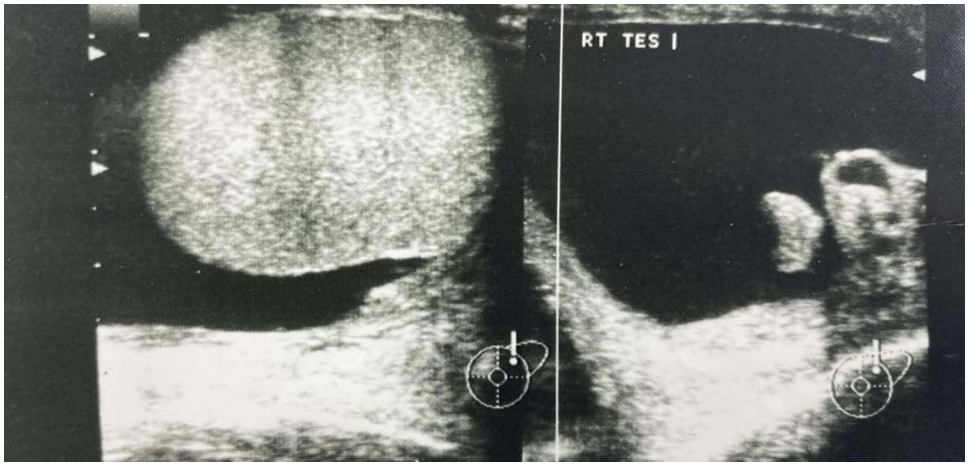



**Figure 2** Grayscale scrotal ultrasonography of the right testis in two planes (left and right panels) confirming a large heterogeneous solid intratesticular tumor, with adjacent fluid consistent with an associated hydrocele.

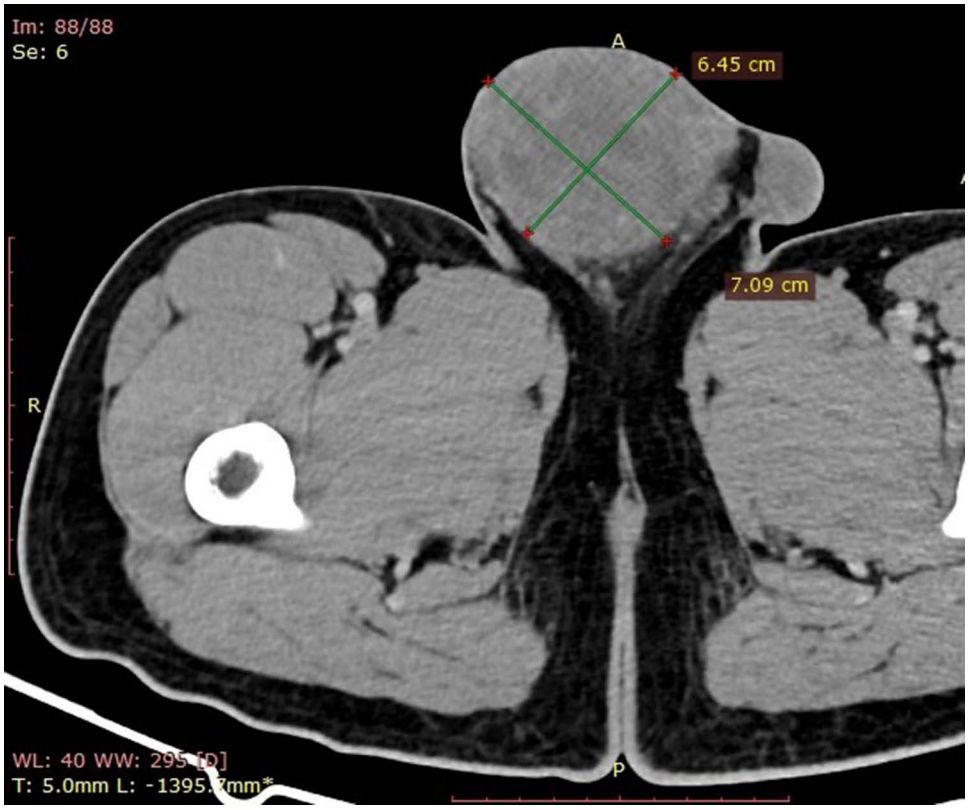



**Figure 3** Axial contrast-enhanced CT of the pelvis demonstrates a markedly enlarged right testis almost entirely replaced by a heterogeneously enhancing solid mass measuring approximately 7.1×6.5 cm (longest axes), in keeping with a primary malignant intratesticular neoplasm. (R: Right, P: posterior).

aortic and axillary lymphadenopathy. The hydronephrosis was also resolved, with no evidence of new lesions or tumor progression. The patient showed a favorable response to therapy, with continued clinical and radiological improvement.

# Literature Review

## Methods

We performed a PubMed search (from database inception to the final search) to identify all published reports of primary testicular or paratesticular rhabdomyosarcoma (RMS) using combinations of controlled vocabulary and free-text terms

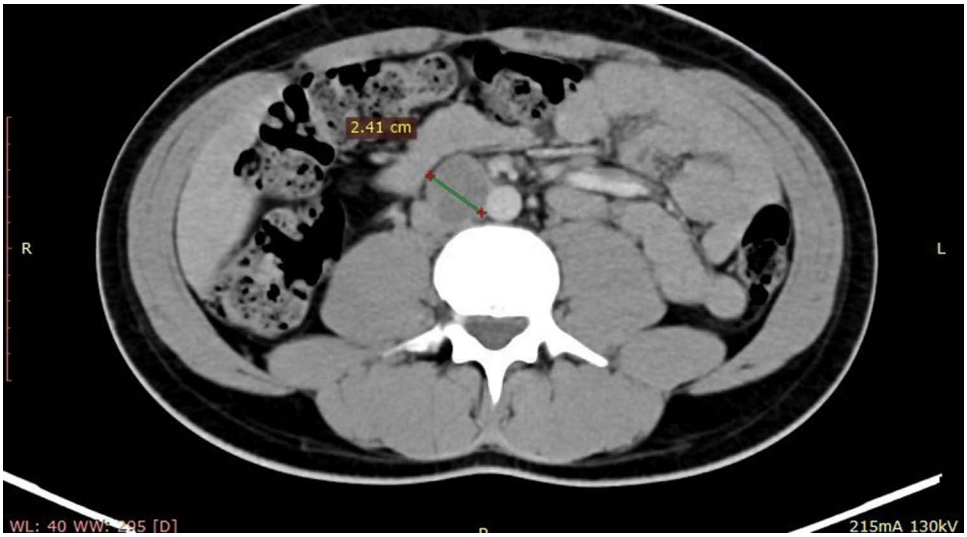



**Figure 4** Axial contrast-enhanced CT of the abdomen showing para-aortic lymphadenopathy with a nodal deposit measuring 2.41 cm in short axis.

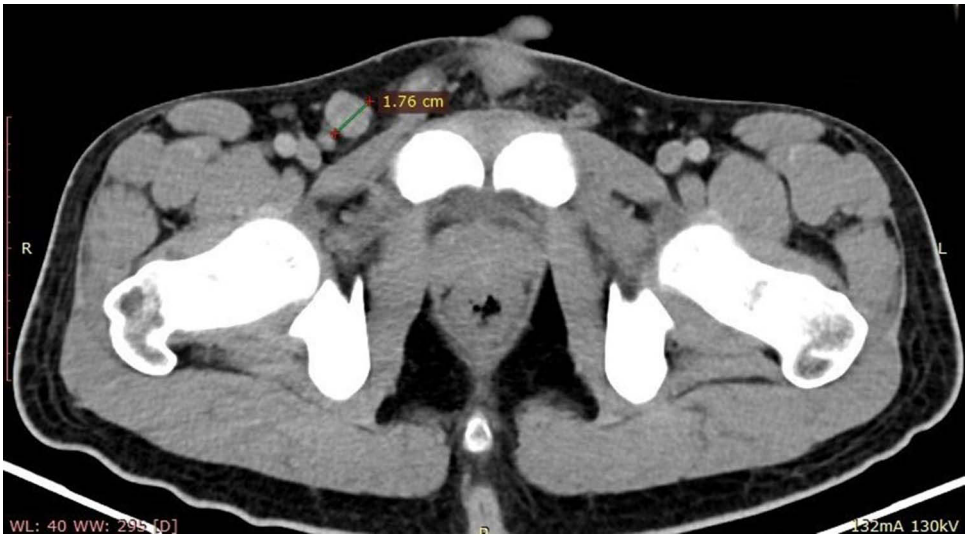



**Figure 5** Axial contrast-enhanced CT of the pelvis depicting an enlarged right inguinal lymph node with a 1.76 cm short-axis diameter. (R: Right, P: posterior).

for rhabdomyosarcoma and scrotal/genitourinary sites (eg, rhabdomyosarcoma AND testis/testicular/paratesticular/intrascrotal/epididymis/spermatic cord). Eligible studies were case reports or case series indexed in PubMed that reported primary intra-testicular or para-testicular RMS with extractable patient-level data for our predefined variables (age, associated syndromes, presenting symptoms, first imaging modality, tumor site [para vs intra], nodal involvement at presentation, distant metastasis, and treatment modality). We excluded records that were (1) not RMS on final histopathology (eg, seminoma, lymphoma, liposarcoma, leiomyosarcoma), (2) secondary testicular involvement/metastasis from a non-testicular primary, (3) reviews/editorials/technical notes without case-level data, (4) duplicates/errata, or (5) reports lacking sufficient detail to populate the required fields. In total, 101 PubMed-indexed records were assessed at full text; 14 were excluded based on the above criteria, leaving 87 included articles, which contributed 99 individual cases for the final descriptive dataset Supplementary Table 1.

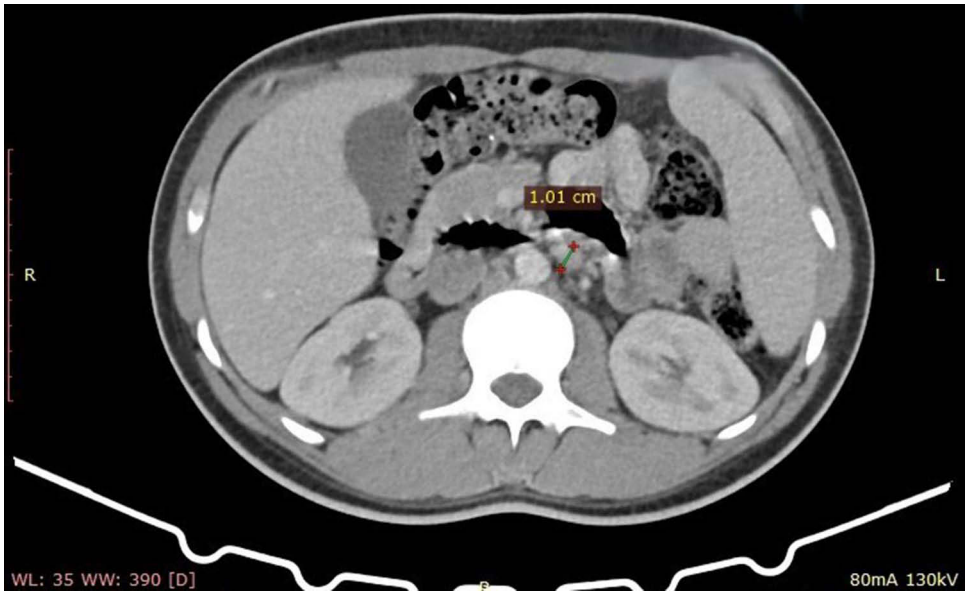



**Figure 6** Axial contrast-enhanced CT of the abdomen demonstrating additional retro/para-aortic nodal disease; representative node measures 1.01 cm in short axis. (R: Right, P: posterior).

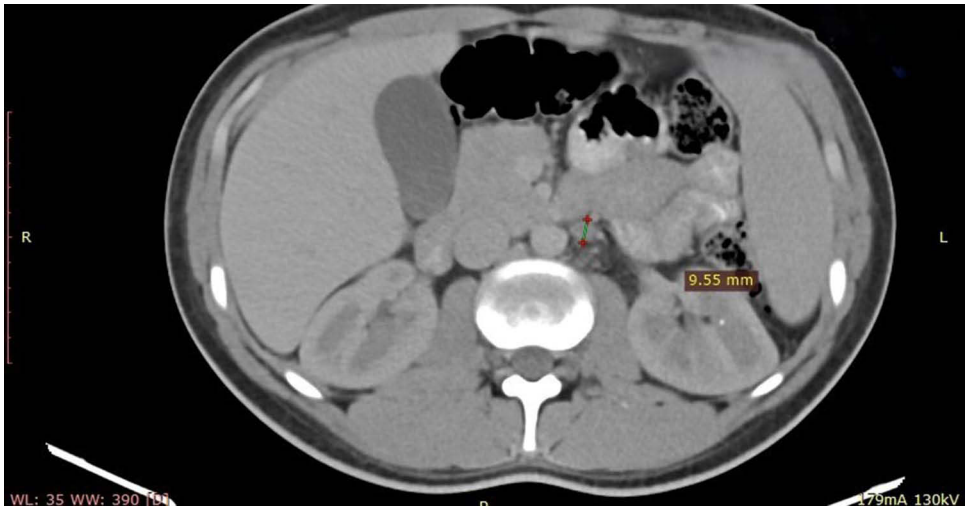



**Figure 7** Axial contrast-enhanced CT of the abdomen revealing further para-aortic lymphadenopathy; index node short axis 9.6 mm, within a cluster of pathologic-appearing nodes. (R: Right, P: posterior).

## Results

Across 87 eligible PubMed-indexed articles contributing 99 individual cases of primary testicular or paratesticular rhabdomyosarcoma, the mean age at presentation (excluding not reported values) was 19.76 years (standard deviation 14.44; not reported in 3/99, 3.0%). Associated syndromes or comorbid conditions were infrequently documented (not reported in 95/99, 96.0%); among the four cases with reported conditions, neurofibromatosis, hemophilia, and factor IX deficiency were each noted in two cases, and coronal hypospadias, spina bifida, and a history of undescended testis (orchiopexy) were each noted once. Presenting symptoms were not reported in 21/99 (21.2%); among reported presentations, painless scrotal or testicular mass/swelling predominated (44/78, 56.4%), followed by systemic or extra-scrotal symptoms (16/78, 20.5%), painful/tender scrotal symptoms (15/78, 19.2%), and asymptomatic or incidental detection (3/78, 3.8%) [Figure 10]. First-line imaging was not reported in 25/99 (25.3%); when specified, ultrasound was most common (53/74, 71.6%), with computed tomography (16/74, 21.6%) and magnetic resonance imaging (5/74, 6.8%)

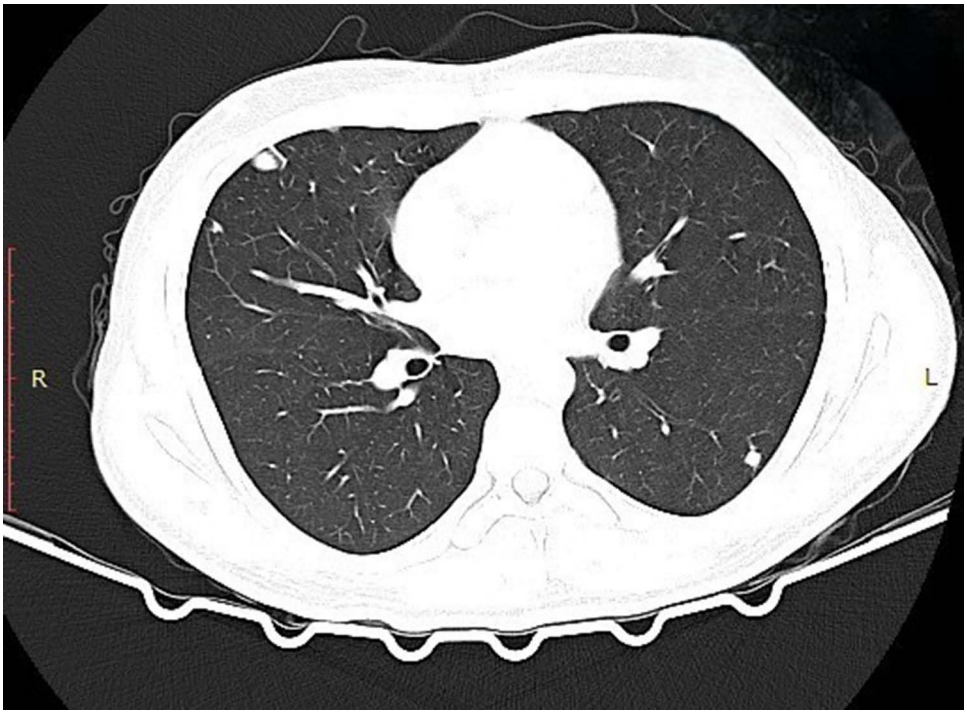



**Figure 8** Axial chest computed tomography (lung window) at presentation showing multiple, well-defined bilateral pulmonary nodules consistent with metastatic disease.

used less frequently. Tumors were predominantly paratesticular (80/99, 80.8%) rather than intratesticular (19/99, 19.2%). Regional nodal status at presentation was not reported in 26/99 (26.0%); among reported cases, nodal involvement was present in 23/73 (31.5%). Distant metastasis at presentation was not reported in 17/99 (17.2%); among reported cases, metastases were present in 21/82 (25.6%). Treatment most commonly consisted of surgery plus chemotherapy (54/99, 54.5%) or trimodality therapy with surgery, chemotherapy, and radiotherapy (24/99, 24.2%), with surgery alone (17/99, 17.2%), surgery plus radiotherapy (3/99, 3.0%), and chemotherapy plus radiotherapy (1/99, 1.0%) reported less often; overall, surgery was administered in 98/99 (99.0%), chemotherapy in 79/99 (79.8%), and radiotherapy in 28/99 (28.3%) cases [Figure 11].

We used descriptive statistics only; continuous variables are reported as mean (SD) and categorical variables as n (%), with denominators varying based on available (non-missing) data. Table 1

The complete list of included articles (full citations) and the extracted case-level dataset are provided in Supplementary Table 1; only key references are cited in the main manuscript.

## Discussion

Rhabdomyosarcoma (RMS) is the most common soft tissue sarcoma in children and adolescents, accounting for approximately 5% of all pediatric malignancies, but its occurrence in the testis or paratesticular region is relatively rare.[7,8] Paratesticular RMS, which includes tumors arising from the epididymis, spermatic cord, and tunica vaginalis, tends to present in two peak age groups: children under 10 and adolescents or young adults.[9] Embryonal rhabdomyosarcoma (ERMS) of the testis is a rare and highly aggressive malignancy that typically affects children and adolescents. With fewer than 25 reported cases worldwide, intratesticular ERMS represents a diagnostic and therapeutic challenge due to its rarity and nonspecific presentation.[3,10,11] The clinical presentation of paratesticular RMS often mimics more common scrotal conditions, such as hydroceles or epididymitis, potentially delaying diagnosis.[12] In this case, a 17-year-old male presented with a progressively enlarging, painless right testicular mass. The absence of trauma, systemic symptoms, or elevated tumor markers, along with ultrasound findings of a solid, non-transilluminating mass, are consistent with previously reported cases of testicular ERMS.[13,14] Ultrasonography remains the first-line imaging modality for scrotal masses, often revealing a heterogeneous, hypoechoic, and non-transilluminating solid mass in

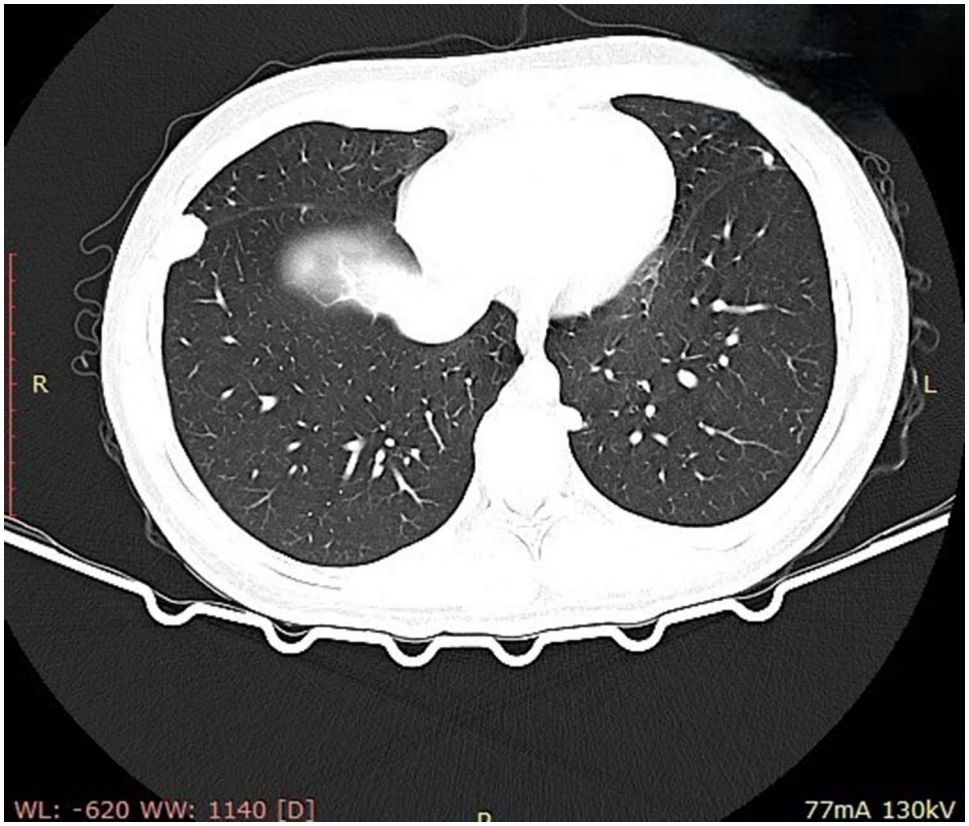
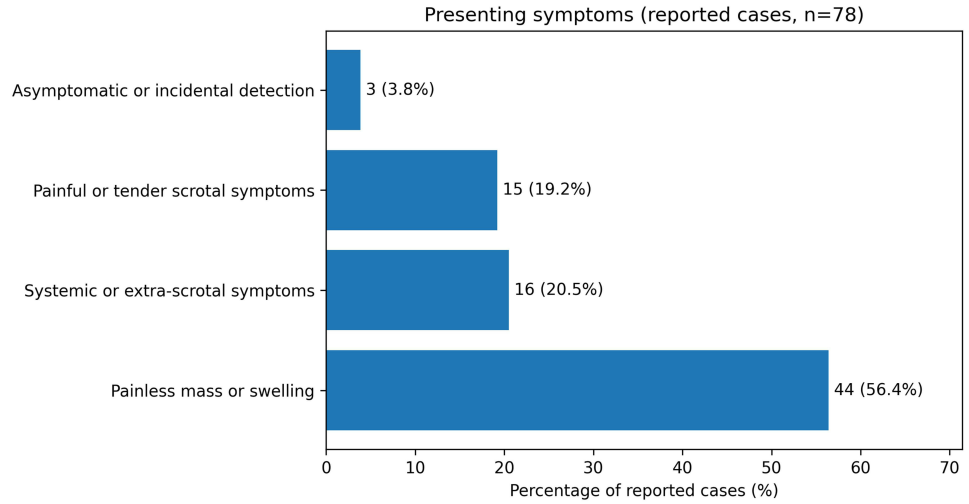



**Figure 9** Additional axial chest computed tomography (lung window) demonstrating representative bilateral pulmonary nodules (including a pleural-based/right lower lung lesion), further supporting pulmonary metastases at diagnosis.




Not reported: 21/99 (21.2%)

**Figure 10** Presenting symptoms at diagnosis. Distribution of presenting symptoms among cases with reported symptom data (n = 78). Categories were assigned using a mutually exclusive hierarchical scheme and are shown as percentage of reported cases; labels indicate n (%) for each category. Symptom data were not reported in 21 of 99 cases (21.2%).

RMS.[15] The diagnosis was confirmed histologically and immunohistochemically, with strong positivity for Desmin, MyoD1, and SMA, markers typical of rhabdomyoblastic differentiation.[14,15] The most common histologic subtype of rhabdomyosarcoma is the embryonal type, which exhibits a relatively better prognosis than alveolar or pleomorphic subtypes. However, size >10 cm, lymphovascular invasion, and metastatic spread present in our patient are associated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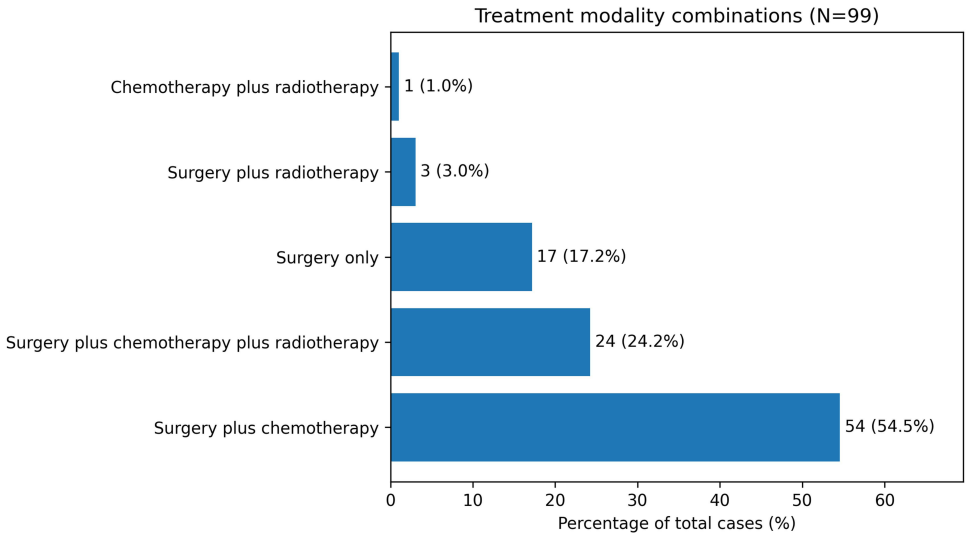


**Figure 1** Treatment modality combinations. Distribution of treatment combinations across all included cases (N = 99). Bars represent the percentage of total cases receiving each combination; labels indicate n (%). Surgery, chemotherapy, and radiotherapy refer to definitive local and/or systemic treatment as reported in the source articles.

with a worse prognosis.[15] In this case, extensive retroperitoneal lymphadenopathy, bilateral pulmonary nodules, and axillary lymphadenopathy at diagnosis indicated stage IV disease. The treatment protocol followed radical orchiectomy followed by systemic chemotherapy using the VAC regimen (Vincristine, Actinomycin D, and Cyclophosphamide) is consistent with current standards drawn from pediatric oncology protocols.[14] The excellent radiological response

**Table 1** Case Characteristics (N = 99)

| Characteristic | Category/Statistic | Value | N |
|---|---|---|---|
| **Age (years)** | Mean (standard deviation) | 19.76 (14.44) | 96 |
| | Not reported | 3 (3.0) | |
| **Associated syndromes or conditions** | | **n (%)** | 99 |
| | Not reported | 95 (96.0) | |
| | Any syndrome or condition reported | 4 (4.0; 100.0) | |
| | Coronal hypospadias | 1 (1.0; 25.0) | |
| | Spina bifida | 1 (1.0; 25.0) | |
| | History of undescended testis (orchiopexy) | 1 (1.0; 25.0) | |
| | Neurofibromatosis | 2 (2.0; 50.0) | |
| | Hemophilia | 2 (2.0; 50.0) | |
| | Factor IX deficiency | 2 (2.0; 50.0) | |
| **Presenting symptoms** | | **n (%)** | 99 |
| | Not reported | 21 (21.2) | |
| | Painless mass or swelling | 44 (44.4; 56.4) | |
| | Painful or tender scrotal symptoms | 15 (15.2; 19.2) | |
| | Systemic or extra-scrotal symptoms | 16 (16.2; 20.5) | |
| | Asymptomatic or incidental detection | 3 (3.0; 3.8) | |

(*Continued*)

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**Table 1** (Continued).

| Characteristic | Category/Statistic | Value | N |
|---|---|---|---|
| **First imaging modality** | | **n (%)** | 99 |
| | Not reported | 25 (25.3) | |
| | Ultrasound | 53 (53.5; 71.6) | |
| | Computed tomography | 16 (16.2; 21.6) | |
| | Magnetic resonance imaging | 5 (5.1; 6.8) | |
| **Tumor site** | | **n (%)** | 99 |
| | Intratesticular | 19 (19.2) | |
| | Paratesticular | 80 (80.8) | |
| **Regional lymph nodes at presentation** | | **n (%)** | 99 |
| | Not reported | 26 (26.3) | |
| | No regional lymph node involvement | 50 (50.5; 68.5) | |
| | Regional lymph node involvement present | 23 (23.2; 31.5) | |
| **Metastasis at presentation** | | **n (%)** | 99 |
| | Not reported | 17 (17.2) | |
| | No metastasis | 61 (61.6; 74.4) | |
| | Metastasis present | 21 (21.2; 25.6) | |
| **Treatment (combination)** | | **n (%)** | 99 |
| | Surgery only | 17 (17.2) | |
| | Surgery plus chemotherapy | 54 (54.5) | |
| | Surgery plus radiotherapy | 3 (3.0) | |
| | Surgery plus chemotherapy plus radiotherapy | 24 (24.2) | |
| | Chemotherapy plus radiotherapy | 1 (1.0) | |
| **Treatment modalities (regardless of combination)** | | **n (%)** | 99 |
| | Surgery | 98 (99.0) | |
| | Chemotherapy | 79 (79.8) | |
| | Radiotherapy | 28 (28.3) | |

**Notes**: Values are n (%) unless otherwise indicated. Age is presented as mean (standard deviation) after excluding not reported values. For variables with not reported values, percentages are shown as percent of the total (N=99) and, after the semicolon, percent among reported cases (excluding not reported). Presenting symptoms were grouped into mutually exclusive categories (painless mass or swelling; painful or tender scrotal symptoms; systemic or extra-scrotal symptoms; asymptomatic or incidental detection). Multiple associated syndromes or conditions could be reported for the same case; therefore, counts for individual conditions may sum to more than the number of cases with any condition reported.

observed after three chemotherapy cycles, including complete pulmonary metastasis resolution and lymphadenopathy regression, is a favorable prognostic sign, though long-term vigilance is required due to high recurrence rates.[14,15] Retroperitoneal lymph node dissection (RPLND) remains controversial in the absence of radiologic evidence of residual disease. In our case, lymphadenopathy responded well to chemotherapy, and surgical debulking was not pursued a decision supported by recent literature that favors a non-surgical approach if nodes regress completely on imaging.[3,11] The pathogenesis of testicular ERMS is not fully understood. Proposed origins include undifferentiated mesenchymal cells with myogenic potential or embryonal muscle remnants displaced during development.[10] Although our patient had

a history of prior hydrocele surgery and was an active smoker, neither of these is definitively established as a risk factor. Long-term follow-up is essential, as recurrences can occur years after initial treatment. The 5-year survival for adult-onset RMS remains poor compared to pediatric cases, primarily due to delayed diagnosis and aggressive tumor biology.[13,15]

## Comparison with the Literature Review

Across 87 eligible PubMed-indexed articles contributing 99 individual cases of primary testicular or paratesticular rhabdomyosarcoma, the mean age at presentation was 19.76 years (SD 14.44; age not reported in 3.0%). Reported presentations most often involved a painless scrotal/testicular mass or swelling (56.4% of cases with symptoms reported), and ultrasound was the most common first-line imaging modality when specified (71.6%), followed by CT (21.6%) and MRI (6.8%). Tumors were predominantly paratesticular (80.8%), with intratesticular primaries comprising 19.2% of cases. Among reports that documented staging at diagnosis, regional nodal involvement was present in 31.5% and distant metastasis in 25.6%. Treatment was most frequently multimodal, most commonly surgery plus chemotherapy (54.5%) or trimodality therapy with surgery, chemotherapy, and radiotherapy (24.2%), while surgery alone was less common (17.2%). Table 1

## Clinical Implications

Against this background, our patient represents a more advanced presentation, with bulky nodal disease and distant involvement (including pulmonary and axillary sites), yet demonstrated a meaningful response to VAC-based chemotherapy. Given that nodal and metastatic disease at presentation are not rare when reported, these findings support thorough upfront staging and early multidisciplinary planning, with systemic therapy playing a central role even when local control strategies are being considered. Our case also aligns with the overall literature pattern favoring multimodality treatment, while highlighting that response to induction chemotherapy can be clinically informative for tailoring subsequent local-regional management. Finally, the substantial proportion of "not reported" fields across published cases underscores the value of standardized reporting (symptoms, initial imaging, nodal and metastatic status, and treatment components) to strengthen future pooled analyses in this rare disease.

# Conclusion

Primary intratesticular rhabdomyosarcoma is an exceptionally rare entity that can present with advanced nodal and pulmonary metastases despite an initially localized scrotal complaint. Accurate diagnosis hinges on thorough histopathology with myogenic immunoprofiles, alongside careful exclusion of germ cell tumor with somatic-type malignancy. Prompt radical inguinal orchiectomy, comprehensive staging, and VAC-based systemic chemotherapy can achieve rapid radiologic responses even in stage IV disease, as illustrated here. Given the propensity for late relapse and treatment-related morbidity, multidisciplinary care and long-term, imaging-guided surveillance are essential. Selective, response-adapted nodal surgery may be avoided when lymphadenopathy regresses completely on systemic therapy.

# Ethical Approval

Institutional Review Board (IRB) approval is not required for de-identified single case reports or case histories, in accordance with institutional policies.

# Patient's Consent

Written informed consent was obtained from the patient's legal guardians for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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## Disclosure

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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