Relationship Between Bile Duct Reconstruction and Complications in Living Donor Liver Transplantation

S. Miyagi*, N. Kawagishi, T. Kashiwadate, A. Fujio, K. Tokodai, Y. Hara, C. Nakanishi, T. Kamei, N. Ohuchi, and S. Satomi

Division of Transplantation, Upper Digestive and Vascular Surgery, Tohoku University, Sendai, Japan

ABSTRACT

Objectives. In living donor liver transplantation (LDLT), the recipient bile duct is thin and short. Bile duct complications often occur in LDLT, with persistent long-term adverse effects. Recently, we began to perform microsurgical reconstruction of the bile duct. The purpose of this study was to investigate the relationship between bile duct reconstruction methods and complications in LDLT.

Methods. From 1991 to 2014, we performed 161 LDLTs (pediatric:adult = 90:71; left lobe:right lobe = 95:66). In this study, we retrospectively investigated the initial bile duct complications in LDLT and performed univariate and multivariate analyses to identify the independent risk factors for complications.

Results. The most frequent complication was biliary stricture (9.9%), followed by biliary leakage (6.8%). On univariate and multiple logistic regression analysis, the independent risk factors for biliary stricture were bile leakage ($P = .0103$) and recurrent cholangitis ($P = .0077$). However, there were no risk factors for biliary leakage on univariate analysis in our study. The reconstruction methods (hepaticojejunostomy or duct-to-duct anastomosis) and reconstruction technique (with or without microsurgery) were not risk factors for biliary stricture and leakage.

Conclusion. In this study, the most frequent complication of LDLT was biliary stricture. The independent risk factors for biliary stricture were biliary leakage and recurrent cholangitis. Duct-to-duct anastomosis and microsurgical reconstruction of the bile duct were not risk factors for biliary stricture and leakage.

A SHORTAGE of organ donors has become a major global problem. Successful liver transplantation from living donors has increased the supply, and living donor liver transplantation (LDLT) has become a standard therapy. However, there are recent reports of many risks associated with LDLT, compared with deceased donor liver transplantation (DDLT), especially with regard to arterial and biliary complications [1,2]. LDLT is technically difficult due to a small bile duct, short hepatic artery, and severe intimal damage. Furthermore, patients with biliary complications experience long-term adverse effects.

Freise et al reported that at least 1 complication occurred after 82.8% of LDLTs and 78.2% of DDLTs ($P = .17$) in the Adult-to-Adult Living Donor Liver Transplantation Cohort Study (A2ALL), which was the largest study of complications in LDLT and DDLT. There was a median of 2 complications after DDLT, and 3 after LDLT [3]. Complications that occurred at a higher rate ($P < .05$) after LDLT included biliary leakage (LDLT = 31.8% vs DDLT = 10.2%), unplanned re-exploration (26.2% vs 17.1%), hepatic artery thrombosis (HAT; 6.5% vs 2.3%), and portal vein thrombosis (2.9% vs 0.0%) [3].

This study was supported by grants-in-aid for scientific research from the Ministry of Education, Science, and Culture of Japan and the Ministry of Welfare of Japan and a grant from the Tohoku University Graduate School of Medicine.

*Address correspondence to Shigehito Miyagi, MD, Division of Transplantation, Upper Digestive and Vascular Surgery, Tohoku University, 1-1 Seiryo-machi, Aoba-ku, Sendai 980-8574, Japan. E-mail: msmsmiyagi@yahoo.co.jp

0041-1345/16
http://dx.doi.org/10.1016/j.transproceed.2015.10.073

There are many reports that the complication rate of LDLT is higher than that of DDLT, especially with regard to biliary leakage and stricture [3–8]. Therefore, the complications and specific disadvantages of LDLT should be investigated, both to elucidate the risk factors and to assure the safety of LDLT. Recently we began to perform microsurgical reconstruction of the bile duct to reduce biliary complications [9].

The aim of this study was to re-evaluate the risk factors for biliary leakage and strictures in LDLT, and to reduce biliary complications following LDLT.

MATERIALS AND METHODS

Informed consent was obtained from the donors and recipients. All procedures were reviewed and approved by the Ethics Committee of Tohoku University School of Medicine, and were performed in accordance with the ethical standards of the Declaration of Helsinki.

From 1991 to 2014, we performed 161 LDLTs (pediatric:adult = 90:71; left lobe:right lobe = 95:66). In this study, we retrospectively investigated the initial bile duct complications in LDLT and performed univariate and multivariate analyses to identify the independent risk factors for complications. The biliary complications were diagnosed using ultrasonography, laboratory examination results, and computed tomography (CT). We investigated the intrahepatic bile duct and arterial flow using daily ultrasonography examinations following LDLT. We also investigated the characteristics of the drainage tube; laboratory examinations included aspartate transaminase, alanine transaminase, and total bilirubin levels. Biliary leakage was defined when bile was recognized in the drainage tube and continued for more than 14 days.

Statistics

All calculations were made with the JMP Pro software package (SAS Institute, Cary, NC, United States). The results were expressed as mean values ± standard deviations. Univariate analysis was performed using Fisher exact test for categorical variables and the Mann-Whitney U test for continuous variables. The factors identified by univariate analysis to be associated with a $P < .20$ were then subjected to a multivariate regression analysis to identify the independent risk factors for recurrences. $P < .05$ was considered statistically significant.

RESULTS

The incidence of biliary complications was 13.7% in LDLT, which was slightly better than reports for LDLT at other institutions (Table 1). This value was similar to that for DDLT at several institutions (Table 1). The most frequent complication was biliary stricture (9.9%), followed by biliary leakage (6.8%).

On univariate analysis, the risk factors for biliary stricture ($P < .10$) were recurrent cholangitis ($P = .0020$), and biliary leakage ($P = .0143$). The reconstruction methods (hepaticojejunostomy or duct-to-duct anastomosis), age, weight, grafted lobe, microsurgical reconstruction, and so on were not found to be risk factors. Subsequent multiple logistic regression analysis identified the independent risk factors for stricture as biliary leakage ($P = .0103$) and recurrent cholangitis ($P = .0077$; Tables 2 and 3).

Table 1. Reference of Biliary Complications

Reference		No. of Cases		Age		Sex (male: female)		Biliary Complication		Biliary Stricture		Biliary Leakage		Complication	
		LDLT	DDLT	LDLT	DDLT	LDLT	DDLT	LDLT	DDLT	LDLT	DDLT	LDLT	DDLT	LDLT	DDLT
Frelse CE et al	2008	384	216	49.6	51.4	162:222	88:128	41.9%	24.5%	18.0–21.6%	16.2%	27.2–37.7%	10.2%	72.7%	63.4%
Saha A et al	2012	18	35	21.6	35.2	NA	NA	27.7%	8.5%	11.1%	5.7%	16.6%	2.8%	38.8%	22.8%
Reichman TW et al	2013	145	145	54.2	53.9	117:28	117:28	34.0%	17.0%	17.9%	11.0%	10.3%	3.4%	46.0%	49.0%
Duilibi DF et al (Review)	2010	616	2227	NA	NA	NA	NA	28.7%	17.3%	15.2%	7.5%	17.1%	6.8%	NA	NA
Zimmerman MA et al	2013	356	189	49.5	49.4	NA	NA	40.0%	25.0%	15.3%	14.9%	25.3%	8.2%	NA	NA
Julka KD et al	2014	87 (pediatric only)	NA	1.0	NA	47:40	NA	17.2%	NA	9.1–10.0%	NA	4.5–11.6%	NA	NA	NA