Biliary Complications in 106 Consecutive Duct-to-Duct Biliary Reconstruction in Right-Lobe Living Donor Liver Transplantation Performed in 1 Year in a Single Center: A New Surgical Technique

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ABSTRACT

Objective. Biliary complications remain a major source of morbidity after living donor liver transplantation (LDLT). Of 109 consecutive right lobe (RL)-LDLTs performed in 1 year in our institution, we present the biliary complications among 106 patients who underwent a new duct-to-duct anastomosis technique known as University of Inonu.

Methods. Of 153 liver transplantations performed in 1 year from January to December of 2008, 128 were LDLTs including 109 RL-LDLTs. The others were left or left lateral grafts. All RL-LDLT patients were adults, all of whom except three included a duct-to-duct anastomosis.

Results. All, but three, biliary reconstructions were completed with a surgical technique, so called UI, in which 6-0 prolene sutures were used. Nine bile leaks were seen in 106 recipients (8.49%) performed in a duct-to-duct fashion in a time period of 1 to 4 weeks. Seventeen patients (16.03%) posed bile duct stricture (BDS). Five patients had both. Although endoscopic stent placement and percutaneous balloon dilatation, 4 patients continued to suffer from BDS on whom a permanent access hepatico-jejunostomy (PAHJ) procedures were performed.

Conclusion. We recommend a duct-to-duct biliary reconstruction because of its de facto advantages over other types of anastomosis provided the native duct is not diseased. After almost 2 years, the bile tract complication rate was 22.64%.

IN 1988 the first living donor liver transplantation (LDLT) was performed in Brazil.[1] The first successful LDLT was performed a year later in an infant by Strong in Australia using the left lateral lobe of the mother's liver.[2] Increasing experience lead to right lobe (RL) transplantation,[3] which in this decade became an acceptable procedure for adult patients with end-stage liver disease. It entails a thousand operative steps performed precisely in the correct sequence. The Biliary reconstruction is a major cause of recipient morbidity and potential mortality. LDLT naturally has a higher incidence of biliary complications versus deceased donor liver transplantation; unfortunately it has not seemed to improve significantly with experience.[4–7] The reported bile leak (BL), bile duct stricture (BDS) after RL-LDLT in four different studies performed in duct-to-duct fashion have been reported to be 4.7%, 23.3%, 7%, 12.5% and 26.6%, 31.7%, 24.3%, 6.25%, respectively[5,8,9,10] the multiple factors conductive to biliary complications, namely leak and stricture, are: the anatomy and quality of the donor bile duct; the techniques of donor and recipient hepatectomies; cytomegalovirus infections; blood type incompatibility; cold ischemic time, and ductal reconstruction technique.

The anatomic variations of the biliary tree are important and fundamental knowledge to have when perform RL-

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LDLT. Our technique of duct-to-duct biliary reconstruction, is actually a modification of the technique described by Haberal et al.[10] Herein we have reported our results of 106 RL-LDLT recipients using the duct-to-duct anastomosis for biliary reconstruction.

PATIENTS AND METHODS

From January to December 2008, we performed 153 liver transplantations in 151 patients, including 128 LDLT, of which 109 were RL-LDLT and the others either left or left lateral lobe grafts.

Donor and recipient demographics included 55 male and 51 female donors of overall mean age of 36 years (range, 19–63 years). The 64 male and 42 female recipients had a mean age of 42.9 years (range 19–66). The mean graft weight was 1256 ± 130 g and the graft-recipient body weight ratio (GRBWR) was 1.11 (range 0.81 to 1.98). The MELD score was 18.3 (range 6.3 to 65.6). The primary indications for RL-LDLT were liver cirrhosis (including incidental hepatocellular carcinoma; n = 85), cholestatic diseases (n = 6), fulminant hepatic failure (n = 7), autoimmune hepatitis (n = 3) and others (n = 7).

Among the RL grafts 45.29% had multiple biliary orifices which necessitated either a duct-to-duct anastomosis after a ductoplasty or more than one duct-to-duct biliary anastomosis. According to the Varotti classification,[11] the bile duct anatomy of the RL grafts were: type 1: (n = 58; 53.2%); type 2 (n = 14; 12.8%); type 3a (n = 4; 3.66%); type 3b (n = 6, 5.50%), and type 4a (n = 6; 5.50% and type 4b (n = 21; 19.6%).

A duct-to-duct biliary reconstruction was applied in 106 cases. All of the biliary tract anastomoses were performed by two surgeons (V.K. S.Y.) beginning in the posterior wall, using a 6-0 double-needled prolene suture both placed at 6 o'clock. The recipients to graft bile duct was sewn in a continuous fashion to both corners using the parachute technique. After placing 7 to 8 sutures reaching both corners, the sutures were tightened from both ends bringing and tightening the posterior rows of the ducts together. Then two stay sutures placed at both corners are tied together. The tied stay sutures at the corners were again tied to the ends of the continuously fashioned 6-0 prolene sutures at both corners. Finally the anterior row was completed in interrupted fashion. A suitable stent that was placed in all but 12 patients, was inserted into the recipient duct and led out through the common bile duct wall as an external stent. It was removed at almost 12 weeks after the procedure.

RESULTS

More than one orifice was present in 45.29% of right lobe grafts necessitating either a single anastomosis after ductoplasty or more than one duct-to-duct biliary anastomosis. A single bile duct was present in 58 patients (54.71%). All but 12 required a biliary tract anastomosis between the common hepatic and a single right lobe bile duct after stent insertion. Donor ductoplasty was performed on 32 grafts (30.18%) at the back table, thereby allowing a single biliary anastomosis using a stent. Because of two or three distantly located biliary orifices in the graft, double duct-to-duct biliary reconstructions were performed by anastomosing each orifice to the right and left hepatic ducts separately in 16 recipients (15.09%). Six of them received two stents inserted in each of the anterior and posterior duct. We used dilated cystic ducts in two cases. In all but 12 cases, we inserted a stent. Although the insertion of a T-tube or stent has been a subject of controversy,[12] a substantial number of authors[13] also, prefer the routine use of a stent or T-tube first to bridge the biliary anastomosis and secondly, for early postoperative assessment of bile quality and cholangiographic anatomy.

Bile leakage, as an early bile tract complication was seen in 9 patients (8.49%). Six surgical and 3 radiological drainage procedures were conducted on these patients in a period of 3 weeks (1 to 3 weeks) after RL-LDLT. Five of these patients posed bile duct stricture in follow-up and underwent ERCP and a nasobiliary stent placement in a period of 4 to 8 weeks after the operation. Three patients did fine but the others suffered from restenose and underwent permanent access hepatico-jejunostomy (PAHJ) procedure[14,15] 1 month after the stent placement. Over 21 to 36 months (mean 28 months) 12 more patient suffered from BDS in a period of 8 to 12 months after transplantation. Among 17 patients with BDS, ERCP and a stent placement was successful in 12 instances. Percutaneously an internal external catheter was successfully placed in 3 patients. And 2 of the patients with BDS are successfully treated with balloon cholangioplasty. Two patients after stent placement with ERCP, one after Balloon cholangioplasty and one after percutaneous internal stent placement suffered from restenose in a period of 2 to 4 months and underwent a PAHJ procedure. Unfortunately, 2 patients were drained surgically, 1 after radiologically drainage, and 2 after the stent/ T-tube removal suffered from sepsis, bile peritonitis and died of the sepsis related complications (4.7%).

Nine patients (8.5%) displayed bile leak, of whom 5 suffered from BDS in the follow up. Twelve more patients posed BDS without prior leak, totaling 17 patients (16.03%) with BDS. Both of them resulted with a biliary complication rate of 22.64%.

DISCUSSION

This series of bile duct complications after duct-to-duct anastomosis in RL-LDLT recipients were performed in 1 year at a single center. The BL, BDS and overall biliary complication (BC) rates were 8.49%, 16.03%, and 22.62%, respectively.

That biliary anastomosis is the Achille's heel of liver transplantation is an accurate statement especially for LDLT.[16] BCs, which are classified as anastomotic strictures or leakages, as diagnosed clinically and radiologically, are commonly associated with RL-LDLT.[17] These problems are associated with deterioration of liver function, abscess, and even sepsis, if an appropriate procedure is not provided for biliary diversion at an early stage. The anatomic variations of the biliary tree are among the most important and fundamental aspects leading to biliary complications.[17] Other risk factors relate to T-tube or stent placement; hepatic artery thrombosis; bleeding; ischemia/reperfusion injury; and other immunological, non-immunological, and

infectious events, which can cause anastomotic (AS) or non-anastomotic strictures (NAS).[18,19]

A duct-to-duct anastomosis in RL-LDLT patients was first reported by Wachs et al in 1998.[20] Because of the de facto physiologic and therapeutic advantages of a duct-to-duct biliary reconstruction over a bilio-enteric anastomosis,[21–24] the duct-to-duct reconstruction has been preferred for single duct grafts since 2000[20,21] and now are preferred for almost all types of ducted variations even with two or three ducts in the RL-grafts.[8,25]

Because of these well-known aspects, we preferred a duct-to-duct anastomosis for all but three of our RL-LDLT cases if the recipient duct was not diseased. Fifty-eight of the RL grafts (54.73%) had one duct suitable for a straightforward biliary reconstruction. A stent was placed in all but 12. Of the 48 RL grafts with two or more bile ducts, 32 (30.18%) had a duct-to-duct biliary reconstruction with a stent, after a ductoplasty has been performed on the back table. Because of two or three distantly located biliary orifices in 16 grafts (15.09%), double duct-to-duct biliary reconstructions were performed by anastomosing each orifice to the right and left hepatic ducts separately, especially for patients of Varotti classifications 3 and 4.[11] In two patients we used wide cystic ducts. BL, BDS, and BC rates among our 106 consequent RL-LDLT recipients were 8.49%, 16.03% and 22.62% respectively.

During early and late 2000, the incidence of BL was reported to be 5% to 21%.[5,8,12,22,26] We believe the most important factor influencing BL is anastomosis technique. Beside other factors, bile, possibly because of its local inflammatory and ischemia effects increases the risk of fibrosis.[27,28] Five of nine BL patients suffered BDS and underwent endoscopic stent placement; two of them had PAHJ because of later restenosis. Two had the benefit of surgical revision. Three of nine with BL died in the early period due to sepsis and sepsis-related complications. Another two patients died after stent removal because of repeated bile sepsis and sepsis-related complications.

On the other hand, BDS, which is generally a late complication, occurred among 16.03% patients at almost 2 years follow-up. In the literature BDS has been reported to occur in 4.7% to 60% of cases[5,8,12,22,26,29,30] (Table 1).

Table 1. Bile Leak, Bile Duct Stricture and Biliary Complications of RL-LDLT Recipients Conducted Duct-to-Duct as Reported in Previous Studies

Source	Case	Bile Leak	Bile Duct Stricture	Complications
Kasahara (2006)[5]	121	%4.7	%26.6	
Gondolesi (2004)[8]	39	%23.1	%31.7	%40.6
Ishiko (2002)[22]	52	%9.6	%23	%32.6
Lee (2008)[12]	90	%14.4	%18.8	%23.3
Kawachis (2002)[29]	5		%60	
Testa (2000)[26]	30	%26.6	%13.3	%26.6
Tashiro (2007)[25]	66	%13.6		
Hisatsune (2003)[30]	73		%35.6	
Inonu Univ (2008)	106	%8.49	%16.03	%22.64

Although all of the above-mentioned factors contribute to BDS, the most important is the blood supply to the recipient bile duct which may be compromised during the hilar dissection. The importance of a high hilar dissection, the so-called glissonean approach, has been described by many authors.[31,32] We performed a modification of high hilar dissection cut the bile ducts at least at the second order. We mostly used the right hepatic artery after minimal dissection.

A single right duct is mostly identified among fewer than 52% of donors.[23] Even in those cases, it frequently immediately subdivides into anterior and posterior ducts which leaves little margin to harvest a single right duct. Working too close to the bifurcation can jeopardize the donor left duct. Preoperative magnetic resonance cholangiopancreatography and an intraoperative cholangiogram can delineate the anatomy was completed in all of our cases. As mentioned by Kasahara et al, multiple ducts jeopardize the safety of biliary reconstruction.[5] Among the 17 cases involving BDS, 7 (12.06%) had undergone a single biliary duct anastomosis and 7 (21.87%) a single biliary duct anastomosis after a ductoplasty was performed at the bench because of multiple biliary duct orifices of the graft. Three cases (18.75%) required double duct-to-duct biliary reconstructions.

In conclusion, our experience showed that BC's are mostly associated with the type of biliary reconstruction, and the blood supply to the ducts, especially these of the recipient. Further developments in surgical techniques as well as radiologic and endoscopic diagnostic and treatment modalities should contribute to reduce BC.

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