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the first 15 cases. After reviewing the technique, we found that despite the recipient reduction ductoplasty, there remained a significant degree of discrepancy between the recipient and graft ducts. It is difficult to fix such incongruence after the completion of the anastomosis. We believe that the majority of our initial anastomotic BC especially bile leak was largely attributed to this factor. In this report, we aim to highlight the technical refinements and details of MBR in LDLT.

MATERIALS AND METHODS

From March 22, 2006, to June 30, 2012, routine MBR was performed in 584 grafts in 581 consecutive LDLT (including 3 dual graft transplants) at Kaohsiung Chang Gung Memorial Hospital, Taiwan. All biliary reconstructions were performed using microsurgical technique by a single microsurgeon (J). The classification of biliary reconstruction was based according to the number of ducts in the graft, the manner in which these ducts were reconstructed (with or without ductoplasty), and the conduit used (recipient duct or jejunum) to reconstruct the biliary tree. All biliary reconstructions were performed under an operating microscope (Carl Zeiss, Jena, Germany) with a magnification of ×5 to ×15. The anastomosis was performed with 6-0 Prolene sutures (Johnson and Johnson, Somerville, NJ) on a 6-0 gauge cardiovascular point needle. The interrupted suturing technique was used for the posterior wall anastomosis first, and then, the continuous suture and interrupted tie technique (combined method) was used for the anterior wall (12).

Surgical Techniques

Duct-to-Duct Biliary Reconstruction and Reduction Ductoplasty

Interrupted suture technique was performed for the posterior wall first. The knots were placed extraluminally. The anterior wall was reconstructed using the combined method. Continuous running suture was initially done, and chain loops were formed. Recipient reduction ductoplasty, if required, because of discrepancy in the graft and recipient ducts, was performed by the microsurgeon under an operating microscope. The running sutures coursed through the anterior and posterior walls of the remaining length of the recipient duct. The reconstruction was completed by interrupted ties.

Duct-to-Jejunum Biliary Reconstruction

Enterotomy was done under microscope. The serosal and mucosal layers were sutured together using 8-0 prolene. Eight sutures were required in this procedure. Interrupted suture technique was performed for the posterior wall first. The knots were placed extraluminally. The anterior wall was reconstructed using the combined method. Continuous running was done, and chain loops were formed. The reconstruction was completed by interrupted ties.

RESULTS

There were 397 right and 184 left lobe grafts. Single duct opening was noted in 440 (75.34%), two duct openings in 135 (23.12%), and three duct openings in 9 (1.54%) grafts. Size discrepancy in the graft and recipient ducts were not significantly related to right or left lobe used, size and number of ducts, discrepancy between recipient and donor ducts, recipient age, ischemia time, and type of graft used. This group consisted of 66 (11.30%) 2-to-2 duct-to-duct and 8 (1.37%) 2-to-2 duct-to-jejunum reconstructions. A 2-to-2 mixed reconstruction was performed in 4 (0.68%). A 3-in-1 reconstruction was used in 2 (0.34%) where recipient duct was utilized as conduit. A 3-to-3 unmixed reconstruction was performed in 2 (0.34%) where all utilized the recipient duct as conduit. A 2-in-1 duct-to-duct and 1-to-1 duct-to-duct unmixed reconstruction was performed in 5 (0.86%).

The overall BC was 7.9%. These included 19 (3.3%) bile leaks and 27 (4.6%) biliary strictures. Only 5.6% of the complications needed interventions. The complications were not significantly related to right or left lobe used, size and number of ducts, discrepancy between recipient and donor ducts, recipient age, ischemia time, and type of graft used.

DISCUSSION

Biliary complications may due to many factors such as rejection, ischemia, hepatic artery complications, cytomegalovirus infections, and blood type incompatibility. Complications related to BC have resulted in considerable number of graft failures and death among liver transplant recipients (6, 9). Hence, investigators have relentlessly delved into understanding its causes, and created several innovations to overcome BC. Some of these advances included the acquisition of a comprehensive understanding of the liver, biliary tree and its blood supply (13–17), conception of novel techniques in hepatic dissection and biliary reconstructions (3, 4, 6, 7, 18–20), use of T-tubes and stents (4, 21–24), and the application of microsurgical technique in biliary reconstruction (11). The high BC has often been attributed to the disparity in bile duct anatomy in partial liver grafts. In contrast to whole organ liver transplant, the bile duct in reduced size grafts, particularly in right lobe grafts, is conspicuously small and at times, multiple (7, 25). Furthermore, the sizes of duct opening in reduced grafts are often divergent (frequently smaller) from that of the recipient duct. These predicaments add up to the difficulty in biliary reconstruction and pose a greater risk of developing BC in LDLT (1, 4, 7). On this basis, some surgeons have performed duct-to-duct reconstruction in selected grafts that would secure a single bile duct anastomosis (8, 26). Such impasse could have resulted in the exclusion of what could have been otherwise a suitable living liver donor.

Microsurgical biliary reconstruction has the technical advantages of enhanced visualization of the operative field under magnification to avoid physical trauma to the bile duct epithelium, effectively approach multiple ducts and allow more precise placement of stitches during anastomosis. Our team has adopted routine MBR since March 2006. Our report comparing this technique with the conventional method showed that the risk of developing BC in MBR was reduced to 4.6% after gaining an ample experience and refinements of the recipient reduction ductoplasty.

Bile leak remains a serious problem (4.7%–18.2%) in LDLT especially in right lobe graft. The presence of bile leaks has emerged as one of the most important factors in addition to technical factors in the causation of biliary stricture (27). In our series, size discrepancy in the graft and recipient
ducts was noted in 83.3% duct-to-duct reconstructions. It is the major course of bile leak. This obstacle could be overcome by the combined method, which precisely approximated the quantity of sutures to securely close the remaining length of the recipient duct and effectively reduced the complication of bile leak to 3.3%.

Biliary complications are difficult to solve in duct-to-jejunum biliary reconstruction once it has been adopted for diseased extra-hepatic bile ducts or duct that was unfit for reconstruction. Size incongruence of intestinal opening and donor bile duct and mistake in suturing due to difficult identification of the intestinal lumen opening are some of the most risk factors causing bile leak and biliary stricture, respectively. Enterotomy under microscope provides delicate creation of intestinal opening and hemostasis. Suturing of the serosal and mucosal layers together using 8-0 Prolene facilitated the duct-to-jejunum biliary anastomosis.

Our technical experience showed that BC in LDLT can be reduced remarkably not only by way of preserving the blood supply of the biliary tree but also by appropriately planning the type of biliary reconstruction and properly aligning the anastomosis of the graft and recipient hepatic ducts. The latter objective is achieved by applying the modifications that were instituted in our techniques (28).

In summary, the routine use of MBR capably surmounts the difficulties brought about by the anatomic variations and the size discrepancies between the graft and recipient hepatic ducts with excellent outcome. The routine use of MBR can decrease early and long-term biliary anatomic complications in LDLT.

REFERENCES

SECTION 10. ENDOSCOPIC MANAGEMENT OF BILARY COMPLICATIONS IN ADULT LIVING DONOR LIVER TRANSPLANTATION

Milljae Shin,1 and Jae-Won Joh1,2

Abstract. Living donor liver transplantation (LDLT) has become an accepted therapeutic option for patients with end-stage liver disease. However, biliary complications remain the major causes of morbidity and mortality for LDLT recipients. Although there are currently no reports of a clear therapeutic algorithm, many approaches have been developed to treat biliary complications, including surgical, endoscopic, and percutaneous transhepatic techniques. Endoscopic treatment is currently the preferred initial treatment for patients that have previously undergone duct-to-duct biliary reconstruction. This article discusses aspects of endoscopic management of biliary complications that occur in adult LDLT.