En bloc high hilar dissection versus conventional hilar dissection in living donor liver transplantation donors: a comparative, single-center study

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Background
Living donor liver transplantation (LDLT) has become an accepted treatment option for end-stage liver disease. Biliary complications still remain a major concern and are considered the Achilles' heel of LDLT, with a morbidity ranging between 20 and 42.1%. The high incidence of biliary complications can be attributed mainly to the affection of the blood supply of bile ducts. The high hilar dissection technique was described aiming at preservation of bile duct vascular supply.

Patients and methods
A total of 66 adult LDLT donors were operated in a single, liver transplant center (Ain Shams University Specialized Hospital) between January 2017 and August 2018.
The study cases were divided into two groups: group A with conventional hilar dissection and group B with en bloc high hilar dissection. A comparative study was conducted between the two groups as regards early and late biliary complications.

Results
The 66 LDLT donors were divided into two groups: group A included 33 donors with conventional hilar dissection and group B included 33 donors with en bloc high hilar dissection. The occurrence of postoperative biliary leak was significantly more in the conventional hilar dissection group (18.2%) compared with the en bloc high hilar dissection group (3.0%) (P=0.046).

Conclusion
The en bloc high hilar dissection technique may decrease the incidence of biliary complications in LDLT donors as it protects the biliary vascular supply and facilitates the closure of the donor stump.

Keywords:
conventional hilar dissection, en bloc high hilar dissection and biliary leak, living donor liver transplantation

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Introduction

Living donor liver transplantation (LDLT) has become an accepted treatment option for end-stage liver disease, especially when it is the only source for liver grafts as in our country, Egypt due to the absence of cadaveric organ transplant.

Although the outcome of right lobe liver transplantation from living donors (R-LDLT) has significantly improved in recent years due to the significant progress in surgical technique, in the postoperative management and immunosuppression, biliary complications still remain a major concern and are considered the Achilles' heel of LDLT, with a morbidity ranging between 20 and 42.1% [1–3].

The high incidence of biliary complications can be attributed to many causes of which the most important is that the blood supply of the bile ducts is affected. That is why different techniques were applied in order to preserve the bile duct blood supply.

The high hilar dissection technique used during the donor graft dissection in LDLT was described aiming at the preservation of the bile duct vascular supply by dissecting the right hepatic artery close to its surface leaving sufficient tissue around the bile duct as far as possible only to allow safe division of the bile duct at the hilar plate.

This study sought to compare the incidence of occurrence of biliary complications between two groups of donors: group A with conventional hilar dissection and group B with en bloc high hilar

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dissection as regards early bile leak or fistula and late bile duct strictures and cholangitis.

Patients and methods

A total of 66 adult LDLT donors were operated in a single, liver transplant center (Ain Shams University Specialized Hospital) between January 2017 and August 2018. A multidisciplinary review of transplant eligibility was performed preoperatively for all recipients and donors.

The 66 LDLT donors included in this study were divided into two groups according to the type of their hilar dissection: group A included 33 donors operated with conventional hilar dissection and group B included 33 donors operated with en bloc high hilar dissection.

A comparative study was conducted between the two groups as regards the preoperative anticipated number of donor bile ducts shown by magnetic resonance Cholangiopancreatography (MRCP), the operative variables include the following: the number of donor ducts, number of biliary anastomosis, and presence of any biliary reconstruction intraoperatively.

The postoperative outcomes were also compared as regards early and late biliary complications. Early biliary complications included: bile leak, fistula, and intraabdominal collection, while late biliary complications included biliary anastomotic strictures and cholangitis.

Bile leak or fistula was diagnosed clinically by persistent bilious drainage from drains or wound for more than 1 week post-transplant. However, intraabdominal collection was diagnosed by ultrasonography imaging with guided aspiration that revealed bile. Biliary stricture was diagnosed by imaging including the MRCP or ultrasonography imaging that showed an intrahepatic biliary dilatation of more than 3 mm with narrowing at the site of anastomosis, accompanied by the cholestatic pattern of liver function tests in the form of elevated total and direct bilirubin and/or alkaline phosphatase and gamma-glutamyl transferase. Fever, rigors with jaundiced patient, elevated liver function tests, and total leukocyte count were very pathognomonic for cholangitis that could happen on the underlying biliary stricture.

Surgical technique

Our interest in this study was targeted to the hilar dissection technique in LDLT donors, either conventional hilar dissection or en bloc high hilar dissection. A total of 33 donors were operated using the conventional hilar dissection technique, after which we switched to the high hilar dissection for the following 33 donors.

Figure 1

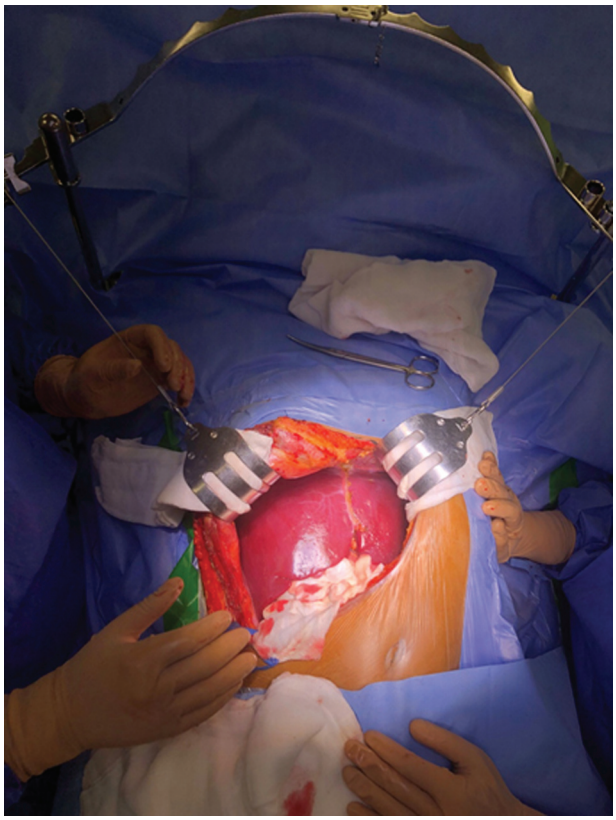
Hockey stick incision.

In our study, all the cases were right lobe graft donors. The standard incision used was the hockey stick incision, after which retraction of the costal margins was done using a self-retaining retractor (Figs 1 and 2).

Mobilization of the liver

After division of the falciform ligament, the right lobe of the liver was mobilized by dividing the right triangular and coronary ligaments with exposing the bare area of the liver. Then meticulous dissection of the right lobe of the liver from the inferior vena cava was done by ligating the small venous branches draining the right lobe, which is named the piggyback technique with preserving any accessory sizable veins to be rechecked on the back table if draining specific segment to be anastomosed in the recipient to avoid any congestion in the lobe graft. This dissection is continued till identification of the right hepatic vein and its isolation which was done carefully to avoid its injury or unnecessary excess thinning of its wall.

Figure 2



Exposure with the self-retaining retractor.

Cholecystectomy with intraoperative cholangiogram

The gallbladder was removed using the fundus first technique, then dissection of the cystic duct was done after ligation of the cystic artery. The cystic duct was used after its cannulation with a 4 Fr silicon tube to do intraoperative cholangiogram. This step is very important to delineate the biliary tree of the donor liver with confirmation of the number of the right hepatic bile duct.

After this step, dissection of the vascular pedicle was done using one of the two techniques we compared here.

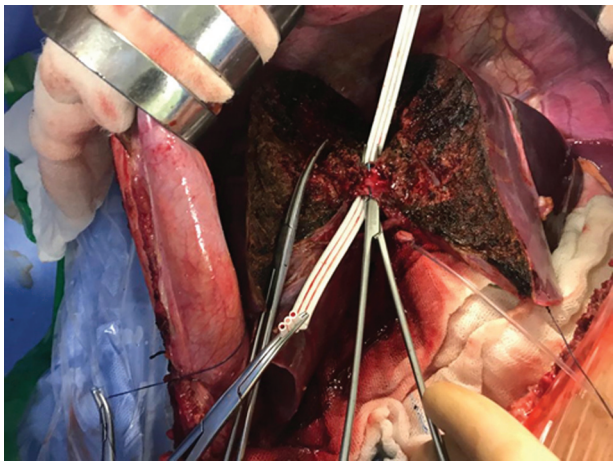
Conventional hilar dissection

In this technique, right hepatic artery and right portal vein were identified and dissected till the hilum of the right lobe. Then dissection of the common hepatic duct was done after identifying the site of insertion of the cystic duct, which was continued more proximally till reaching the right hepatic duct which was then divided after the cholangiogram was redone to confirm the site of division. The resection step was started afterwards.

En block high hilar dissection

This technique was adopted by our team recently in which the right hepatic duct along with the artery were lifted off the portal vein surface. Dissection of the right hepatic artery was done close to its surface without any trial to dissect the periductal tissue surrounding the right hepatic duct in order to preserve its blood supply. Only the right hepatic artery was freed from the duct to allow its division without ligation of the feeding branches as far as possible.

Figure 3



Marking of the right hepatic duct line of division with metal clips.

Here, we did not divide the right hepatic duct, but we shifted for the resection step after which division of the right hepatic duct was done. Marking of the line of division by metal clips at the edges of the duct was a standard and crucial step with a repeat cholangiogram to avoid injury or stenosis in the donor remnant bile duct to avoid unnecessary increase in the number of right ducts (Fig. 3). Moreover, this technique facilitated the closure of the donor's duct stump after completion of resection.

Hepatic resection

After the previous preparatory steps, right formal resection was accomplished using the Cavitron Ultrasonic Surgical Aspirator, bipolar cautery, and monopolar spray cautery for hemostatic resection. During resection, any sizable veins draining both segments 5 and 8 should be carefully preserved to be reconstructed in the recipient in order to avoid graft congestion and small-for-size syndrome.

After vascular control of the arterial and portal inflow and venous outflow, the right lobe was procured to be flushed at the back table.

The back table step

Flushing of the graft using a preservation solution histidine-tryptophan-ketoglutarate was done. Possible ductoplasty in case of multiple ducts

could be done by their approximation with no tension using absorbable PDS 6/0 sutures.

Results

In this study, we included 66 LDLT donors who were divided into two groups: group A included 33 donors with conventional hilar dissection and group B included 33 donors with en bloc high hilar dissection. The time period along which the operations were done was from January 2017 to August 2018. The two groups showed no significant statistical differences in their demographic data as regards age, sex, and BMI (Table 1).

Also, no significant differences were found as regards other patients' characteristics including blood group, relation of the donor to the recipient, anticipated number of ducts in MRCP preoperatively, and actual number of bile ducts found intraoperatively by a cholangiogram (Table 2).

The occurrence of postoperative biliary complications, in particular bile leak was significantly more in the conventional hilar dissection group (18.2%) compared with the en bloc high hilar dissection group (3.0%) (P=0.046) (Table 3 and Fig. 4). In both groups, bile leakage was managed conservatively as in most of those patients the drain stopped to drain bile spontaneously with only one patient requiring ultrasound-guided aspiration and pig tail insertion.

No significant differences were found between the two groups as regards the other postoperative outcomes.

The mean±SD duration of follow-up for group A was 2.64±0.21 years (range, 2.3–2.98 years) while it was 1.85±0.26 years (range, 1.42–2.27 years) for group B.

Discussion

In the absence of cadaveric organ transplant in Egypt, LDLT is considered the only source for liver grafts needed for patients with end-stage liver disease. However, still the postoperative biliary complications are considered the most frequent and crucial short-term complication.

The main cause of biliary complications postoperatively is the affection of the biliary tree blood supply leading to what is called biliary ischemia. A delicate arterial plexus surrounding the biliary tract is one of the most important sources of this blood supply.

As in LDLT, the donor patient is so precious and all measures are done to eliminate postoperative complications to the least percentage. That is why the new en bloc high hilar dissection was applied in order to preserve bile duct vascularity.

The en bloc high hilar dissection technique was originally described from hepatectomy techniques, as during the dissection, en bloc control of liver pedicles was done and was found to reduce liver ischemia and blood loss [4,5].

Here, in en bloc high hilar dissection, the right hepatic artery, which is considered the main blood supply of the hilar plate and bile ducts [6], was preserved in the same bundle together with the bile duct, and only freed to allow safe division of the duct as far as possible at the hilar plate without any dissection of the periductal tissue.

During the donor operation with en bloc high hilar dissection technique, dissection along the bile duct should be done so carefully and away from the bile duct wall to avoid any injury to the fine arterial plexus surrounding the wall. Also, the marking of the line of division with metal clips and reassessment with

Table 1 Demographic data of the study groups

	Group A (N=33)	Group B (N=33)	Test value	P value	Significance
Age					
Mean±SD	29.21±8.95	27.85±6.60	0.704[b]	0.484	NS
Range	18–49	18–46			
Sex [n (%)]					
Female	11 (33.3)	7 (21.2)	1.222[a]	0.269	NS
Male	22 (66.7)	26 (78.8)			
BMI					
Mean±SD	25.22±2.36	25.18±2.77	0.067[b]	0.947	NS
Range	20.2–29	19–29.6			

[a]χ^2 test. bIndependent t test. P value more than 0.05, nonsignificant (NS); P value less than 0.05, significant (S); P value less than 0.01, highly significant (HS).

Table 2 Patient characteristics and number of bile ducts

	Group A [*n* (%)]	Group B [*n* (%)]	Test value[a]	*P* value	Significance
Blood group					
A +ve	8 (24.2)	9 (27.3)	3.269	0.659	NS
B +ve	7 (21.2)	6 (18.2)			
O +ve	14 (42.4)	16 (48.5)			
O –ve	1 (3.0)	0			
A –ve	0	1 (3.0)			
AB +ve	3 (9.1)	1 (3.0)			
Relations					
Son	8 (24.2)	13 (39.4)	12.276	0.267	NS
Daughter	4 (12.1)	3 (9.1)			
Brother	3 (9.1)	4 (12.1)			
Sister	0	3 (9.1)			
Mother	1 (3.0)	0			
Wife	4 (12.1)	1 (3.0)			
Cousin	1 (3.0)	2 (6.1)			
Nephew	1 (3.0)	2 (6.1)			
Niece	1 (3.0)	0			
Related	3 (9.1)	0			
Unrelated	7 (21.2)	5 (15.2)			
Previous surgical operations					
No	22 (66.7)	23 (69.7)	8.222	0.512	NS
Tonsillectomy	3 (9.1)	6 (18.2)			
Appendectomy	3 (9.1)	2 (6.1)			
Tonsillectomy and appendectomy	1 (3.0)	0			
Hysterectomy	1 (3.0)	0			
Wrist fracture	1 (3.0)	0			
Cesarean section	1 (3.0)	0			
Plate and screw of lower limb	1 (3.0)	0			
Paraumbilical sinus	0	1 (3.0)			
Left nephrolithotomy	0	1 (3.0)			
MRCP					
Single right	23 (69.7)	16 (48.5)	3.090	0.213	NS
2 right	9 (27.3)	15 (45.5)			
3 right	1 (3.0)	2 (6.1)			
Intraoperative cholangiogram					
Single right	15 (45.5)	9 (27.3)	3.706	0.295	NS
2 right	13 (39.4)	18 (54.5)			
3 right	4 (12.1)	6 (18.2)			
5 right	1 (3.0)	0			

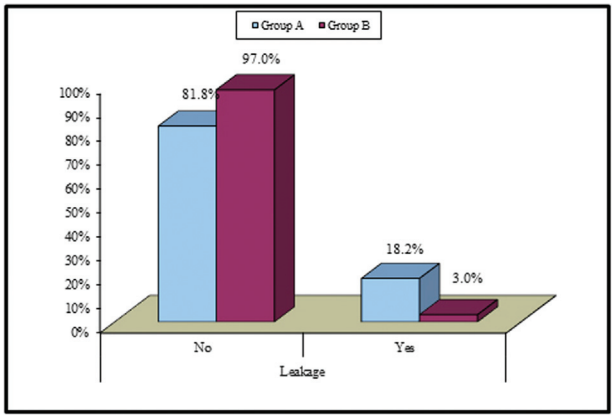
MRCP, magnetic resonance cholangiopancreatography. [a]χ^2 test. *P* value more than 0.05, nonsignificant (NS); *P* value less than 0.05, significant (S); *P* value less than 0.01, highly significant (HS).

Table 3 Postoperative biliary complications

	Group A [*n* (%)]	Group B [*n* (%)]	Test value	*P* value	Significance
Leakage					
No	27 (81.8)	32 (97.0)	3.995	0.046	S
Yes	6 (18.2)	1 (3.0)			
Collection					
No	33 (100.0)	33 (100.0)	–	–	–
Yes	0	0			
Stricture					
No	33 (100.0)	33 (100.0)	–	–	–
Yes	0	0			
Cholangitis					
No	33 (100.0)	33 (100.0)	–	–	–
Yes	0	0			

[a]χ^2 test. *P* value more than 0.05, nonsignificant (NS); *P* value less than 0.05, significant (S); *P* value less than 0.01, highly significant (HS).

Figure 4



Incidence of postoperative bile leak between the two groups.

cholangiogram after completing the resection were found to be a more protective technique for the donor as it helped to avoid any stenosis of the bile duct stump and helped more with its safe closure which is believed to decrease the incidence of bile leak with this technique.

In our study, lower rates of postoperative biliary complications were found within the en bloc high hilar dissection group after controlling of patient characteristics. Particularly, the incidence of bile leak was significantly less than the other group with conventional hilar dissection. The results in our study were similar to what Soejima *et al.* [7] reported when high hilar dissection technique was applied [8].A systematic review of biliary complications in 2812 LDLT patients by Akamatsu *et al.* [9] reported the incidence of biliary strictures of 19% and bile leak of 9.5% with high hilar dissection. Abu-Gazala *et al.* [10] also reported less biliary complications when applying the en bloc high hilar dissection technique.

Our results are comparable to the recorded worldwide results of biliary complications with this new technique; however, it is important to mention some limitations of our study. One of these is that it was a single-center study; so, the results may not be generalized for other transplantation centers. Also, the number of cases and sample size of both groups was relatively small; therefore, it may be insufficient for significant differences as regards other outcomes to be detected.

Conclusion

In conclusion, our single-center study results suggest that this technique with the en bloc high hilar dissection is the preferred one to decrease the incidence of biliary complication in LDLT donors. This is due to the preservation of good vascular supply of the bile duct with safe closure of the donor bile stump facilitated by this technique. However, further prospective studies by multiple centers are required to assess the benefits and outcomes of this technique accurately and in LDLT donors.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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