

Paratesticular Masses: Diagnostic Challenges and Management

Ali Büyük¹, Fatih Çolak²

¹Trabzon Fatih State Hospital, Clinic of Urology, Trabzon, Türkiye

²Karadeniz Technical University Faculty of Medicine, Department of Urology, Trabzon, Türkiye

Abstract

Paratesticular masses are uncommon and heterogeneous extratesticular lesions arising from the epididymis, spermatic cord, tunica vaginalis, and adjacent soft tissues. Although most lesions are benign or tumor-like, malignant tumors, particularly sarcomas in adults and rhabdomyosarcoma in children and adolescents, require timely recognition and oncologically appropriate management. Ultrasonography is the first-line modality for lesion localization and distinguishing intratesticular from extratesticular masses; however, benign, tumor-like, borderline, and malignant paratesticular lesions may show overlapping appearances. Magnetic resonance imaging is most useful for indeterminate, large, or complex lesions, especially for tissue characterization and local surgical planning. Histopathological assessment remains essential for suspicious solid masses. Benign or low-risk lesions may be managed with local excision or testis-sparing surgery, with intraoperative frozen section considered in selected cases. Image-guided core needle biopsy may be considered for selected indeterminate or suspicious lesions, particularly when sarcoma is suspected and the result would influence multidisciplinary planning. Lesions suspicious for malignancy generally require an inguinal oncologic approach, whereas pediatric paratesticular rhabdomyosarcoma warrants distinct multidisciplinary management. A structured, risk-based approach integrating age, clinical behavior, imaging findings, biopsy or frozen section when appropriate, and definitive pathology may reduce unnecessary orchiectomy for benign disease while avoiding undertreatment of malignant paratesticular tumors.

Keywords: Paratesticular mass, scrotal mass, ultrasonography, magnetic resonance imaging, biopsy, sarcoma, rhabdomyosarcoma, orchiectomy

Introduction

Paratesticular masses are uncommon lesions arising from structures adjacent to the testis, including the epididymis, spermatic cord, tunica vaginalis, vestigial remnants, and associated mesenchymal tissues. A recent systematic review emphasized the importance of risk-based evaluation because these lesions include a wide spectrum of benign and malignant entities requiring different treatment strategies (1). Multimodality imaging studies have also shown that paratesticular neoplasms and their rare mimics may appear similar clinically and radiologically, making preoperative diagnosis challenging (2). Ultrasonography is highly useful for distinguishing extratesticular from intratesticular lesions, but its ability to determine histology or biological behavior is limited (3).

The pathological spectrum is broad and should be described with precise terminology. Tumor-like lesions are not synonymous with borderline tumors. Tumor-like or pseudotumoral lesions are generally non-neoplastic or reactive conditions, such as fibrous pseudotumor, inflammatory pseudotumor, granulomatous

lesions, hematoma, infarction, and hernia-related mimics, that may clinically or radiologically mimic true neoplasms. In contrast, borderline paratesticular tumors are rare true neoplasms with low or intermediate malignant potential and are most often reported as serous or Mullerian-type borderline tumors of the paratestis. Therefore, benign tumors, tumor-like lesions, borderline tumors, and malignant tumors should be considered separate diagnostic categories (Table 1) (4-7).

Most malignant paratesticular tumors are sarcomas. Case series and literature reviews have shown that paratesticular sarcomas are rare but clinically important because inadequate initial excision may increase the risk of recurrence and compromise subsequent management (8). Imaging-focused studies of paratesticular sarcoma also emphasize that these tumors often present as non-specific extratesticular masses and may require oncological surgical planning (9). Management of spermatic cord and paratesticular malignant tumors requires adherence to oncological principles, including an inguinal approach, radical orchiectomy when indicated, high spermatic cord ligation, and multidisciplinary assessment (10).

Correspondence: Ali Büyük MD, Trabzon Fatih State Hospital, Clinic of Urology, Trabzon, Türkiye

E-mail: dr.alibyk@gmail.com **ORCID-ID:** orcid.org/0000-0001-6369-831X

Received: 21.05.2026 **Accepted:** 09.07.2026 **Epub:** 14.10.2026

Cite this article as: Büyük A, Çolak F. Paratesticular masses: diagnostic challenges and management. J Urol Surg. [Epub Ahead of Print]

©Copyright 2026 The Author(s). Published by Galenos Publishing House on behalf of the Society of Urological Surgery.

This is an open access article under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License.



Table 1. Practical classification of paratesticular masses

Category	Common examples	Key diagnostic point	Usual management implication
Benign tumors	Lipoma, adenomatoid tumor, leiomyoma, hemangioma, schwannoma, cystadenoma	Usually slow-growing and well-circumscribed; imaging may still overlap with malignancy	Local excision or testis-sparing surgery when feasible
Tumor-like/pseudotumoral lesions	Fibrous pseudotumor, inflammatory pseudotumor, sperm granuloma, chronic hematoma, infarction, hernia-related mimics	Non-neoplastic or reactive mimics; not synonymous with borderline tumors	Observation in selected cases, lesion-directed treatment, or testis-sparing excision
Borderline tumors	Rare serous or Mullerian-type borderline tumors of the paratestis	True neoplasms with low/intermediate malignant potential; require expert pathology	Complete excision and individualized follow-up
Malignant tumors	Liposarcoma, leiomyosarcoma, rhabdomyosarcoma, undifferentiated pleomorphic sarcoma, malignant mesothelioma, lymphoma, metastasis	Solid, enlarging, invasive, heterogeneous, or hypervascular features increase suspicion	Inguinal oncologic approach; radical orchiectomy/high cord ligation when indicated; MDT care
MDT: Multidisciplinary team			

Age is an important determinant in the differential diagnosis. Paratesticular rhabdomyosarcoma is particularly important in children, adolescents, and young adults, and may present with normal serum tumor markers despite aggressive behavior (11). Pediatric imaging reviews also show that testicular and paratesticular tumors in children differ from adult lesions in histology, behavior, and staging requirements (12). Consequently, evaluation of paratesticular masses should integrate patient age, clinical history, growth pattern, serum tumor markers, ultrasonographic appearance, magnetic resonance imaging (MRI) findings (when indicated), histopathology, and multidisciplinary decision-making.

Anatomy and Classification

The paratesticular region includes the epididymis, spermatic cord, tunica vaginalis, tunica albuginea, rete testis, vestigial remnants, vascular and lymphatic structures, and surrounding soft tissues. Because these structures contain epithelial, mesothelial, and mesenchymal elements, paratesticular masses may arise from multiple tissue lineages.

A practical classification divides these lesions into four clinically useful groups: benign tumors, tumor-like or pseudotumoral lesions, rare borderline tumors, and malignant tumors. Benign tumors include lipomas, adenomatoid tumors, leiomyomas, hemangiomas, schwannomas, and cystadenomas. Tumor-like lesions include fibrous pseudotumor, inflammatory pseudotumor, granulomatous lesions, chronic hematoma, infarction, and hernia-related mimics. Borderline tumors are rare and include serous or Mullerian-type tumors of the paratestis. Malignant tumors include liposarcoma, leiomyosarcoma, rhabdomyosarcoma, undifferentiated pleomorphic sarcoma, malignant mesothelioma, lymphoma, metastatic carcinoma, and rare appendageal malignancies. This separation is important because tumor-like lesions are not borderline tumors and

usually do not require the same oncologic pathway as malignant or borderline neoplasms (1,4-7).

Clinically, the primary distinction is whether a mass is intratesticular or extratesticular. Intratesticular solid masses are usually treated as malignant until proven otherwise, whereas extratesticular masses are more frequently benign. However, extratesticular location does not exclude malignancy, especially when the lesion is solid, enlarging, heterogeneous, hypervascular, or invasive (2,3).

Epidemiology and Pathological Spectrum

Paratesticular tumors are rare but pathologically diverse. Large clinical and institutional experiences demonstrate that the proportion of benign and malignant lesions varies according to referral pattern, patient selection, and center expertise (13,14). Some centers report a predominance of benign lesions, whereas tertiary referral centers may encounter a higher proportion of suspicious or malignant masses.

Among benign paratesticular lesions, the adenomatoid tumor is one of the most frequent neoplasms and is generally of mesothelial origin. Lipomas are common, particularly in the spermatic cord and inguinal canal, and may mimic an inguinal hernia. Leiomyoma is less common, but it may arise from smooth muscle elements of the epididymis, spermatic cord, or tunics. Fibrous pseudotumor is a benign reactive lesion but is clinically important because it may closely mimic malignant disease (4,5).

Borderline tumors are much less common than benign lesions and sarcomas. They are most often reported as serous- or Mullerian-type borderline tumors involving structures such as the tunica vaginalis or tunica albuginea. Their rarity, overlap with other paratesticular epithelial and mesothelial lesions, and limited long-term data support expert pathological review and individualized follow-up (6,7).

Malignant lesions are predominantly mesenchymal. Liposarcoma and leiomyosarcoma are more typical in adults, whereas rhabdomyosarcoma is the key malignant tumor in pediatric and adolescent patients (8,9,11,12). Rare paratesticular sarcomas and atypical presentations reported in case-based literature illustrate the diagnostic heterogeneity of this region (15). Additional case reports of pediatric rhabdomyosarcoma and rare childhood paratesticular neoplasms reinforce the need for individualized evaluation, especially in children and adolescents (16-18).

Pediatric rhabdomyosarcoma warrants separate consideration because its management differs from that of adult sarcomas. Contemporary reviews of paratesticular rhabdomyosarcoma highlight the importance of age, tumor size, nodal evaluation, systemic chemotherapy and radiotherapy in selected cases, and long-term follow-up (19). Even rare pediatric fibrous pseudotumor cases may create diagnostic and therapeutic uncertainty because they can mimic malignant tumors (20).

Clinical Presentation

Most paratesticular masses present as painless scrotal or inguinoscrotal swelling. Some patients report progressive enlargement, heaviness, discomfort, or pain. Acute pain is less common but may occur with torsion, hemorrhage, infarction, inflammation, trauma, or rapid tumor expansion.

Clinical examination may suggest an extratesticular origin when the mass is palpably separate from the testis. However, physical examination alone is frequently insufficient to define the tissue of origin or biological behavior. Serum tumor markers, including alpha-fetoprotein, beta-human chorionic gonadotropin, and lactate dehydrogenase, are typically normal in paratesticular tumors and are mainly useful to exclude germ cell tumors (11).

Rapid growth, particularly in children and adolescents, should raise suspicion for rhabdomyosarcoma (11,19). In adults, a progressively enlarging solid mass of the spermatic cord or paratesticular soft tissue should raise concern for sarcoma, particularly liposarcoma or leiomyosarcoma (8,9).

Diagnostic Challenges

The first diagnostic challenge is localization. The clinician must determine whether the lesion is intratesticular or extratesticular. Ultrasonography is central to this distinction and should be the first-line imaging modality. However, once an extratesticular lesion is confirmed, differentiating benign, borderline, and malignant lesions remains difficult.

The traditional rule that extratesticular lesions are usually benign is useful but incomplete. Benign lesions, such as adenomatoid tumor and fibrous pseudotumor, may appear as solid or vascular masses, whereas malignant sarcomas may initially appear as well-defined extratesticular masses. Therefore, a diagnosis based only on location can be misleading.

Features that should raise concern include rapid growth, large size, irregular or infiltrative margins, heterogeneous echotexture, necrotic or cystic components, hypervascularity, invasion of adjacent structures, extension into the inguinal canal, spermatic cord involvement, and suspicious lymphadenopathy. These features should be interpreted in combination with age, clinical history, tumor markers, ultrasonographic features, MRI findings, and histopathology. The key diagnostic red flags suggesting malignant paratesticular disease are summarized in Table 2.

Imaging Evaluation

Ultrasonography

Ultrasonography is the first-line imaging modality for scrotal and paratesticular masses. It is widely available, noninvasive, inexpensive, and effective for determining lesion location, cystic or solid composition, relationship to the testis, and vascularity (21,22). Sonographic reviews of paratesticular lesions demonstrate that ultrasound can identify extratesticular origin and guide further investigation, but benign and malignant lesions often overlap (21). Imaging reviews similarly emphasize that ultrasound findings must be interpreted alongside the clinical and pathological context (22).

Table 2. Diagnostic red flags suggesting malignant paratesticular disease

Red flag	Clinical significance
Rapid growth	Particularly suspicious in children and adolescents
Large solid mass	Raises concern for sarcoma
Irregular or infiltrative margins	Suggests local invasion
Heterogeneous echotexture	May indicate necrosis, hemorrhage, or malignant tissue
Hypervascularity on Doppler	Seen in many malignant tumors but not specific
Fat-containing lesion with thick septa or nodular enhancement	Suggestive of liposarcoma rather than lipoma
Inguinal canal or spermatic cord involvement	Important for surgical planning
Suspicious retroperitoneal nodes	Especially relevant in rhabdomyosarcoma
Prior incomplete excision	Increases risk of residual disease and recurrence
Pediatric/adolescent solid paratesticular mass	Rhabdomyosarcoma must be excluded

Typical benign features include a well-defined border, homogeneous echotexture, and low vascularity. Lipomas are often hyperechoic and relatively avascular. Adenomatoid tumors may be well-circumscribed, but may show vascularity and mimic malignancy. Multiparametric ultrasound and elastography may provide additional information, but even advanced ultrasound techniques may not be sufficient to confidently exclude malignancy in all cases (23).

Features suggestive of malignancy include irregular margins, heterogeneous echotexture, necrotic or cystic areas, and increased vascularity. However, classic radiological-pathological correlation studies have shown that while ultrasonography is highly useful for localization, specificity for malignancy remains limited (3,24).

MRI

MRI is recommended when ultrasound findings are indeterminate, when the lesion is large or complex, or when surgical planning requires better evaluation of local extension. MRI offers superior soft-tissue contrast and can characterize fat, hemorrhage, fibrosis, necrosis, and invasion more accurately than ultrasound (25). MRI-focused studies of extratesticular masses support its role as a problem-solving tool, particularly when the tissue of origin or local extent is unclear (25).

MRI is also useful for differentiating fat-containing lesions. A homogeneous fat-containing lesion with complete signal suppression and without enhancing solid components supports benign lipoma, whereas thick septa, nodular nonfatty components, enhancement, and invasive features suggest liposarcoma. MRI recommendations from the European Society of Urogenital Radiology support MRI use as an adjunct in selected scrotal masses, particularly when sonographic findings are equivocal or when local staging is needed (26).

Despite these advantages, MRI cannot replace histopathological confirmation. It should be regarded as a tool for refining risk assessment and surgical planning, rather than as a definitive diagnostic test.

Computed Tomography (CT) and Positron Emission Tomography/CT (PET/CT)

CT is not routinely required for benign-appearing lesions, but it is important for staging suspected malignant tumors, particularly sarcomas. CT of the chest, abdomen, and pelvis may be used to assess pulmonary metastases, retroperitoneal lymphadenopathy, and distant spread (8,9).

PET/CT is not routinely indicated for all paratesticular masses. It may be considered in selected pediatric rhabdomyosarcoma cases or when conventional imaging is equivocal regarding nodal or distant disease (11,19).

Histopathological Spectrum

Histopathological examination remains the gold standard for diagnosis. Because imaging findings overlap, tissue diagnosis is frequently necessary for solid, enlarging, or suspicious paratesticular lesions.

Benign Lesions

Adenomatoid tumors are benign mesothelial neoplasms and are among the most common paratesticular tumors. They usually arise from the epididymis but may also involve tunical structures. Local excision is typically curative (4,5).

Lipomas are benign adipocytic tumors that often arise in the spermatic cord or the inguinal canal. Their clinical relevance lies in their ability to mimic an inguinal hernia or a liposarcoma. Imaging can be helpful, but fat-containing lesions with thick septa, nodular nonfatty components, or enhancement require careful evaluation.

Leiomyomas are benign smooth muscle tumors that may arise from the epididymis, spermatic cord, or tunics. They are usually slow-growing and may be treated with testis-sparing excision.

Fibrous pseudotumor is a benign reactive fibroinflammatory lesion involving the tunica vaginalis, tunica albuginea, epididymis, or spermatic cord. It is clinically important because it can mimic malignancy. Intraoperative frozen section may help prevent unnecessary orchiectomy in selected cases (20).

Tumor-like and Borderline Lesions

Tumor-like lesions should be separated from borderline tumors. Tumor-like lesions are usually non-neoplastic, reactive, inflammatory, traumatic, vascular, or anatomic mimics that may resemble tumors on examination or imaging. Examples include fibrous pseudotumor, inflammatory pseudotumor, sperm granuloma, chronic hematoma, infarction, vascular malformations, cystic lesions, ectopic tissue, and hernia-related mimics. Their management is usually conservative, testis-sparing, or lesion-directed once malignancy has been reasonably excluded.

Borderline paratesticular tumors are rare, true neoplasms rather than pseudotumoral lesions. Serous or Mullerian-type borderline tumors are the best-described examples. They may have favorable outcomes after complete excision; however, because they are rare and may overlap morphologically with other epithelial or mesothelial tumors, expert pathological assessment and individualized follow-up are recommended (6,7).

Malignant Lesions

Paratesticular sarcomas constitute the most important group of malignant tumors. Liposarcoma and leiomyosarcoma are typical adult tumors, while rhabdomyosarcoma is characteristic of

children and adolescents (8,9,11). Undifferentiated pleomorphic sarcoma and other rare sarcomas have also been reported (15).

Rhabdomyosarcoma requires particular attention: it may grow rapidly, tumor markers are often normal, and multimodal treatment is usually required. Immunohistochemistry plays a critical diagnostic role; desmin, MyoD1, and myogenin support rhabdomyoblastic differentiation (11).

Appendageal tumors and tumor-like lesions of the testis and paratestis represent another diagnostically challenging group. Their morphology and immunohistochemical profile may overlap with other benign, borderline, or malignant lesions, making expert pathological evaluation important (4,5).

Role of Biopsy and Frozen Section

The role of biopsy depends on the level of clinical and radiological suspicion, the likelihood that the mass is truly extratesticular, and whether the result will change management. For small, well-circumscribed benign-appearing lesions, especially cystic lesions or those with typical benign imaging features, preoperative biopsy is not routinely required; direct local excision, selected surveillance, or testis-sparing surgery may be appropriate.

For large, solid, rapidly growing, or indeterminate extratesticular lesions suspicious for sarcoma, carefully planned image-guided core needle biopsy may be useful for histological confirmation, grading, and multidisciplinary treatment planning, particularly if neoadjuvant therapy or referral to a sarcoma-experienced center is being considered (27). Fine-needle aspiration is generally less informative than core needle biopsy for soft tissue tumors.

Biopsy route and timing are critical. If a primary testicular malignancy cannot be confidently excluded, transscrotal biopsy or scrotal violation should be avoided; inguinal exploration with possible frozen section is the safer approach. When a biopsy is performed for a suspected sarcoma, it should be planned by the treating multidisciplinary team to avoid compromising definitive surgery.

Frozen section can help intraoperative decision-making in selected cases when imaging and clinical features are equivocal,

but a benign disease is likely. A benign frozen-section result may support testis-sparing excision, whereas suspicious or malignant findings should prompt an oncologic inguinal approach. Frozen section should be interpreted cautiously because sampling limitations can occur, and definitive management should ultimately be guided by final histopathology.

Management

Management should be individualized according to clinical suspicion, imaging characteristics, patient age, tumor size, histology, and local extent. The practical roles of biopsy, frozen section, and surgical approaches are summarized in Table 3.

Benign or Low-risk Lesions

Small, benign-appearing, well-circumscribed lesions may be managed with local excision or testis-sparing surgery when technically feasible. This approach is particularly important in young patients and in lesions such as adenomatoid tumor, leiomyoma, lipoma, and fibrous pseudotumor.

Selected surveillance may be reasonable for simple cystic or clinically stable lesions when imaging confidently supports a benign diagnosis and the patient is asymptomatic. However, surveillance should not be used for lesions that are enlarging, solid, heterogeneous, invasive, or otherwise suspicious.

An intraoperative frozen section can be useful when imaging and clinical findings are equivocal, but benign pathology is suspected. Frozen section may allow testis preservation and reduce unnecessary radical orchiectomy (10,20).

Suspicious or Malignant Lesions

Suspicious lesions should generally be approached through an inguinal incision. If malignancy is suspected or confirmed, radical inguinal orchiectomy with high ligation of the spermatic cord and wide excision of involved paratesticular soft tissue remains the standard surgical approach for many malignant paratesticular tumors (8-10).

Mass excision alone should not be the default strategy for a lesion that is clinically or radiologically suspicious for malignancy,

Table 3. Practical role of biopsy and frozen section

Clinical scenario	Role of biopsy/frozen section	Management implication
Clearly benign-appearing lesion	Usually, no routine preoperative biopsy	Selected surveillance, local excision, or testis-sparing surgery
Indeterminate solid extratesticular lesion	Frozen section or core needle biopsy may be considered depending on risk and surgical plan	Avoid unnecessary orchiectomy while maintaining oncologic safety
Suspicion for sarcoma	MDT-planned image-guided core needle biopsy may be useful when results alter management	Plan biopsy tract so that definitive surgery is not compromised
Possible testicular malignancy	Avoid transscrotal biopsy or scrotal violation	Prefer inguinal exploration and testicular tumor pathway
Intraoperative uncertainty	Frozen section may guide testis-sparing excision versus radical surgery	Final pathology remains decisive because frozen section has sampling limitations
MDT: Multidisciplinary team		

particularly when sarcoma is suspected. Limited excision may be considered only in carefully selected cases when imaging strongly suggests a benign extratesticular lesion, the testis and spermatic cord are clearly uninvolved, fertility or endocrine preservation is important, and frozen section or preoperative pathology supports a benign or low-risk diagnosis. If malignancy is diagnosed after limited excision, re-excision, completion of radical surgery, or referral to a sarcoma-experienced multidisciplinary team should be considered based on margin status, histology, grade, and stage.

For adult sarcomas, complete excision with negative margins is critical. Local recurrence is a major failure pattern, and inadequate initial excision may compromise disease control. Spermatic cord sarcoma outcome studies show that recurrence and failure patterns are strongly related to local control and margin status (28). Adult spermatic cord sarcoma series also support aggressive surgical management and careful follow-up (29). Wide resection, hemiscrotectomy in selected cases of scrotal skin involvement or previous scrotal violation, and referral to sarcoma-experienced centers should be considered (6,28,29).

The role of adjuvant radiotherapy in adult paratesticular sarcomas is not fully standardized, but may be considered in high-risk cases, including positive or close margins, high-grade tumors, local recurrence, or anatomically constrained resections. Chemotherapy has no universally established role in adult paratesticular sarcomas, but it may be considered based on histology, grade, stage, and sarcoma oncology recommendations.

Pediatric Rhabdomyosarcoma

Paratesticular rhabdomyosarcoma requires a distinct management strategy. Radical inguinal orchiectomy remains central, but treatment usually includes systemic chemotherapy and, in selected cases, radiotherapy (11,19). Recent case-based literature continues to emphasize the importance of surgical and oncologic integration in paratesticular rhabdomyosarcoma (30).

Nodal evaluation is important because retroperitoneal lymph node involvement may occur even when imaging is negative, especially in older children and adolescents. The role of retroperitoneal lymph node dissection remains debated, but contemporary pediatric protocols emphasize risk-adapted nodal staging and multimodal management (19). Fertility preservation, endocrine follow-up, and long-term survivorship should be addressed whenever possible, especially in adolescents and young adults (11).

Proposed Diagnostic Algorithm

The proposed risk-based evaluation and management pathway is summarized in Figure 1. The algorithm begins with clinical examination, serum tumor markers, when indicated, and scrotal ultrasonography with Doppler. Intratesticular lesions should

be managed according to the testicular tumor pathway. For extratesticular lesions, risk assessment should integrate size, growth, solid or cystic nature, margins, echotexture, vascularity, invasion, inguinal canal or spermatic cord involvement, and lymph nodes. Low-risk benign-appearing lesions may undergo selected surveillance or testis-sparing local excision. Indeterminate or suspicious lesions require MRI and, when malignancy is suspected, staging CT, as well as multidisciplinary planning; selected cases may benefit from planned core-needle biopsy or inguinal exploration with frozen section.

Discussion

Paratesticular masses remain diagnostically challenging because they are rare, heterogeneous, and frequently non-specific in presentation. Although most lesions are benign, the consequences of missing a malignant sarcoma are significant. Conversely, many benign or tumor-like lesions are overtreated because they mimic malignancy clinically or radiologically.

Ultrasonography should remain the initial imaging modality because it reliably localizes scrotal lesions and distinguishes intratesticular from extratesticular masses (21,22). However, sonographic features alone cannot consistently distinguish benign from malignant paratesticular lesions. MRI is therefore useful in indeterminate cases, particularly when tissue characterization or assessment of local invasion is required (25,26).

The central clinical goal is to avoid both overtreatment and undertreatment. Benign and tumor-like lesions should be managed with testis-sparing strategies whenever it is safe. In this context, the frozen section can be valuable in selected cases, especially for fibrous pseudotumor and other benign-appearing solid lesions (10,20). On the other hand, suspected sarcoma requires an inguinal oncologic approach, wide excision, and high cord ligation to optimize local control (8,28,29).

Pediatric patients require a distinct clinical mindset. Paratesticular rhabdomyosarcoma has unique staging, nodal evaluation, chemotherapy, radiotherapy, and survivorship considerations (11,19,30). Therefore, children and adolescents with solid paratesticular masses should be evaluated in collaboration with pediatric oncology and radiology teams.

A structured algorithmic approach may improve clinical decision-making. Such an approach should begin with ultrasonographic localization, proceed to MRI for indeterminate or suspicious lesions, use staging imaging studies when malignancy is suspected, and incorporate biopsy, frozen section, or definitive histopathology when appropriate to guide the extent of surgery. Multidisciplinary management is particularly important for sarcomas, recurrent tumors, pediatric lesions, and cases with uncertain pathology.

Diagnostic Algorithm for Paratesticular Masses

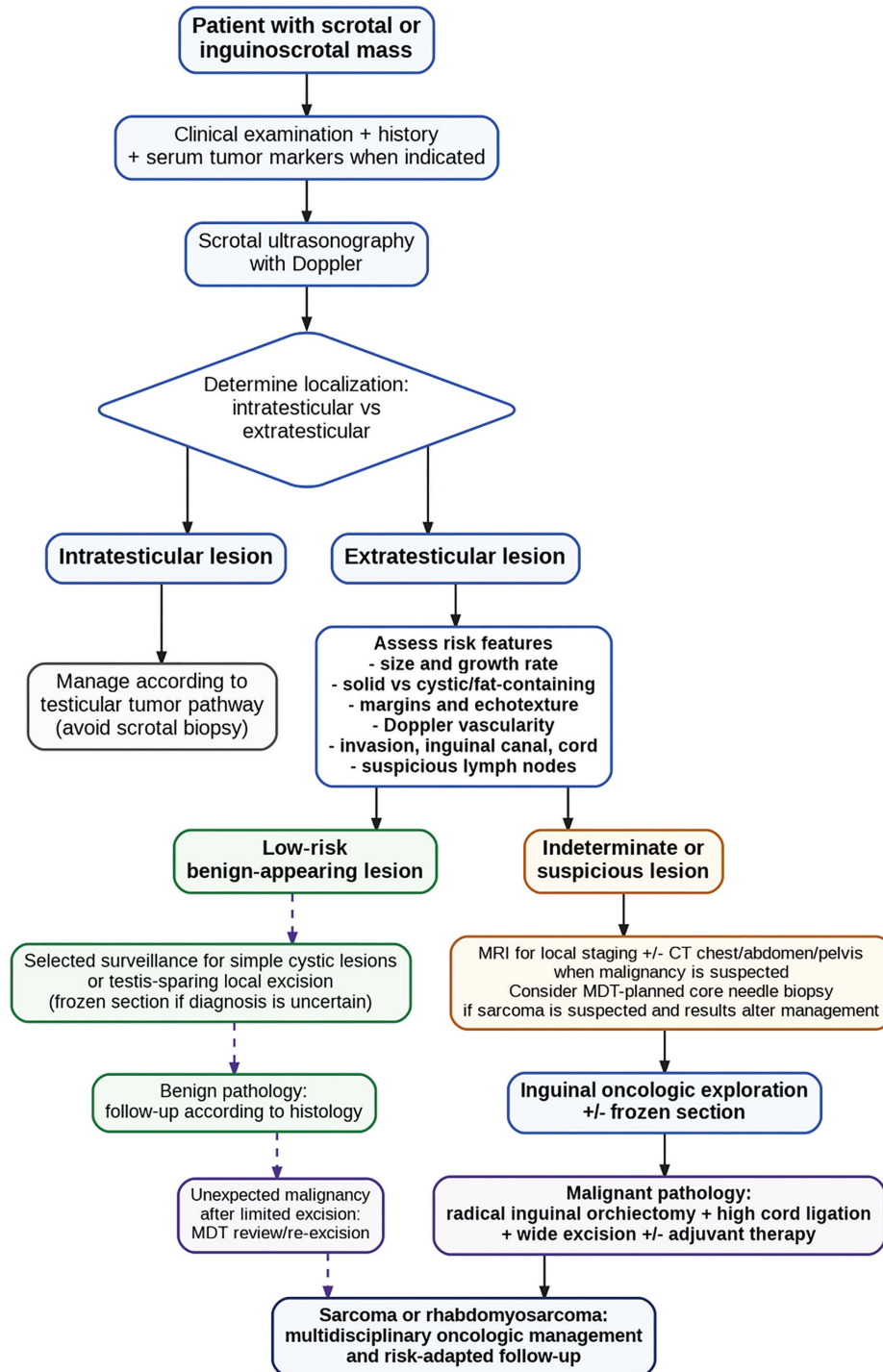


Figure 1. Diagnostic algorithm for the evaluation and management of paratesticular masses. Initial evaluation should begin with history, clinical examination, serum tumor markers when indicated, and scrotal ultrasonography with Doppler. Intratesticular lesions should be managed according to the testicular tumor pathway. For extratesticular lesions, risk assessment should include lesion size, growth rate, solid or cystic nature, margins, echotexture, vascularity, local invasion, inguinal canal or spermatic cord involvement, and lymph nodes. Low-risk benign-appearing lesions may be observed in selected cases or treated with testis-sparing local excision. Indeterminate or suspicious lesions may require MRI, staging CT when malignancy is suspected, multidisciplinary planning, selected core needle biopsy, and/or inguinal exploration with frozen section. Malignant pathology should prompt oncologically appropriate management, including radical inguinal orchiectomy with high cord ligation and wide excision when indicated

MDT: Multidisciplinary team, CT: Computed tomography, MRI: Magnetic resonance imaging

Future Directions

Future research should focus on improving preoperative risk stratification. Multiparametric ultrasound, contrast-enhanced ultrasound, elastography, and advanced MRI techniques may improve lesion characterization, but their ability to reliably distinguish benign from malignant paratesticular lesions remains limited. Larger multicenter registries are needed because single-center series are often small and affected by referral bias.

Molecular pathology may also refine the diagnosis, especially for rare appendageal tumors, borderline tumors, rhabdomyosarcoma variants, and atypical sarcomas. Standardized algorithms for when to observe, biopsy, excise, or perform radical orchiectomy would be valuable, particularly for indeterminate extratesticular solid masses.

Conclusion

Paratesticular masses are rare but clinically important, as they encompass a wide spectrum of lesions ranging from benign and tumor-like to borderline and malignant. Tumor-like lesions should not be considered synonymous with borderline tumors. Ultrasonography is the first-line modality, while MRI provides additional value in indeterminate lesions and surgical planning. Histopathological confirmation remains essential because imaging findings frequently overlap. Benign and tumor-like lesions should be treated with testis-sparing strategies whenever it is safe, whereas malignant tumors require radical oncologic management. A multidisciplinary, algorithm-based approach can reduce unnecessary orchiectomy while ensuring timely and adequate treatment of malignant disease.

Footnotes

Authorship Contributions

Concept: A.B., F.Ç., Design: A.B., Analysis or Interpretation: A.B., F.Ç., Literature Search: A.B., Writing: A.B., F.Ç.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

AI Disclosure Statement: AI-assisted tools were used for text editing, language correction, and literature assistance. The authors reviewed and approved all content and accept full responsibility for the final manuscript.

References

1. Jhang D, Amin K, Farkouh A, Eshaghian E, Alsyuf M, Hu B. Paratesticular tumors: a systematic review and proposed risk-based management algorithm. *Urology*. 2026;207:248-258. [\[Crossref\]](#)
2. Akbar SA, Sayyed TA, Jafri SZ, Hasteh F, Neill JS. Multimodality imaging of paratesticular neoplasms and their rare mimics. *Radiographics*. 2003;23:1461-1476. [\[Crossref\]](#)
3. Frates MC, Benson CB, DiSalvo DN, Brown DL, Laing FC, Doubilet PM. Solid extratesticular masses evaluated with sonography: pathologic correlation. *Radiology*. 1997;204:43-46. [\[Crossref\]](#)
4. Al-Obaidy KI, Alruwaili FI, Ulbright TM, Idrees MT. Appendageal tumors and tumor-like lesions of the testis and paratestis: a 32-year experience at a single institution. *Hum Pathol*. 2020;103:25-33. [\[Crossref\]](#)
5. Vega M, Idrees MT. Review of paratesticular appendageal tumors, morphology, immunohistochemistry, and recent molecular advances. *Surg Pathol Clin*. 2025;18:119-131. [\[Crossref\]](#)
6. McClure RF, Keeney GL, Sebo TJ, Cheville JC. Serosal borderline tumor of the paratestis: a report of seven cases. *Am J Surg Pathol*. 2001;25:373-378. [\[Crossref\]](#)
7. Patel M, Dudiak C, Turk T, Picken M. A unique case of a serous borderline tumor of the paratestis. *Urol Ann*. 2015;7:380-382. [\[Crossref\]](#)
8. Keenan RA, Nic An Riogh AU, Stroeescu A, Fuentes A, Heneghan J, Cullen IM, Daly PJ. Paratesticular sarcomas: a case series and literature review. *Ther Adv Urol*. 2019;11:1756287218818029. [\[Crossref\]](#)
9. Ap Dafydd D, Messiou C, Thway K, Strauss DC, Nicol DL, Moskovic E. Paratesticular sarcoma: typical presentation, imaging features, and clinical challenges. *Urology*. 2017;100:163-168. [\[Crossref\]](#)
10. Rodríguez D, Olumi AF. Management of spermatic cord tumors: a rare urologic malignancy. *Ther Adv Urol*. 2012;4:325-334. [\[Crossref\]](#)
11. Zhu Y, Zhu Z, Xiao Y, Zhu Z. Case report: paratesticular rhabdomyosarcoma. *Front Oncol*. 2021;11:629878. [\[Crossref\]](#)
12. Hermann AL, L'Herminé-Coulomb A, Irtan S, Audry G, Cardoen L, Brisse HJ, Vande Perre S, Pointe HDL. Imaging of pediatric testicular and paratesticular tumors: a pictorial review. *Cancers (Basel)*. 2022;14:3180. [\[Crossref\]](#)
13. Demirel HC, Tokuç E, Eryılmaz OT, Aykanli E, Yavuzsan AH, Ozagari AA, Kirecci SL, Horasanli K. The fate of paratesticular masses: 13 years' experience in a tertiary referral centre. *Aktuelle Urol*. 2024;55:148-153. English. [\[Crossref\]](#)
14. Wang Y, Miao C, Sun S, Chen W, Wang Z, Liang C. Diagnosis and treatment of paratesticular tumors: a 10-year experience with 19 cases of single center. *SSRN Electron J*. 2022. [\[Crossref\]](#)
15. Nunes NA, Shah AA, Murugan G. A rare case of paratesticular sarcoma: a case report. *Cureus*. 2024;16:e58793. [\[Crossref\]](#)
16. Tabouri S, Zeroual S, Larbaoui B. Paratesticular rhabdomyosarcoma: diagnostic and therapeutic advances through a case report. *Clin Res Stud*. 2025;4. [\[Crossref\]](#)
17. Pratiwi S, Erlina N. Report of a rare case of childhood paratesticular rhabdomyosarcoma (PT-RMS) and literature review. *IJSOC*. 2025;7:480-487. [\[Crossref\]](#)
18. Giacosa F, Berger M, Lariguet I, Grasso A, Allende A, Curci V, Astori E, Marchisella M. Testicular and paratesticular neoplasms in pediatrics: report of 5 cases with atypical presentation and literature review. *SVOA Paediatrics*. 2024;3:159-165. [\[Crossref\]](#)

19. Dangle PP, Correa A, Tennyson L, Gayed B, Reyes-Múgica M, Ost M. Current management of paratesticular rhabdomyosarcoma. *Urol Oncol*. 2016;34:84-92. [\[Crossref\]](#)
20. White O. Rare paratesticular fibrous pseudotumour in a pediatric patient presents both diagnostic and treatment challenges. *Am J Clin Pathol*. 2025;164(Suppl 1):aqaf121.151. [\[Crossref\]](#)
21. Rafailidis V, Huang DY, Sidhu PS. Paratesticular lesions: aetiology and appearances on ultrasound. *Andrology*. 2021;9:1383-1394. [\[Crossref\]](#)
22. Secil M, Bertolotto M, Rocher L, Pekindil G, Stocca T, Richenberg J, Ramchandani P, Derchi LE; European Society of Urogenital Radiology Scrotal Imaging Subcommittee. Imaging features of paratesticular masses. *J Ultrasound Med*. 2017;36:1487-1509. [\[Crossref\]](#)
23. Corvino A, Catalano O, Faggian G, Delli Pizzi A, Tafuri D, Corvino F, Borzelli A, Picchi SG, Lassandro G, Boccatonda A, Schips L, Cocco G. Multiparametric ultrasound diagnostic approach to malignancy-mimicking adenomatoid tumors of the scrotum: is strain elastography enough? *Medicina (Kaunas)*. 2023;59:1261. [\[Crossref\]](#)
24. Woodward PJ, Schwab CM, Sesterhenn IA. From the archives of the AFIP: extratesticular scrotal masses: radiologic-pathologic correlation. *Radiographics*. 2003;23:215-240. [\[Crossref\]](#)
25. Edo H, Yagi F, Mizuno M, Okada M, Hyoe E, Ozaki I, Akita H, Jinzaki M, Shinmoto H. Extratesticular masses focusing on MRI findings. *Jpn J Radiol*. 2024;42:1087-1099. [\[Crossref\]](#)
26. Tsili AC, Bertolotto M, Turgut AT, Dogra V, Freeman S, Rocher L, Belfield J, Studniarek M, Ntorkou A, Derchi LE, Oyen R, Ramchandani P, Secil M, Richenberg J. MRI of the scrotum: recommendations of the ESUR Scrotal and Penile Imaging Working Group. *Eur Radiol*. 2018;28:31-43. [\[Crossref\]](#)
27. von Mehren M, Kane JM, Agulnik M, Bui MM, Carr-Ascher J, Choy E, Connelly M, Dry S, Ganjoo KN, Gonzalez RJ, Holder A, Homsy J, Keedy V, Kelly CM, Kim E, Liebner D, McCarter M, McGarry SV, Mesko NW, Meyer C, Pappo AS, Parkes AM, Petersen IA, Pollack SM, Poppe M, Riedel RF, Schuetze S, Shabason J, Sicklick JK, Spraker MB, Zimel M, Hang LE, Sundar H, Bergman MA. Soft tissue sarcoma, version 2.2022, NCCN clinical practice guidelines in oncology. *J Natl Compr Canc Netw*. 2022;20:815-833. [\[Crossref\]](#)
28. Ballo MT, Zagars GK, Pisters PW, Feig BW, Patel SR, von Eschenbach AC. Spermatic cord sarcoma: outcome, patterns of failure and management. *J Urol*. 2001;166:1306-1310. [\[Crossref\]](#)
29. Coleman J, Brennan MF, Alektiar K, Russo P. Adult spermatic cord sarcomas: management and results. *Ann Surg Oncol*. 2003;10:669-675. [\[Crossref\]](#)
30. Kura MM, Umar AM, Arogundade AK, Afolayan AO, Abdulsalam KI, Lawan AI. Giant primary paratesticular rhabdomyosarcoma: a case report and review of surgical and oncologic management. *Afr J Urol*. 2025;31:24. [\[Crossref\]](#)