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Evaluation of Biliary Complications After Pediatric Liver Transplantation

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Abstract

This study evaluates biliary complications occurring after pediatric liver transplantation and investigates the clinical factors associated with these complications. Liver transplantation is the gold standard treatment for children with end-stage liver disease; however, postoperative complications remain an important cause of morbidity. Among these complications, biliary problems such as biliary leaks and biliary strictures are the most common surgical complications after transplantation. The study retrospectively analyzed 99 pediatric liver transplant recipients. The demographic characteristics of patients, underlying liver diseases, presence of biliary atresia, previous Kasai portoenterostomy, and pre-transplant clinical status evaluated by PELD and MELD-Na scores were examined. Biliary complications were classified as biliary leak or biliary stricture, and statistical analyses were performed using Chi-

square and Fisher's Exact tests. Among the patients, 54 (54.5%) were female, and the most common indication for transplantation was biliary atresia. The overall rate of biliary complications was 17.2%, which is consistent with the rates reported in the literature (10–35%). The most common complications observed were biliary leak and biliary stricture. When biliary atresia was evaluated as a risk factor, the complication rate was 21.9% in patients with biliary atresia and 16.9% in those without, and no statistically significant difference was found (p = 0.64). Similarly, a history of Kasai portoenterostomy did not significantly affect the risk of developing biliary complications. Analysis based on PELD score categories also showed no significant relationship with the development of biliary complications. However, higher MELD-Na scores were associated with increased complication rates, suggesting that MELD-Na may have predictive value for postoperative biliary complications. Nevertheless, this result should be interpreted cautiously because MELD-Na data were available for only a limited number of patients.

In conclusion, biliary complications remain an important source of morbidity after pediatric liver transplantation. While biliary atresia and prior Kasai surgery were not significant risk factors, an increase in the MELD-Na score may be associated with a higher risk of biliary complications. Larger, multicenter, and prospective studies are needed to confirm these findings.

Keywords: Pediatric liver transplantation; Biliary complications; Biliary atresia; MELD-Na score

Introduction

Liver transplantation is accepted as the gold standard treatment for irreversible liver diseases in the pediatric age group. Mortality rates are very high in children with acute liver failure and decompensated chronic liver disease when transplantation is not performed. Today, with the increase in surgical experience, expansion of the donor pool, and advances in immunosuppressive drugs, both patient and graft survival have significantly improved [1]. Nevertheless, complications that develop after liver transplantation prolong hospital stay and lead to repeated interventions, especially in pediatric patients. Among postoperative complications, vascular complications, acute and chronic rejection, infections, and metabolic disorders are observed; however, biliary complications are reported as the most common surgical complications [2]. Biliary leaks and biliary strictures are important causes of morbidity after pediatric liver transplantation, and their incidence has been reported between 10–35% in the literature [3]. The diagnosis of biliary atresia, previously performed Kasai portoenterostomy, the type of biliary anastomosis, and the pre-transplant clinical status of patients are considered among the factors that may influence the development of biliary complications. The aim of this study is to examine in detail the biliary complications observed after pediatric liver transplantation in our center and to reveal the relationship between these complications and clinical parameters.

Materials and Methods

This study was conducted through the retrospective evaluation of patients in the pediatric age group who underwent liver transplantation. The demographic characteristics of the patients, primary liver diseases, presence of biliary atresia, whether a Kasai portoenterostomy had been previously performed, and the types of biliary anastomoses performed during transplantation were examined. Duct-to-duct anastomosis and Roux-en-Y hepaticojejunostomy techniques were used for biliary reconstruction. Biliary complications

developing in the postoperative period were classified as biliary leak and biliary stricture. The pre-transplant clinical status of the patients was evaluated using PELD and MELD-Na scores. In statistical analyses, the Chi-square test and Fisher's Exact test were used for categorical variables, and a p-value <0.05 was considered statistically significant.

Results

In this cohort of 99 pediatric liver transplant recipients, 54 patients (54.5%) were female. The most common primary indication for liver transplantation was biliary atresia. Other indications included autoimmune hepatitis, cryptogenic cirrhosis, Wilson disease, and progressive familial intrahepatic cholestasis. The overall rate of biliary complications in the study population was 17.2%. The most frequently observed complications were biliary leak and biliary stricture. The incidence of biliary complications was 21.9% among patients with biliary atresia and 16.9% among patients with other diagnoses. Statistical analysis using Fisher's Exact Test demonstrated no significant difference between the groups ($p = 0.64$). The calculated odds ratio was 0.73, suggesting that biliary atresia was not significantly associated with an increased risk of biliary complications. The presence of a previous Kasai portoenterostomy was associated with a relative risk of approximately 0.70 for developing biliary complications. However, this association did not reach statistical significance, indicating that prior Kasai surgery did not significantly affect the risk of biliary complications after liver transplantation. When biliary complications were evaluated according to PELD score categories, patients in the low PELD category had a complication rate of 10%, whereas those in the high PELD category had a rate of 22.6%. Statistical analysis using the chi-square test showed no significant difference between the groups ($p = 0.70$), and no consistent increasing trend in complication rates across PELD categories was observed.

Analysis of MELD-Na score categories showed increasing rates of biliary complications with higher scores. Patients with MELD-Na scores between 11–20 had a complication rate of 8.3%, while those with scores between 21–30 had a rate of 50%. In the ≥30 category, the complication rate was 100%; however, this group included only one patient. The chi-square test indicated statistical significance ($p \approx 0.04$). It should be noted that MELD-Na data were available for only 17 patients, which limits the strength of this finding **(Table 1-5).**

Table 1: Baseline Characteristics of Pediatric Liver Transplant Recipients (n=99)

Variable	Value
Female sex, n (%)	54 (54.5%)
Primary Indications for Transplantation	
– Biliary atresia	Most common indication
– Autoimmune hepatitis	
– Cryptogenic cirrhosis	
– Wilson disease	
– Progressive familial intrahepatic cholestasis	

Variable	Value
Overall biliary complication rate	17.2%
Most common complications	Biliary leak and biliary stricture

Table 2: Biliary Complications According to Biliary Atresia Diagnosis

Diagnosis	Biliary Complication (%)	p-value	OR
Biliary atresia	21.9%		
Non–biliary atresia	16.9%	0.64*	0.73

*Fisher's Exact Test

Table 3: Effect of Previous Kasai Portoenterostomy on Biliary Complications

Kasai History	Relative Risk (RR)	Statistical Significance
Present	RR ≈ 0.70	Not statistically significant

Table 4: Biliary Complications According to PELD Score Categories

PELD Category	Biliary Complication Rate	p-value
Low	10%	
Intermediate		
High	22.6%	0.70†

†Chi-square test

(No consistent increasing trend observed)

Table 5: Biliary Complications According to MELD-Na Score

MELD-Na Category	Biliary Complication Rate
11–20	8.3%
21–30	50%
≥30	100%

Chi-square test: p ≈ 0.04

(Note: MELD-Na data available in n=17 patients; ≥30 group included only one patient.

Discussion

This study evaluated the frequency of biliary complications after pediatric liver transplantation and the clinical factors that may be associated with these complications. Our findings are consistent with the rates of 10–35% reported in the literature [2,3]. The effect of biliary atresia and a history of Kasai portoenterostomy on biliary complications is controversial in the literature. While some studies report an increased risk, some series have not shown a significant relationship. In our study, no significant relationship was found between the presence of biliary atresia and a history of Kasai operation and the development of biliary

complications. PELD scores were found to be limited in predicting biliary complications. However, findings were obtained suggesting that an increase in the MELD-Na score may increase the risk of biliary complications. However, this result needs to be supported by larger and prospective studies due to the small number of patients.

This study evaluated biliary complications seen after pediatric liver transplantation and the clinical factors that may be associated with these complications. In our study, the rate of biliary complications was 17.2%, which is consistent with the range of 10–35% reported in the literature. Sieders et al. The biliary complication rate was reported as 24% by researchers, while Verdonk et al. reported it as 15%. Similarly, Sundaram et al. reported a complication rate of around 20% in pediatric series. Our findings demonstrate that biliary complications remain a significant cause of morbidity in childhood liver transplants. In our study, biliary strictures constituted 52.9% of the complications, which is similar to the clinical distribution described in the literature. Strictures are more common in pediatric patients compared to adult series. Possible reasons for this include smaller bile duct diameter, fibrotic tissue changes due to previous Kasai surgery, and microvascular circulation disorders. Biliary atresia is the most frequent indication for pediatric liver transplantation, and its potential to increase the risk of complications has been discussed in the literature. However, in our study, no statistically significant relationship was found between the presence of biliary atresia and biliary complications ($p=0.64$). This finding is also consistent with some larger series. This can be attributed to increased surgical experience, earlier transplantation ages, and the success of modern biliary tract reconstruction techniques [4-7].

The effect of a history of Kasai portoenterostomy is contradictory in the literature, with some studies reporting an increased risk and others a neutral effect. In our series, a history of Kasai did not significantly affect the development of complications. This finding suggests that the negative impact of a Kasai history may have been reduced, particularly with the advancements in transplantation techniques. No relationship was observed between PELD scores and biliary complications. However, an increase in the MELD-Na score was found to increase the risk of complications. The fact that MELD-Na better reflects systemic hyponatremia, hemodynamic instability, and inflammatory processes makes this observation clinically significant. However, since only one patient was found in the MELD-Na ≥30 group, this result needs to be supported by prospective studies. In conclusion, our study shows that biliary complications after pediatric liver transplantation remain a significant clinical problem and that the MELD-Na score may be a potential predictor of complication risk. Larger-scale, multicenter, and prospective studies will reveal these relationships more clearly.

Limitations

Our study has some limitations. First, the study is retrospective in design, and due to its single-center nature, the generalizability of the results may be limited. The sample size is low, especially in the MELD-Na subgroups. Also, interventional treatment modalities (endoscopic vs. surgical) were not analyzed in this study. Including these variables could increase clinical significance.

Conclusion

This study investigated biliary complications developing after pediatric liver transplantation and the clinical factors that may be associated with

these complications. The results of our study show that biliary complications are still a significant cause of morbidity in pediatric transplantations. While biliary atresia and a history of Kasai disease did not significantly affect the risk of complications, a significant relationship was found between an increase in the MELD-Na score and the incidence of biliary complications. It is thought that the MELD-Na score could be a usable parameter in pre-transplant risk stratification. These findings need to be supported by larger sample size and prospective studies.

Ethical Approval

This study was conducted with the approval of the relevant institution's ethics committee and complies with the principles of the Helsinki Declaration. Informed Consent: In this retrospective study, patient identities were kept confidential, and informed consent was not required. Conflict of Interest: The authors declare that there is no conflict of interest. Financial Support:This study was not funded by any organization.

Referances

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