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COMPARATIVE SURVIVAL OUTCOMES BETWEEN ATYPICAL LIVER RESECTION AND HEMIHEPATECTOMY IN CHILDREN WITH HEPATOBLASTOMA

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Abstract

Background

Hepatoblastoma is the most common primary malignant liver tumor in children. Complete surgical resection combined with platinum-based chemotherapy remains the cornerstone of curative treatment. However, the optimal extent of liver resection remains controversial, particularly regarding oncological outcomes and postoperative morbidity.

Objective

To compare survival outcomes, recurrence rates, and postoperative complications between atypical liver resection and hemihepatectomy in pediatric patients with hepatoblastoma.

Materials and Methods

A retrospective comparative study was conducted involving pediatric patients diagnosed with hepatoblastoma who underwent surgical treatment between 2015 and 2025. Patients were divided into two groups according to surgical approach: atypical liver resection (Group I) and hemihepatectomy (Group II). Overall survival (OS), disease-free survival (DFS), postoperative complications, and recurrence rates were analyzed. Survival analysis was performed using the Kaplan–Meier method, and comparisons were assessed with the log-rank test.

Results

A total of 62 pediatric patients were included in the study. Group I consisted of 28 patients who underwent atypical liver resection, while Group II included 34 patients treated with hemihepatectomy. The 5-year OS was 82.1% in Group I and 88.2% in Group II ($p > 0.05$). Disease-free survival reached 71.4% and 79.4%, respectively. Local recurrence was observed more frequently following atypical resection (17.8%) compared with hemihepatectomy (8.8%). Major postoperative complications occurred more commonly after hemihepatectomy, including transient liver insufficiency and biliary leakage.

Conclusion

Both atypical liver resection and hemihepatectomy provide satisfactory long-term survival in children with hepatoblastoma when complete tumor removal is achieved. Atypical resection offers the advantage of preserving functional liver parenchyma, whereas hemihepatectomy demonstrates superior local disease control in advanced tumors. Surgical strategy should be individualized according to PRETEXT stage, vascular involvement, and future liver remnant volume.

Keywords: hepatoblastoma; pediatric liver tumors; atypical liver resection; hemihepatectomy; survival; pediatric oncology; liver surgery.

Introduction

Hepatoblastoma accounts for approximately 80% of malignant liver tumors in children and predominantly affects patients younger than five years of age. The incidence has increased over recent decades, partly due to improved survival of premature infants and advances in neonatal care. Despite its rarity, hepatoblastoma remains a major challenge in pediatric oncology because of its aggressive biological behavior and complex surgical management.

Current multimodal treatment protocols incorporating neoadjuvant chemotherapy and radical surgery have significantly improved outcomes, with reported overall survival rates approaching 80–90% in developed centers. Nevertheless, complete surgical excision remains the most important prognostic factor for long-term survival.

The extent of hepatic resection in pediatric hepatoblastoma is determined by tumor localization, PRETEXT classification, vascular invasion, multifocality, and response to chemotherapy. Hemihepatectomy is traditionally considered the standard procedure for large or centrally located tumors, whereas atypical liver resection may preserve greater functional liver volume in selected patients with peripheral lesions.

However, concerns remain regarding oncological radicality after limited resections and the potential risk of local recurrence. Conversely, major hepatic resections may increase postoperative morbidity and the risk of liver failure.

The present study aimed to compare survival outcomes and perioperative results between atypical liver resection and hemihepatectomy in children with hepatoblastoma.

Materials and Methods

This retrospective cohort study included pediatric patients with histologically confirmed hepatoblastoma treated surgically at specialized pediatric oncology centers between January 2015 and January 2025.

Inclusion Criteria: age below 18 years; histologically verified hepatoblastoma; surgical treatment with curative intent; complete clinical and follow-up data available.

Exclusion Criteria: unresectable metastatic disease; liver transplantation; recurrent hepatoblastoma at presentation; incomplete medical records.

Patient Groups: Patients were divided into two groups:

Group I: Children who underwent atypical (non-anatomical) liver resection.

Group II: Children treated with anatomical hemihepatectomy (right or left).

Preoperative Assessment. All patients underwent: abdominal ultrasonography; contrast-enhanced computed tomography or MRI; serum alpha-fetoprotein (AFP) measurement; PRETEXT staging; assessment of chemotherapy response according to SIOPEL protocols.

Surgical Technique

Atypical liver resections were performed for peripheral lesions with adequate resection margins and absence of major vascular invasion. Hemihepatectomy was indicated in patients with extensive segmental involvement or tumors adjacent to major vascular structures.

Intraoperative ultrasonography was used routinely to determine tumor boundaries and vascular anatomy.

Outcome Measures

Primary endpoints: overall survival (OS); disease-free survival (DFS).

Secondary endpoints: postoperative complications; local recurrence rate; duration of hospitalization; perioperative mortality.

Statistical Analysis

Statistical analysis was performed using SPSS version 27.0. Continuous variables were expressed as mean ± standard deviation. Survival curves were generated using the Kaplan–Meier method and compared by the log-rank test. A p-value < 0.05 was considered statistically significant.

Results

Patient Characteristics

A total of 62 children met the inclusion criteria. The mean age at diagnosis was 3.2 ± 1.4 years. Male predominance was observed (58.1%).

PRETEXT distribution demonstrated: PRETEXT I–II predominantly in Group I; PRETEXT III–IV predominantly in Group II.

Elevated AFP levels were observed in 93.5% of patients.

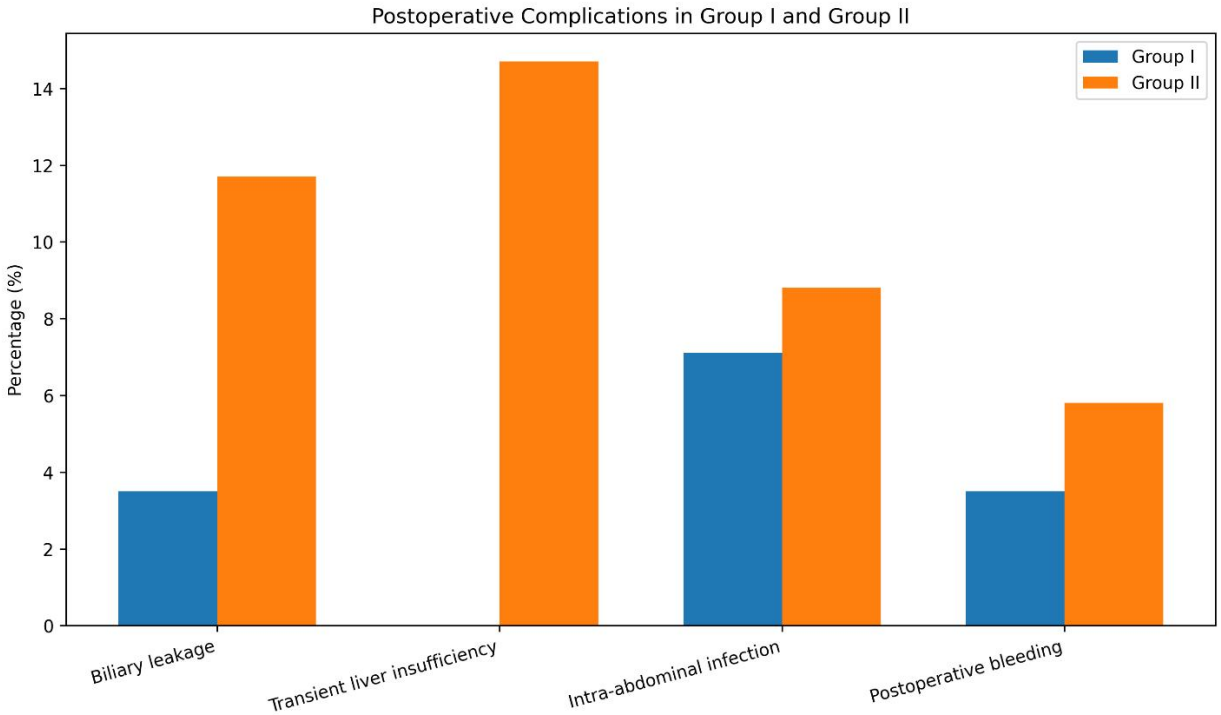
Survival Outcomes. The median follow-up period was 58 months. The 5-year OS rate was: 82.1% in Group I; 88.2% in Group II. No statistically significant difference was identified between groups (p = 0.34). Disease-Free Survival. The 5-year DFS rate was: 71.4% after atypical resection; 79.4% after hemihepatectomy. Although DFS tended to be higher after hemihepatectomy, the difference did not reach statistical significance.

Recurrence

Tumor recurrence occurred in: 5 patients (17.8%) after atypical resection; 3 patients (8.8%) after hemihepatectomy. Local recurrence represented the predominant pattern in Group I, whereas distant pulmonary metastases were more common in Group II.

Postoperative Complications

Major postoperative complications were significantly more frequent following hemihepatectomy. Observed complications included:



Mean hospital stay was significantly shorter in Group I (9.4 ± 2.1 days) compared with Group II (15.7 ± 4.3 days). No perioperative mortality was observed.

Discussion

The management of hepatoblastoma has evolved substantially over the last two decades due to advances in chemotherapy, imaging, perioperative care, and pediatric hepatobiliary surgery.

Our findings demonstrate that both atypical liver resection and hemihepatectomy provide favorable long-term survival when complete tumor excision (R0 resection) is achieved. These results are consistent with previously published international studies reporting overall survival rates exceeding 80%.

Atypical liver resection offers several advantages, particularly preservation of functional liver parenchyma and reduced perioperative morbidity. This strategy may be especially beneficial in younger children with limited hepatic reserve.

Nevertheless, local recurrence was more frequent following atypical resections, likely reflecting narrower surgical margins and the technical difficulty of achieving radical excision in non-anatomical procedures.

Hemihepatectomy demonstrated superior local tumor control but was associated with increased postoperative morbidity. Larger resections inevitably increase the risk of biliary complications and transient postoperative liver dysfunction.

The choice of surgical strategy should therefore be individualized. Limited resection appears appropriate for small peripheral tumors without vascular involvement, whereas hemihepatectomy remains preferable for centrally located or multifocal disease.

Importantly, outcomes in hepatoblastoma strongly depend on multidisciplinary management within specialized pediatric oncology centers.

Limitations

The present study has several limitations, including its retrospective design, relatively small sample size, and potential selection bias related to tumor stage distribution between groups. Larger multicenter prospective studies are required to validate these findings.

Conclusion

Both atypical liver resection and hemihepatectomy are effective surgical approaches for pediatric hepatoblastoma.

Atypical liver resection provides adequate survival with reduced postoperative morbidity and better preservation of liver parenchyma in selected patients. Hemihepatectomy offers improved local disease control for advanced tumors but carries a higher risk of postoperative complications.

Complete tumor removal remains the principal determinant of survival regardless of surgical technique.

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