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CLINICAL OUTCOMES OF RETROPERITONEAL SARCOMA: A CASE SERIES OF SIX PATIENTS

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Abstract

Background: Retroperitoneal sarcomas (RPS) are rare malignancies arising in the retroperitoneum, accounting for a small fraction of adult cancers. They often present late due to their deep location and can reach large sizes, posing unique management challenges.

Methods: We retrospectively reviewed six patients with primary RPS treated at a tertiary center. Clinical data, imaging findings, surgical details, histopathology, and outcomes were collected. Overall survival (OS) was analyzed with Kaplan-Meier methods.

Results: The cohort had a median age of 56 years (range 45–68) and included 4 males and 2 females. Tumor size at presentation was large (median ~20 cm), with common symptoms being abdominal pain or a palpable mass. All patients underwent surgical resection; four required multivisceral en bloc resection of adjacent organs. Histologic subtypes included well-differentiated and dedifferentiated liposarcoma (50% of cases), leiomyosarcoma, undifferentiated pleomorphic sarcoma, and solitary fibrous tumor. Complete gross resection (R0/R1) was achieved in 5 of 6 patients; one had residual disease (R2 resection). After a median follow-up of 36 months, three patients were alive (two disease-free) and three had died of disease. The 3-year OS was ~50%, with a median OS of approximately 30 months.

Conclusion: This case series highlights the aggressive behavior and management complexity of RPS. Complete surgical resection at specialized centers remains the cornerstone of therapy, often necessitating removal of adjacent organs to achieve clear margins. Despite aggressive surgery, recurrence rates are high and overall survival is guarded, consistent with literature. Tailored multidisciplinary strategies and continued research into adjunct therapies are needed to improve outcomes.

INTRODUCTION

Retroperitoneal sarcomas (RPS) are a rare subset of soft tissue sarcomas, representing only about 0.2% of all adult malignancies
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. The annual incidence is approximately 2.7 cases per million population
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. These tumors arise in the retroperitoneal space (the deep compartment of the abdomen) and often grow to considerable size before detection; the median tumor diameter at presentation is about 20–30 cm
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. Patients may have vague symptoms (e.g. abdominal discomfort, early satiety, back pain) or may be asymptomatic until the tumor attains massive size. In some cases, RPS are discovered incidentally on imaging performed for unrelated reasons. Because of the expansive potential of the retroperitoneum, tumors can become very large and cause significant local effects by displacing or invading adjacent organs, while sometimes remaining clinically silent.
RPS comprise approximately 10–20% of all soft tissue sarcomas (STS)
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. The histologic spectrum of RPS is broad, reflecting the heterogeneity of mesenchymal tumors. Over 50 distinct histologic subtypes of STS exist; in the retroperitoneum, the most common histologies are liposarcomas (particularly well-differentiated and dedifferentiated liposarcoma) and leiomyosarcoma
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. Less frequently, subtypes such as solitary fibrous tumor (SFT), undifferentiated pleomorphic sarcoma (UPS, formerly malignant fibrous histiocytoma), or malignant peripheral nerve sheath tumor (MPNST) may occur in this location
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. The biological behavior of RPS varies by subtype: for example, well-differentiated liposarcomas are typically low-grade, tend to recur locally, and almost never metastasize, whereas dedifferentiated liposarcomas and leiomyosarcomas are high-grade and carry a substantial risk of distant metastasis
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. These differences have important treatment implications, and there is growing recognition of the need for histology-tailored management strategies
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Surgical resection is the mainstay of treatment for RPS and the only potentially curative modality
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. Complete resection with negative margins (R0) is the goal, as margin-positive resection (R1) still leaves microscopic disease and gross incomplete resection (R2) is associated with very poor outcomes
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. However, achieving wide margins in RPS is challenging due to the proximity of vital structures and the large tumor size at diagnosis. In practice, a macroscopically complete resection (R0 or R1) is often the best that can be achieved. In experienced centers, R0/R1 resection can be accomplished in the majority of patients
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. Complete resection frequently requires en bloc removal of adjacent organs that are invaded or tightly adherent to the tumor, such as kidney, colon, pancreas, spleen, or major blood vessels. In 2009, an aggressive surgical approach termed “extended resection” was proposed, advocating systematic resection of certain adjacent organs even if not overtly involved, in order to remove a rim of uninvolved tissue around the tumor (analogous to taking a margin in extremity STS)
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. Retrospective studies from high-volume centers in Europe showed that such extended multivisceral resections could significantly improve local recurrence rates
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. For instance, one study reported 5-year local recurrence rates of 29% with routine extended resection vs 48% with standard organ-sparing resection
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. However, this approach remains debated: critics noted that those studies were retrospective and that extended resection did not clearly improve overall survival
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. Consequently, there is no universal consensus on resecting uninvolved organs; most surgeons agree to resect any structure with overt tumor involvement, while prophylactic resection of adjacent structures is considered on a case-by-case basis balancing potential benefit and morbidity.
Given the rarity and complexity of RPS, management in specialized sarcoma centers is recommended. Outcomes for RPS patients are significantly better at high-volume centers with multidisciplinary expertise, compared to treatment at non-specialist centers
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. Specialized surgeons familiar with sarcoma principles can achieve more complete resections and avoid pitfalls like tumor “piecemeal” removal, which has been associated with worse recurrence and survival
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. Indeed, one large multicenter study found that patients treated by specialized sarcoma surgeons had improved survival, underscoring the importance of centralized care
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The role of adjuvant or neoadjuvant therapies in RPS has been an area of active investigation. Unlike extremity STS, for which adjuvant radiotherapy is often used to improve local control, the benefit of radiation in RPS is less clear due to the risk of toxicity to abdominal organs. A recent phase III randomized trial (EORTC 62092, STRASS) compared preoperative radiotherapy plus surgery vs surgery alone in primary RPS. The trial found no significant difference in abdominal recurrence-free survival between the two groups, and thus was considered a negative trial not supporting routine use of preoperative radiotherapy in RPS
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. Subset analyses hinted that certain subtypes (e.g. liposarcomas) might derive some benefit in local control, but these findings are not yet practice-changing. As for systemic therapy, conventional chemotherapy has modest efficacy in most STS and has not been routinely employed for primary RPS outside of specific subtypes like high-grade leiomyosarcoma. Currently, an ongoing trial (STRASS-2) is evaluating the role of neoadjuvant chemotherapy in high-risk RPS (particularly dedifferentiated liposarcoma and leiomyosarcoma)
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. The concept of tailoring neoadjuvant therapy to tumor histology is a promising avenue, given the distinct patterns of spread of different subtypes.
In summary, RPS are uncommon tumors with unique challenges in management. Surgical resection remains essential, often involving complex operations. Yet even after aggressive surgery, the risk of recurrence is high and long-term survival is limited, especially for high-grade tumors. In this context, we present a case series of six patients with retroperitoneal sarcoma treated at our institution. We detail their presentation, management, and outcomes, and we discuss these findings in light of the current literature and evolving trends in RPS care.

METHODS

Study Design: This study is a retrospective case series of patients with retroperitoneal sarcoma, conducted at a single tertiary referral center. We identified all patients with primary RPS who underwent surgical treatment between 2015 and 2020. A total of six patients met inclusion criteria for this series. Institutional review board approval was obtained for retrospective data collection, and all patients had provided general consent for use of their medical records for research purposes.
Inclusion Criteria: Adult patients (age ≥18) with a histologically confirmed primary retroperitoneal soft tissue sarcoma were included. We excluded sarcomas of the abdominal wall or viscera (to focus specifically on true retroperitoneal tumors) and metastatic or recurrent RPS cases (to limit confounding from prior treatments). All included patients had undergone attempted curative-intent resection of the primary tumor.
Data Collection: We reviewed medical records, imaging studies, operative reports, and pathology reports. The following data were collected for each patient: demographic information (age, sex), clinical presentation (symptoms, physical findings), tumor characteristics on imaging (size, location, involvement of adjacent structures, and any evidence of metastasis), surgical procedure details (extent of resection, organs removed, reconstruction performed if any), histopathological findings (tumor subtype, grade, resection margin status), and postoperative outcomes. Postoperative outcomes included complications (graded by Clavien-Dindo, not detailed here for brevity), use of adjuvant therapies, and follow-up status (disease recurrence or progression, survival status at last follow-up).
Pathology and Classification: Tumors were classified according to the World Health Organization (WHO) classification of soft tissue tumors. Histologic subtype and tumor grade were recorded for each case. Tumor grade was determined using the French Federation of Cancer Centers Sarcoma Group (FNCLCC) grading system (which incorporates tumor differentiation, mitotic count, and necrosis). Resection margins were categorized as R0 (microscopically negative), R1 (microscopic residual disease/immediate adjacency of tumor to margin), or R2 (macroscopic residual tumor).
Statistical Analysis: Given the small sample size, analysis was primarily descriptive. Continuous variables are presented as medians and ranges. Categorical variables are summarized as frequencies and percentages. Overall survival (OS) was defined as the time from the date of surgical resection to the date of death from any cause or last follow-up. Patients alive at last follow-up were censored. OS was estimated using the Kaplan-Meier method. A Kaplan-Meier survival curve was generated to illustrate the survival distribution for the cohort. Because of the limited number of patients, no inferential statistics (e.g. comparison between subgroups) were performed. Disease-free survival (DFS) or recurrence-free survival was not formally calculated due to the small sample and heterogeneity of

follow-up, but instances of recurrence are reported individually. Data analysis was performed with standard statistical software, and figures were created using Python's matplotlib library.

RESULTS

Patient Demographics and Presentation

Six patients with primary retroperitoneal sarcoma were included in this series. The median age at diagnosis was 56 years (range 45–68 years). There were four male and two female patients. Table 1 summarizes the key demographic details and clinical presentation of each case. Four patients presented with abdominal pain and/or a palpable abdominal mass. In two patients, the tumor was an incidental finding on imaging — one during a workup for nephrolithiasis and another during a routine health check ultrasound. Symptoms, when present, were typically insidious and related to the mass effect of the tumor (abdominal distension, early satiety, vague discomfort). None of the patients had a known hereditary syndrome or prior radiation exposure predisposing to sarcoma. All patients were previously healthy without significant comorbidities, aside from one patient with well-controlled hypertension.

Table 1. Patient demographics and clinical characteristics.

Patient	Age (yrs)	Sex	Presentation	Symptoms
1	48	M	Incidental (imaging for stones)	Asymptomatic
2	61	M	Abdominal mass & pain	Dull flank pain
3	53	F	Increasing abdominal girth	Bloating, fullness
4	68	M	Abdominal pain	Weight loss, pain
5	45	M	Palpable abdominal mass	Abdominal pain
6	59	F	Incidental (routine ultrasound)	Asymptomatic

All patients underwent a thorough preoperative evaluation with imaging. Contrast-enhanced computed tomography (CT) of the abdomen and pelvis was performed in all six cases, which delineated a retroperitoneal soft tissue mass in each patient. None of the patients had detectable distant metastases on initial staging (chest imaging was negative for lung metastases in all). Image-guided core needle biopsies were obtained in four patients prior to surgery to establish a diagnosis; in the other two patients, given the radiologic appearance strongly suggestive of liposarcoma and the logistics of referral, the multidisciplinary tumor board opted to proceed directly to surgery without preoperative biopsy.

Imaging Findings

The tumors were large in size, with a median largest diameter of 18 cm (range 12–28 cm) on imaging. Table 2 summarizes the radiologic characteristics. Four tumors were located predominantly in the left retroperitoneum and two in the right. The kidney on the involved side was the most commonly affected adjacent organ – in three cases the mass was compressing or encasing the ipsilateral kidney. Two tumors (Patients 2 and 4) showed evidence of direct invasion into the kidney or renal hilum region on imaging. Two patients had tumor extension to or encasement of segments of the colon. One tumor (Patient 3) appeared to originate from or heavily involve the inferior vena cava (IVC), consistent with a possible leiomyosarcoma of the IVC. Another tumor (Patient 5) was centered in the psoas muscle and extending into paraspinal area, abutting the lumbar spine. Despite the large size of these masses, there was no evidence of distant spread at diagnosis. Figure 1 shows a representative PET CT image from one patient, illustrating a large right retroperitoneal tumor displacing abdominal viscera.

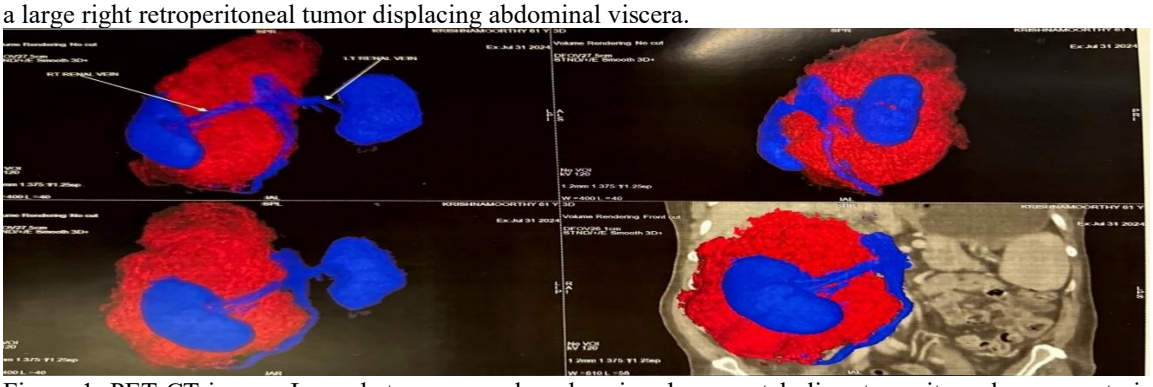

Figure 1: PET CT image- Large heterogeneously enhancing, hypermetabolic retroperitoneal mass posterior to right kidney.

Table 2. Imaging findings and tumor characteristics.

Patient	Tumor Size (cm)	Location (Side)	Key Imaging Findings (Adjacent Structures)
1	15	Left retroperitoneum	Left kidney displaced (no direct invasion)
2	25	Left retroperitoneum	Encasing left kidney and spleen; colon displaced
3	12	Central/IVC region	IVC enlargement suggesting intraluminal tumor
4	28	Right retroperitoneum	Involving right kidney upper pole; colon adherent
5	18	Left psoas/para-spinal	Arising from psoas muscle; abuts L4 vertebra
6	16	Left retroperitoneum	Posterior left colon wall tethered to tumor

On imaging, all tumors were well-circumscribed but displaced adjacent structures. The fat content within the masses varied. Patients 1 and 2 had tumors with substantial fat density on CT, highly suggestive of liposarcoma (with Patient 2's tumor also containing solid enhancing components indicative of dedifferentiation). Patient 3's tumor was a predominantly solid mass within the IVC trajectory. Patient 5's tumor in the psoas was solid and heterogeneous, with areas of necrosis. Patient 6's tumor was a well-defined mass with soft-tissue density abutting the descending colon and left kidney. These radiologic impressions were later corroborated by histopathology. No patient had evidence of liver lesions or lung nodules on staging scans. One patient (Patient 5) had a questionable lytic area at the L4 vertebra on imaging, raising concern for bone involvement; this was noted to possibly represent tumor invasion versus pressure remodeling of bone.

Surgical Management

All six patients proceeded to surgical exploration with curative intent. The surgical approach in each case was planned by a multidisciplinary team including surgical oncologists and relevant subspecialists (urology, vascular surgery, orthopedic spine surgery as needed). At surgery, complete gross resection of the tumor was achieved in five out of six cases. One patient (Patient 5) had an incomplete resection due to tumor invasion into the spine that could not be fully resected without exorbitant morbidity. The operative details and surgical outcomes are summarized in Table 4. Five patients underwent en bloc resection of the tumor with one or more adjacent organs. The most commonly resected organ was the kidney (n = 3), followed by segments of colon (n = 2). In Patient 3, a segment of the IVC (about 6 cm length) was resected along with the tumor and reconstructed with an interposition PTFE graft, due to a leiomyosarcoma arising from the IVC. Patient 4's surgery included resection of the right kidney and a portion of the colon (right hemicolectomy) en bloc with the tumor. Patient 2 underwent a left radical nephrectomy and distal pancreatectomy/splenectomy as part of the en bloc resection, given the tumor's encroachment on those structures. Patient 6 required resection of an attached segment of the descending colon with primary colonic anastomosis. Patient 1's tumor was removed without needing any adjacent organ resection – it was found to be a well-differentiated liposarcoma that shelled out, with the left kidney preserved (the kidney was mobilized and spared as the tumor was mainly pushing it aside rather than invading).

In all cases except Patient 5, the surgeons achieved removal of the tumor in one piece without rupture. There were no instances of piecemeal or fragmented resection. Intraoperative tumor spill was carefully avoided, as that is known to worsen local recurrence risk

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. The median operative time was 5 hours (range 3–9 hours), reflecting the complexity of these cases. Two patients (Patients 2 and 4) required multi-team involvement (vascular and hepatobiliary surgeons for Patient 2, and colorectal surgeons for Patient 4).

Histopathology: Final pathology confirmed the diagnosis of sarcoma in all cases, with specific subtypes as listed in Table 3. Liposarcoma was the single most frequent histology: three of six patients had liposarcomas (one well-differentiated [Patient 1] and two dedifferentiated [Patients 2 and 4]). Leiomyosarcoma was diagnosed in Patient 3 (originating from the IVC). Patient 5's tumor was an undifferentiated pleomorphic sarcoma (UPS), and Patient 6 had a malignant solitary fibrous tumor. Tumor grade by FNCLCC criteria was high grade (Grade 3) in four cases (the dedifferentiated liposarcomas, leiomyosarcoma, and UPS) and intermediate in two cases (the SFT and one dedifferentiated liposarcoma which was borderline Grade 2–3). The well-differentiated liposarcoma was Grade 1 (low grade).

Table 3. Histopathology of tumors.

Patient	Histologic Subtype	FNCLCC Grade
1	Well-differentiated liposarcoma	1 (Low)

Patient	Histologic Subtype	FNCLCC Grade
2	Dedifferentiated liposarcoma	2 (Intermediate)
3	Leiomyosarcoma (IVC origin)	3 (High)
4	Dedifferentiated liposarcoma	3 (High)
5	Undifferentiated pleomorphic sarcoma (UPS)	3 (High)
6	Solitary fibrous tumor (malignant)	2 (Intermediate)

Resection margin status was R0 (microscopically negative margins) in three patients and R1 (microscopic residual or close margins) in two patients (Table 4). The R1 resections occurred in the two dedifferentiated liposarcoma cases (Patients 2 and 4), where pathology noted microscopic tumor foci at the inked margin in areas where further resection was not possible (retroperitoneal margin abutting vital structures). In both cases, however, the resection was macroscopically complete. Patient 5 had an R2 resection, as expected, because of unresected tumor portion along the spine; the posterior margin was grossly positive where tumor could not be separated from the vertebral bone and spinal canal. For Patient 5, after multidisciplinary discussion, adjuvant radiotherapy was considered but ultimately not given due to the large field that would be required and the patient's postoperative recovery issues. Instead, palliative radiation was reserved for if/when tumor progression caused severe symptoms.

Adjuvant Therapy: Only one patient received adjuvant systemic therapy. Patient 3 (leiomyosarcoma of the IVC, high grade) was treated with adjuvant chemotherapy (doxorubicin plus ifosfamide regimen) starting 6 weeks after surgery, in an attempt to mitigate metastatic risk given the tumor's vascular origin and high grade. This decision was made on an individualized basis; evidence for adjuvant chemotherapy in RPS is limited, but leiomyosarcomas are relatively chemosensitive and have a high propensity for early metastasis. The remaining patients did not receive adjuvant chemotherapy. No patients in this series received adjuvant radiation therapy. The rationale was that in those with R0/R1 resection, the STRASS trial results did not support routine radiation, and for the R2 case the disease was already metastatic shortly after (making local radiation less relevant). All patients were discussed in a multidisciplinary tumor board postoperatively to formulate surveillance plans. Typically, follow-up consisted of imaging (CT scans) every 3–4 months for the first 2 years, then spacing out to every 6 months, consistent with sarcoma guidelines.

Table 4. Surgical outcomes and follow-up for each patient.

Patient	Organs Resected (en bloc)	Margin Status	Outcome (Follow-up)
1	*None* (tumor only, kidney spared)	R0	Alive, no recurrence (48 mo)
2	Left kidney, spleen, pancreas tail	R1	Died (30 mo, local recurrence)
3	IVC segment (graft reconstruction)	R0	Alive, lung metastases (36 mo)
4	Right kidney, colon (hemicolectomy)	R1	Died (18 mo, liver metastases)
5	Left psoas muscle (partial)	R2	Died (12 mo, progressive disease)
6	Descending colon (resected segment)	R0	Alive, no recurrence (30 mo)

All patients had an uneventful immediate postoperative recovery except Patient 2, who developed a postoperative pancreatic fistula (Grade II complication) due to the distal pancreatectomy; this was managed conservatively. There were no postoperative mortalities within 30 days.

Survival and Outcomes

Over a median follow-up period of 36 months (range 12–48 months), three of the six patients were alive at last follow-up. Among the survivors, two (Patients 1 and 6) have no evidence of disease, while one (Patient 3) is alive with disease (managing pulmonary metastases with systemic therapy). Three patients died from their disease during the follow-up period. The estimated 1-year OS was 83%, 2-year OS ~66%, and 3-year OS ~50%. The median overall survival was approximately 30 months. Notably, all three fatalities occurred in patients with high-grade tumors (two dedifferentiated liposarcomas and one UPS) and were associated with either uncontrolled local recurrence or metastatic spread.

Local recurrence developed in two patients. Patient 2 (dedifferentiated liposarcoma, R1 resection) experienced a local recurrence in the left retroperitoneum 18 months after surgery, which was deemed inoperable due to encasement of the mesenteric root; the patient eventually succumbed to progressive local disease at 30 months. Patient 5 (UPS, R2 resection) had residual disease that rapidly progressed locally; despite palliative chemotherapy, the tumor grew, and the patient died at 12 months. Distant metastases were noted in two patients: Patient 3 (leiomyosarcoma) developed multiple bilateral lung metastases within 2 years of surgery (currently receiving chemotherapy), and Patient 4 (dedifferentiated liposarcoma) developed liver metastases and peritoneal sarcomatosis at 15 months, leading to demise

at 18 months. Patient 1 and Patient 6 (both had low or intermediate grade tumors with R0 resections) have remained free of recurrence to date, at 4 years and 2.5 years of follow-up respectively.

Figure 2: Kaplan-Meier overall survival curve for the six patients in the case series. The vertical steps represent the cumulative proportion of patients surviving over time after surgery. Censor marks (crosses on the curve) indicate patients who were alive at last follow-up (Patients 1, 3, and 6). The 3-year overall survival was ~50%, and median survival was approximately 30 months. Patients with high-grade sarcomas had early deaths due to recurrence/metastasis, whereas those with low/intermediate-grade tumors remain alive. This small series underscores the variable prognosis of RPS depending on tumor biology and completeness of resection.

DISCUSSION

This case series of six patients provides insight into the presentation, management, and outcomes of primary retroperitoneal sarcoma (RPS) treated at a specialized center. The demographic profile of our patients (median age in the mid-50s, slight male predominance) is consistent with the known epidemiology of RPS
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. RPS typically affects adults in the 5th to seventh decade of life and has no strong gender predilection, although some series report a marginal male predominance. All patients in our series presented with large tumors (12–28 cm), which aligns with the literature that RPS often grow to considerable size prior to detection
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. Indeed, a recent population-based analysis found that over 40% of RPS cases presented with tumors >15 cm, far more frequently than soft tissue sarcomas at other anatomical sites
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. The insidious growth of these tumors in the roomy retroperitoneal space allows them to remain asymptomatic until they reach a point where they compress surrounding organs. Two of our six cases were asymptomatic incidental findings, underscoring that a high index of suspicion is sometimes needed to diagnose RPS early.

The histologic distribution in our series was in line with expectations. Half of the patients had liposarcoma (with dedifferentiated liposarcoma being the most common subtype), and we also observed one leiomyosarcoma, one UPS, and one malignant solitary fibrous tumor. In larger studies, liposarcomas account for roughly 50%–60% of RPS cases, followed by leiomyosarcoma as the next most frequent subtype
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. The predominance of high-grade histologies (4 of 6 were FNCLCC grade 3) in our cohort may reflect a degree of referral bias to our tertiary center (more aggressive cases being referred), but it is also consistent with the fact that dedifferentiated liposarcomas and leiomyosarcomas, which constituted the majority of our cases, are typically high-grade lesions. The solitary fibrous tumor in our series is a less common retroperitoneal tumor; when malignant, SFTs can behave aggressively, though they often follow a somewhat different clinical course (with potential for late recurrences).

Complete surgical excision remains the cornerstone of curative therapy for RPS, and our management focused on achieving R0/R1 resection in all cases. Five out of six patients had a macroscopically complete resection, yielding an 83% complete resection rate, which is comparable to rates reported in high-volume sarcoma centers
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. For example, a French Sarcoma Group study of 586 RPS patients achieved macroscopically complete resection in 76% of cases
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. The one patient in whom we could not resect all disease (Patient 5) had tumor invading the spine – an anatomic scenario where the morbidity of radical resection (such as vertebrectomy) must be carefully weighed. Unfortunately, that patient had a poor outcome, illustrating the well-known fact that an R2 resection portends extremely high risk of mortality from disease
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. In the literature, residual gross disease (R2) is associated with significantly worse local control and survival; one analysis showed a hazard ratio of ~2.8 for local recurrence when a gross residual was left
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. Our experience reinforces that if an R0/R1 resection cannot be achieved, prognosis is grim and alternate strategies (clinical trials, palliative care) should be considered.

The practice of multivisceral resection was common in our series – four patients (67%) required removal of at least one adjacent organ. This is in concordance with modern surgical series where en bloc organ resection is frequently

needed to clear the tumor. We did not pursue routine resection of uninvolved organs; rather, organs were removed only when directly involved or when necessary to clear margins. For instance, we spared the kidney in Patient 1's well-differentiated liposarcoma since it was only displaced, not invaded. Our approach is somewhat more conservative than the "extended resection" strategy advocated by some groups, where even adjacent organs without obvious invasion may be taken to ensure a wide margin
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. Extended resection has shown improved local recurrence rates in retrospective studies
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, but it did not clearly improve overall survival and carries a risk of added morbidity
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. In our small cohort, local recurrences occurred in two cases, both of which had known risk factors (one had an R1 margin, and the other was an R2 resection). It is conceivable that a more radical resection might have prevented the local recurrence in the R1 case; however, it is equally likely that microscopic disease could recur despite aggressive surgery, given the infiltrative nature of dedifferentiated liposarcoma. The question of how extensive a resection should be is still debated, and prospective data are lacking. Our results highlight the balance that must be struck between achieving negative margins and avoiding unnecessary organ loss – a decision that should be individualized per patient and ideally handled by experienced surgeons.

Notably, all surgeries in this series were performed by or in conjunction with specialized sarcoma surgeons at a high-volume center. We believe this contributed to the favorable surgical outcomes (no intraoperative tumor ruptures, no surgical deaths, acceptable complication profile). The importance of specialization is well supported by literature: patients operated on by specialized teams have better local control and survival
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. Our center's policy of multidisciplinary planning (including vascular, urologic, or orthopedic surgeons as needed for anticipated resections) likely helped us accomplish en bloc resections in complex scenarios (e.g., IVC resection and reconstruction in Patient 3). This multidisciplinary coordination is essential given the anatomic complexity of RPS resections
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The survival outcomes in our series mirror the generally guarded prognosis of high-grade RPS. We observed a 3-year overall survival of ~50%. By comparison, larger series report 5-year overall survival rates on the order of 50–60% for resected RPS
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, though outcomes vary with tumor grade and histology. Our series' median OS of ~30 months is a bit lower than some literature benchmarks; this is likely due to the small sample size and the fact that several patients had very aggressive tumor biology (two patients died before 2 years). Population-based data indicate that RPS confers a worse survival than extremity STS of equivalent grade, partly because achieving wide margins is more difficult and local recurrences can be lethal
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. For instance, one registry study found a 3-year disease-specific mortality of ~43% in RPS vs 26% in non-retroperitoneal STS
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. Our finding that all patients who died had high-grade sarcomas (dedifferentiated or UPS) while those with low/intermediate grade tumors remain alive underscores the impact of tumor biology on outcomes. High grade histology and incomplete resection are well-known adverse prognostic factors in RPS.

The patterns of failure in our series also reflect typical RPS behavior. Local recurrence was a dominant problem: two patients had unresectable local recurrences (including the one with initial R2 resection). Even in the absence of distant metastasis, uncontrolled local disease can be fatal in RPS due to compression of vital structures in the abdomen
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. This highlights why local control is so crucial in RPS management. At the same time, distant metastases occurred in two patients (33%) – notably the leiomyosarcoma and one high-grade liposarcoma. This is consistent with the known predilection of leiomyosarcomas to metastasize (commonly to lungs or liver) and the ability of dedifferentiated liposarcoma to occasionally metastasize (20–30% risk)
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. The fact that our well-differentiated liposarcoma patient has had no recurrence is in line with the typically indolent nature of that subtype (though longer follow-up is needed, as well-differentiated tumors can recur locally many years

later). Our solitary fibrous tumor patient also remains disease-free at 30 months, which is encouraging; malignant SFTs can recur, but often on a longer timeline. All these observations reinforce the importance of long-term surveillance. RPS patients require prolonged follow-up because late recurrences (even a decade out) are not uncommon, especially for well-differentiated liposarcomas which can recur multiple times over a protracted period athenaeumpub.com

Our series did not utilize adjuvant radiation therapy in any patient, reflecting the current uncertainty about its benefit. The recently published STRASS randomized trial showed no significant improvement in recurrence-free survival with preoperative radiation overall pmc.ncbi.nlm.nih.gov. In the context of those results, our institution has reserved radiotherapy for either clinical trial settings or palliation. Patient 5, for example, might have been a candidate for adjuvant radiotherapy given the R2 resection, but because metastatic progression occurred so quickly, systemic therapy was prioritized instead. In retrospect, earlier postoperative radiation to the residual tumor might not have altered that outcome, as the disease was multifocal. Adjuvant chemotherapy was given to one patient (Patient 3 with leiomyosarcoma) in our series. While there is no established survival benefit for adjuvant chemotherapy in RPS, we chose to treat this high-risk LMS in light of its high metastatic potential and some extrapolation from uterine LMS data. Ongoing trials like STRASS-2 are investigating neoadjuvant chemotherapy in RPS pmc.ncbi.nlm.nih.gov, and results are eagerly awaited to clarify any role for systemic therapy in improving outcomes. The concept of histology-driven therapy is important: for example, an anthracycline-based regimen might be considered in a high-grade leiomyosarcoma (as we did), whereas for a dedifferentiated liposarcoma, there are emerging targeted therapies (like MDM2 inhibitors) being tested rather than traditional chemotherapy.

When comparing our findings to other published case series, one notable aspect is the consistency of poor outcomes associated with incomplete resection and high-grade histology. Our case with residual disease had survival of only 1 year, paralleling reports that patients with unresectable or residual RPS rarely survive beyond 1–2 years pmc.ncbi.nlm.nih.gov. Conversely, patients with low-grade tumors like well-differentiated liposarcoma often have prolonged survival despite multiple recurrences, as long as those recurrences remain resectable. In our series, the patient with a well-differentiated tumor remains alive and disease-free at 4 years; it will be important to continue surveillance, as late recurrence is likely. This underscores a key insight: "RPS" is not a uniform prognosis – outcome is highly dependent on tumor grade and subtype. This heterogeneity means that averaging outcomes across all RPS can be misleading for individual patients. A patient with a low-grade liposarcoma can expect a very different disease trajectory than one with a high-grade pleomorphic sarcoma.

Another insight from our series is the critical nature of multidisciplinary collaboration. Complex cases (such as tumor encasing major vessels or invading bone) required involvement of vascular or orthopedic surgeons. The ability to mobilize such expertise likely contributed to achieving R0 resections in cases 3 and 4. High-volume sarcoma centers typically have these resources and protocols in place, which is one reason outcomes are superior at specialized centers cco.amegroups.org. Our experience supports current recommendations that patients with RPS be referred to centers with multidisciplinary sarcoma teams for initial management.

Limitations: We acknowledge that our study is limited by the small number of patients and its retrospective nature. As a case series, no causal inferences can be drawn, and our outcomes should be interpreted with caution. The follow-up duration, while a median of 3 years, is still relatively short to capture late recurrences that are known to occur in RPS (particularly for low-grade tumors). Despite these limitations, detailed case series like ours add to the body of evidence and help illustrate practical management considerations and outcomes on an individual level, which large databases may not capture. Each case provides learning points — for instance, the importance of IVC reconstruction in LMS (case 3), or the aggressive biology of even a completely resected dedifferentiated liposarcoma (case 4's early metastasis).

Comparative Literature: Our findings are generally in agreement with larger series and reviews. The overall 5-year survival in contemporary reports ranges from approximately 50% to 70% for resected primary RPS pmc.ncbi.nlm.nih.gov, and our observed survival falls within this spectrum given the small sample. The high local recurrence rate (roughly 30–50% at 5 years in literature) is reflected in two of our six patients experiencing recurrence. We did not formally calculate a recurrence rate due to the size, but qualitatively it is similar. We also demonstrated the concept of histology-

specific patterns: our leiomyosarcoma case behaved with early hematogenous spread, whereas our liposarcomas were more prone to local recurrence, mirroring known patterns
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. One area where our series cannot provide insight is the potential role of radiotherapy or newer therapies, since none of our patients received radiation and only one received chemotherapy. However, our choice to forego routine radiation is supported by level I evidence (the STRASS trial) and reflects an overall trend in sarcoma management: to personalize adjuvant treatment decisions based on tumor characteristics and emerging trial data
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The case series also highlights the need for continual follow-up and possibly multiple operations. In RPS, a strategy of iterative resection for recurrence can prolong survival in select patients. In our series, no one underwent a re-resection for recurrence (because recurrences were either not resectable or accompanied by metastasis). But in other reports, aggressive re-operation for local recurrences has been shown to yield additional years of survival in well-differentiated or borderline resectable cases. This was not exemplified here but is an aspect of management to consider.
Future Directions: The management of RPS is evolving. There is interest in molecular profiling of these tumors to identify potential targets (for instance, MDM2 amplification in liposarcoma has led to trials of MDM2 inhibitors). Immunotherapy has not yet played a significant role in RPS, as sarcomas in general have shown limited responses to checkpoint inhibitors except in certain subtypes. However, novel immunotherapeutic approaches and combination therapies are under exploration. Collaboration through consortia such as the Transatlantic Australasian RPS Working Group (TARPSWG) has facilitated pooled analyses and multi-institutional studies, which are crucial given the rarity of RPS. Our series adds to the collective clinical experience suggesting that **complete resection by specialized teams remains the cornerstone** — a message that future research will build upon by trying to improve adjunct treatments. Ongoing trials (like STRASS-2 for chemotherapy, and others evaluating targeted therapy) may offer new avenues to improve outcomes beyond surgery alone.

CONCLUSION

Retroperitoneal sarcomas are challenging tumors that require an individualized and aggressive multidisciplinary approach. In this case series of six patients, we observed that complete macroscopic resection is achievable in most cases at a specialized center, often requiring en bloc removal of adjacent organs to obtain clear margins. Histologic subtype and tumor grade strongly influence outcomes: low-grade tumors can have prolonged survival, whereas high-grade sarcomas carry a high risk of early recurrence and death despite optimal surgery. Our experience underscores several key lessons: **(1)** Early referral to a sarcoma center is critical to maximize the chance of complete resection and proper management, **(2)** even with aggressive surgery, vigilant long-term follow-up is necessary given the high incidence of recurrence, and **(3)** treatment strategies should be tailored to tumor biology, with emerging evidence supporting subtype-specific approaches (such as considering systemic therapy for high-risk histologies)
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. We also highlight that incomplete resection (R2) is associated with poor outcomes, emphasizing that if a tumor is deemed unresectable, systemic therapies or clinical trials should be considered rather than compromising on surgical principles.
In conclusion, our case series aligns with the broader literature in finding that RPS outcomes remain guarded, with roughly half of patients succumbing to disease by 3–5 years despite modern management. Nonetheless, those patients who achieve durable local control can enjoy long-term survival, and thus every effort should be made to optimize initial treatment. Future improvements will likely come from advancements in adjunct therapies — ongoing clinical trials and research into the molecular underpinnings of RPS are expected to yield new options. Collaborative efforts and data sharing across sarcoma centers will be essential to refine management guidelines for these rare tumors. Ultimately, a combination of meticulous surgery, personalized adjunct therapy, and close surveillance constitutes the best current strategy for managing retroperitoneal sarcoma and improving patient outcomes

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