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Clinicopathological Characteristics and Outcomes of Pediatric Retroperitoneal Lesions: A Retrospective Study

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ABSTRACT

Background: Pediatric retroperitoneal lesions are rare and heterogeneous, often presenting with nonspecific symptoms that complicate early diagnosis. Understanding their clinical and pathological characteristics is essential for improving their management and outcomes. This study evaluated the clinical, pathological, and survival features of pediatric retroperitoneal lesions.

Methods: This retrospective cross-sectional study evaluated 14 patients younger than 18 years with histologically confirmed retroperitoneal lesions treated at Shahid Sadoughi Hospital, Yazd, Iran, from 2016 to 2021. The research data collected included demographics, clinical presentation, tumor origin, pathological diagnosis, metastasis, recurrence, and survival. The statistical analyses included descriptive statistics, Chi-square tests, and Kaplan-Meier survival analysis.

Results: The patients' mean age was 13.9 ± 3.38 years, with an equal sex distribution. Secondary tumors were the most common lesions (64.3%), followed by primary malignant tumors (21.4%) and primary benign tumors (14.3%). The retroperitoneum was the most frequent site of origin (50%). Common presentations included nausea and vomiting (64.3%), abdominal pain (50%), and urinary symptoms (50%). Recurrence was observed in 21.4% of the patients. Five-year survival rates were 100% for primary benign tumors, 73.9% for primary malignant tumors, and 67.5% for secondary tumors. Recurrence was significantly associated with poorer survival (P = 0.027).

Conclusion: In this small cohort, pediatric retroperitoneal lesions were predominantly secondary tumors, while lymphoma was the most common primary malignancy. Their nonspecific presentation highlights the importance of imaging and pathological evaluation. Tumor recurrence was associated with reduced survival, suggesting prognostic significance and emphasizing the need for long-term follow-up. These findings are preliminary and require validation in larger studies.

Introduction

Anatomical and clinical background

The retroperitoneal space is a complex anatomical compartment containing major organs, vascular structures, lymphatic channels, nerves, and embryologic remnants [1]. The lesions arising in this region constitute a heterogeneous spectrum of disorders with diverse etiologies, ranging from benign developmental abnormalities to highly aggressive malignant tumors[2]. Because of the deep anatomical location of the retroperitoneum and the absence of early, specific clinical manifestations, these lesions frequently remain asymptomatic and may reach considerable size before detection, especially in pediatric populations[1, 3].

Pediatric-specific considerations

Although retroperitoneal tumors are more frequently encountered in adults, a distinct subset occurs in children. The tumors in this subset are characterized by differences in epidemiology, pathology, and biological behavior[4]. In pediatric patients, retroperitoneal lesions commonly originate from neurogenic embryonal germ cells or lymphatic tissues. Representative examples include neuroblastoma, rhabdomyosarcoma, lymphangioma, and extragonadal germ cell tumors[5]. Compared to adults, primary epithelial malignancies and metastatic diseases are relatively rare in children, highlighting the importance of age-specific diagnostic considerations[4].

Clinical presentation

The clinical manifestations of pediatric retroperitoneal lesions are often nonspecific, depending largely on lesion size, anatomical location, and involvement of adjacent organs[6]. The common features of these lesions include abdominal distension, a palpable mass, abdominal pain, and gastrointestinal or urinary symptoms caused by mass effect[7]. Systemic symptoms such as fever or weight loss are less frequent and are typically associated with malignant or inflammatory conditions. Given the often limited findings on physical examination, imaging plays a pivotal role in the diagnostic evaluation[8].

Objective of the study

The study was conducted to describe the pathological characteristics and clinical features of pediatric retroperitoneal lesions, with a particular emphasis on the lesions confined to the retroperitoneal space. By providing preliminary data, this study sought to contribute to the improvement of diagnostic accuracy and patient management and to inform future larger-scale investigations.

Materials and Methods

Study design

This research was designed as a retrospective analytical cross-sectional study.

Research population

The research population consisted of pediatric patients (under 18 years of age) diagnosed with retroperitoneal masses whose specimens were referred to the Department of Pathology at Shahid Sadoughi Hospital, Yazd, Iran, from 2016 to 2021. The pediatric cases included in the study were all those with available medical records and a definitive histopathological diagnosis during the study period. Patients with incomplete medical records or inconclusive pathological diagnoses were excluded from the study.

Sampling method

A census sampling method was employed to select and enroll the eligible pediatric cases of retroperitoneal masses referred during the specified timeframe.

Data collection

After obtaining approval from the Department of Pathology and the Ethics Committee of Shahid Sadoughi University of Medical Sciences, patient data were retrospectively extracted from the hospital medical records and the Hospital Information System (HIS). The collected variables included age, sex, clinical presentation, presence or absence of metastasis, tumor origin, recurrence status, and final histopathological diagnosis. The data

were recorded using a researcher-designed data collection form.

Tumor classification

The primary benign tumors included leiomyoma and lipoma. Primary malignant tumors consisted exclusively of lymphoma. The secondary lesions included metastatic germ cell tumors, metastatic adenocarcinoma, and lymph node metastases.

Statistical analysis

The statistical analyses were performed using the SPSS software (v version 23, IBM Corporation, Armonk, NY). Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were summarized as frequencies and percentages. Comparisons of categorical variables were conducted using the Chi-square test. A survival analysis was also performed using the Kaplan–Meier method. A $P < 0.05$ was considered statistically significant.

Results

Patient characteristics

The study included 14 pediatric patients diagnosed with retroperitoneal lesions. Their mean age at diagnosis was 13.9 ± 3.38 years. The research population consisted of seven males (50%) and seven females (50%), showing an equal sex distribution (Table 1).

Table 1. Demographic and Clinical Characteristics of Pediatric Patients with Retroperitoneal Masses

Variable	Number (%) or Mean ± SD	P
Age (years)	13.9 ± 3.38	
Sex		
Male	7 (50%)	0.99
Female	7 (50%)	
Tumor type		
Primary benign	2 (14.3%) = 1 lipoma and 1 leiomyoma	
Primary malignant	3 (21.4%) = 3 lymphomas	0.02
Secondary (Metastatic)	9 (64.3%) = 4 metastatic germ cell tumors, 3 metastatic adenocarcinomas, and 2 metastatic lymph nodes	
Tumor origin		
Retroperitoneum	7 (50%)	
Testis	3 (21.4%)	0.11
Ovary/Uterus	2 (14.3%)	
Cervix	1 (7.1%)	
Small bowel	1 (7.1%)	
Clinical symptoms		
Nausea/Vomiting	9 (64.3%)	
Abdominal pain	7 (50%)	0.89
Urinary symptoms	7 (50%)	
Abdominal distension	3 (21.4%)	
Diarrhea	3 (21.4%)	
Pathological features		
Tumor necrosis	2 (14.3%)	0.03
Perineural invasion	0 (0%)	
Recurrence	3 (21.4%)	
Outcomes		
Death	5 (35.7%)	0.42
Survival (mean ± SD, years)	3.61 ± 0.49	
5-year survival		
Primary benign	100%	
Primary malignant	73.9%	
Secondary(Metastatic)	67.5%	
Prognostic factor	Recurrence was significantly associated with lower survival (P = 0.027)	

Tumor classification

Secondary tumors were the most common type of retroperitoneal lesions, accounting for nine cases (64.3%). Primary malignant tumors were identified in three patients (21.4%), while primary benign tumors were observed in two patients (14.3%). The primary benign lesions included leiomyomas and lipomas. All primary malignant tumors were classified as lymphomas. No cases of sarcoma or carcinoma were identified in this pediatric cohort. The secondary tumors consisted of metastatic germ cell tumors in four cases (28.6%), metastatic adenocarcinoma in three cases (21.4%), and lymph node metastases in two cases (14.3%) (Table 1).

Tumor origin

The most frequent primary origin of retroperitoneal lesions was the retroperitoneum, as observed in seven patients (50%). The other tumor origins included the testis in three cases (21.4%), the ovary and uterus in two cases (14.3%), the cervix in one case (7.1%), and the small intestine in one case (7.1%) (Table 1).

Clinical presentation

The clinical manifestations were variable and nonspecific. The most common symptoms were nausea and vomiting (64.3%), abdominal pain (50%), and urinary symptoms (50%). Abdominal distension and diarrhea were each reported in three patients (21.4%) (Table 1).

Pathological features and outcomes

Metastatic involvement was detected in nine patients (64.3%). Lymph node metastasis occurred in two patients (14.3%). Tumor necrosis was reported in two patients (14.3%), and tumor recurrence developed in three patients (21.4%). There was no evidence of perineural invasion. During the follow-up period, five patients (35.7%) died (Table 1).

Survival analysis

The Kaplan–Meier survival analysis demonstrated a mean survival time of 3.61 ± 0.49 years for the pediatric cohort. Five-year survival rates were 100% for patients with primary benign tumors, 73.9% for those with primary malignant tumors, and 67.5% for secondary tumors. Tumor recurrence was associated with reduced survival outcomes (log-rank test, $P = 0.027$); however, given the small sample size, this finding should be interpreted as exploratory and primarily hypothesis-generating (Table 1).

Discussion

Pediatric retroperitoneal lesions are uncommon, but they encompass a wide spectrum of pathological entities. Because of their deep anatomical location and close relationship with major vessels and vital organs, these lesions are often diagnosed late and present considerable difficulties in management.

Lack et al.[9] reported that pediatric retroperitoneal tumors arise predominantly from mesenchymal, lymphatic, and embryonal tissues, emphasizing that lymphomas and germ cell tumors represent a substantial proportion of malignant retroperitoneal masses in children. This observation is consistent with the findings of the present study, in which lymphoma emerged as the most common primary malignant tumor among the pediatric patients, while secondary tumors accounted for the majority of lesions.

In a clinicopathological review by Chaudhary et al.[10] lymphoid malignancies were identified as a frequent cause of retroperitoneal involvement in pediatric patients, often appearing as bulky masses with extensive lymph node involvement. Similarly, in our cohort, lymph node metastasis and disseminated disease were observed in a significant number of patients, highlighting the aggressive behavior of malignant retroperitoneal lesions in children.

Short et al.[11] analyzed pediatric retroperitoneal germ cell tumors and noted that these lesions frequently present with nonspecific abdominal symptoms such as pain, nausea, vomiting, and urinary complaints due to mass effect. In agreement with these findings, gastrointestinal and

urinary symptoms were the most common clinical manifestations in our study, reinforcing the limited specificity of clinical presentation and the importance of imaging for early detection.

Regarding prognosis, Chouliaras et al.[12] reported that recurrence is a major determinant of survival in retroperitoneal tumors, regardless of histological subtype. In this small cohort, tumor recurrence was associated with reduced survival, suggesting that recurrence may be an important prognostic factor. However, given the limited sample size, this finding should be considered exploratory; it requires validation in larger studies. This finding suggests that careful postoperative and post-treatment surveillance may be valuable for children with retroperitoneal lesions, although further validation in larger cohorts is needed.

Iwanaka et al. demonstrated that patients with benign retroperitoneal tumors generally have excellent long-term survival, whereas malignant and metastatic lesions are associated with poorer outcomes[13]. Our survival analysis showed a similar pattern, with primary benign tumors demonstrating favorable survival, while lower survival rates were observed among the patients with primary malignant and secondary tumors.

Despite advances in diagnostic techniques and therapeutic approaches, pediatric retroperitoneal tumors continue to be associated with substantial morbidity and mortality[14]. Sudour-Bonnange et al.[14] emphasized that, even after complete surgical resection, local recurrence is not uncommon and has a significant negative impact on overall survival. Consistent with this report, recurrence in our small cohort was associated with a marked reduction in survival, which may reflect the aggressive nature of the recurrent disease, though this interpretation is limited by the small sample size.

This study has several limitations. The retrospective design and the small sample size limit the generalizability of the findings. Additionally, treatment-related variables such as chemotherapy protocols, surgical margins, and radiotherapy details were not consistently available. Nevertheless, the present study provides valuable insight into the pathological spectrum, clinical behavior, and prognostic factors associated with pediatric retroperitoneal lesions.

Conclusion

Pediatric retroperitoneal lesions constitute a rare and diverse group of diseases with variable clinical behavior and outcomes. In this study, secondary tumors were found to be the most common lesions, while lymphoma was the predominant primary malignant tumor. The clinical presentations were largely nonspecific, with gastrointestinal and urinary symptoms reported as the most frequent. In this cohort, survival outcomes appeared to be influenced by tumor recurrence, suggesting the potential importance of early diagnosis, appropriate treatment planning, and meticulous long-term follow-up. These findings are preliminary; thus, they should be confirmed in larger studies. Imaging combined with histopathological correlation plays a central role in establishing an accurate diagnosis and guiding management strategies. Greater awareness of the pathological spectrum and potential prognostic factors associated with pediatric retroperitoneal lesions may improve diagnostic accuracy and contribute to better clinical outcomes, although further multicenter studies are needed to confirm these findings. Further multicenter, prospective studies with larger pediatric cohorts are recommended to better define the prognostic indicators and optimize treatment approaches for this rare but clinically significant group of lesions.

Conflict of Interest

The authors declare that they have no conflicts of interest regarding this research.

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Ethical Considerations

This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran (IR.SSU.MEDICINE.REC. 1401.134). All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee. The confidentiality of patient information was strictly maintained, and all data were analyzed anonymously. No additional costs were imposed on the patients. In addition, verbal informed consent was obtained from all patients during the follow-up telephone interviews.

Author's Contribution

Study design, pathology review, and manuscript editing: M. V., M. R. R, and S. E.; Data analysis and overall supervision: M. V. All authors read and approved the final manuscript.

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