Management of difficult hepatic artery anastomosis in living donor liver transplantation: mansoura experience

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Background
One of the most difficult and important procedure in living donor liver transplantation (LDLT) is hepatic artery reconstruction. Difficult hepatic artery reconstruction may be because of pathological factor such as intimal dissection (ID) and anatomical variation. Difficult hepatic artery reconstruction is a risk factor for hepatic artery complications. This study was done to evaluate difficult hepatic artery reconstruction in LDLT at our center and its surgical outcomes.
Patient and methods
Consecutive patients who were treated for end-stage liver cirrhosis by LDLT were retrospectively reviewed. The management of hepatic artery with ID is carried out according to the extent of ID.
Results
Hepatic artery ID was found in 21/375 (5.6%) cases. Overall, seven (33%) cases were reconstructed with the graft hepatic artery after trimming the edge until reaching a healthy segment. A total of 11 (52.4%) cases were reconstructed with the graft hepatic artery after intimal fixation of ID. Moreover, three (14.3%) cases had severe ID and failed intimal fixation and were reconstructed with the recipient splenic artery. Biliary stricture developed in two patients who had severe ID, and three patients developed transient bile leak. No hepatic artery complications, graft failure, or mortality occurred.
Conclusion
Intimal fixation technique proved to be an effective technique in most of the cases, with good short-term and long-term follow-up results. In severe ID or failure of intimal fixation, alternative recipient arteries other than hepatic artery can be used.

Keywords:
biliary stricture, hepatic artery, intimal dissection, living donor transplant

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Introduction

Living donor liver transplantation (LDLT) has obtained worldwide agreement, especially in countries that lacked deceased donors [1–3]. In many countries, the use of deceased donor liver transplantation (LT) has not been approved legally. Therefore, LDLT remains the only hope for management of patients with end stage liver disease (ESLD) [3–5]. One of the most difficult and important procedures in LDLT is reconstruction of the hepatic artery (HA) because the HA of the graft is usually short and small in diameter [6–8]. Moreover, the recipient artery is occasionally damaged and adds a more difficult scenario to an already existing one [9,10].

HA complications, including HA stenosis, hepatic artery thrombosis (HAT), bleeding from the anastomotic site, and rupture pseudoaneurysm, during LT can lead to increased morbidity and mortality in liver transplant recipients, and a retransplantation may be required in most of the cases [11,12]. The incidence of HA complications is 1.6–8% in adult recipients and 2–23.6% in pediatric recipients [5–8]. The causes of HA complications are multifactorial including technical, anatomical, pediatric LT, intimal dissection (ID), and pathological factors [7–12]. The incidence of HAT has reduced in recent years owing to improvement in surgical techniques, postoperative anticoagulants, and radiological modalities [9,13].

ID is one of the risk factors of HA complications. The intima of HA may be injured during dissection, during transarterial embolization (TAC), or because of atherosclerosis [8–10,14,15]. The ID was classified according to the extent of intimal injury into three grades: mild ID, when the extent of ID was less than one-quarter of the circumference of the HA; moderate ID, when it involved one-half of the circumference of the artery of the HA; and severe

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ID, when the extent of ID reached more than one-half of the circumference of the HA or the entire vessel wall [9,15]. The management of ID is performed according to the extent of intimal injury, by either trimming the edge until a healthy part of the artery is reached, fixation of the intima, or by using alternative vessels to replace the injured native HA [8–10,14–16]. The results of intimal fixation for ID of HA have not been fully elucidated. This study was done to evaluate the incidence and different management techniques of ID of HA and its outcome.

Patients and methods

Consecutive patients, who were treated for end-stage liver cirrhosis by LDLT at Gastroenterology Surgical Center, Mansoura University, Egypt, during the period from April 2004 to April 2015, were retrospectively reviewed. In this period, three cases were done for children who received the left lobe graft from their mothers. All data were reviewed from a prospectively maintained database on internal web-based registry system completed by paper records.

Preoperative assessment

Donor selection and workup

A multistep, multidisciplinary protocol was used for donor evaluation in our center, and it has been described elsewhere [4,5].

Recipient workup

Initial evaluation includes complete blood count (CBC), electrolytes, liver function tests (LFT), coagulation profile, viral serology, AFP, ABO blood typing, C-reactive protein, and renal function tests. The model for end-stage disease score was calculated. Radiographic studies including abdominal ultrasound (US) and triphasic computed tomography were used to assess the liver status and in case of hepatocellular carcinoma (HCC) to assess the number and size of the tumor.

Surgical procedures

Donor surgery

Surgery was performed through a right subcostal incision with midline extension. The operative details in our center were described elsewhere [4,5]. Overall, 100 IU/kg heparin was injected before HA clamping. The liver graft was flushed immediately with cold histidine-tryptophan-ketoglutarate solution through the portal vein on the back table. Cannulation and flushing of the artery was not performed to avoid damage to the intima of the HA. The diameter of middle hepatic vein (MHV) tributaries was rechecked on the back table, and those with a diameter of more than 5 mm were considered for reconstruction.

Recipient surgery

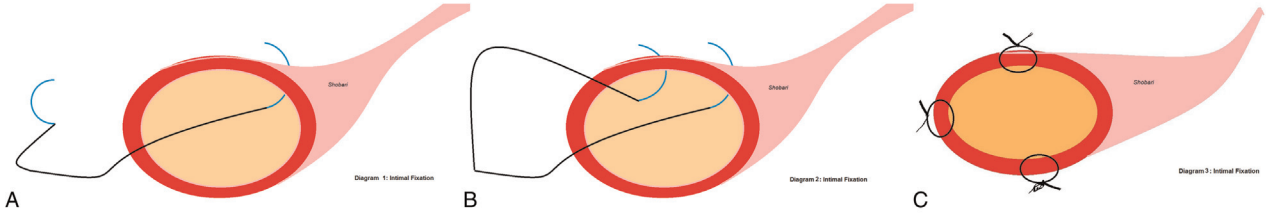
The abdomen was entered through a low subcostal incision with midline extension in all cases. The abdomen was thoroughly examined for any extrahepatic metastasis missed on preoperative imaging in cases with HCC. The liver was mobilized by dissecting all its ligaments. Hilar dissection was then approached with minimal dissection between arterial and biliary systems. Total hepatectomy was performed, preserving the inferior vena cava (IVC). The left hepatic vein (LHV) stump or the MHV/LHV stump was closed in most of the cases or used for MHV reconstructions.

The right hepatic vein (RHV) plasty was done routinely. The RHV of the patient and the liver graft are anastomosed in an end-to-end fashion using running 4/0 prolene sutures, leaving a loose stitch for venting of blood. Portal vein reconstruction was done using prolene 6-0. After venting of 300 ml of blood, the loose suture in the hepatic venous anastomosis was tied and the graft was reperfused.

Hepatic arterial reconstruction was performed using interrupted 8/0 Prolene sutures under 4.5 loupe magnification using midposterior wall first technique. Our policy is to anastomose either the right or left branch of the HA to the donor artery.

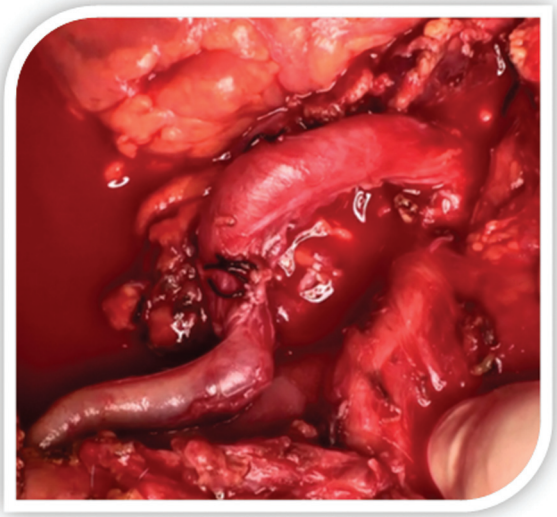
The management of HA with ID is carried out according to the extent of intimal injury; in cases with mild or moderated ID, trimming the edge was done until reaching a healthy part of the artery. Intimal fixation was performed with either 1, 2, 3 or even 4 quadrants and then proceed to anastomosis in cases of moderate or severe ID. We use double needle 6-mm 8/0 Prolene suture from inside out 2 mm away from the edge to fix the intima to adventitia to facilitate the anastomosis, and then ligation outside (Fig. 1a–c). All interrupted stitches of the anastomosis were carried out from the inside of the artery to the outside. The total number of stitches range from eight to 12 according to the arterial caliber. The recipient artery used for reconstruction were hepatic arteries, except in a few cases where the HA was severely damaged, in which the splenic artery was used for reconstruction (Fig. 2). Intraoperative Doppler was done for all cases at the end of the procedure to assess the vascular patency and blood flow in RHV, portal vein (PV), and HA. Duct-to-duct biliary anastomosis is performed using 6/0

Figure 1



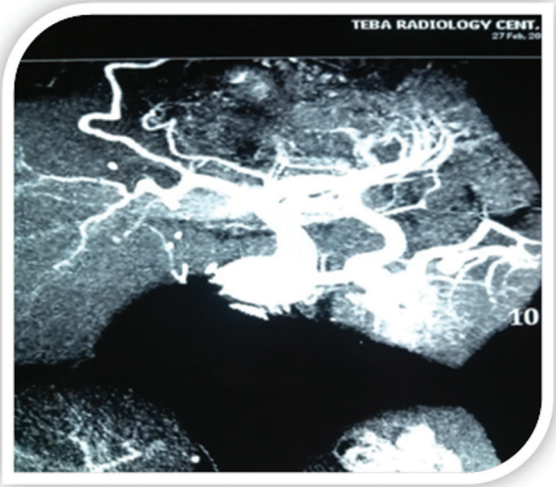
(a–c) Intimal fixation was performed with either 1, 2, 3 or even 4 quadrants using double needle 6 mm 8/0 prolene suture from inside out, 2 mm away from the edge then ligation outside.

Figure 2



Splenic artery used as an alternative to hepatic artery.

Figure 3



Angiography revealing patent hepatic artery was performed 6 months after liver transplantation after IF.

polydioxanone suture (PDS) or Maxon 6/0 in an interrupted fashion, over an indwelling 4–5 Fr catheter. This stent emerges from either CBD or cystic duct stump. Three drains were placed in right subphrenic space, cut margin of the graft, and pelvis.

Postoperative management

All patients were managed in the ICU before transfer to the ward. All patients received prophylactic antibiotics intraoperatively and postoperatively. Anticoagulant was not given postoperatively. Routinely all patients were given intravenous infusion of magnesium and phosphate until tolerating diet. The drain was removed if the amount was less than100 ml/day after 1 week and if there was no bile leak, or pus. Complete blood picture, liver function tests, serum electrolytes, creatinine and C-reactive protein findings were monitored daily.

Vascular patency was followed up using Doppler ultrasonography (DUS) daily for 2 weeks, weekly till discharge, and then monthly till 6 months. Computed tomography angiography was performed 6 months after LT (Fig. 3). A measurable velocity flow on DUS was considered an indicator of patency.

Immunosuppressive treatment started intraoperatively after arterial reconstruction and consisted of steroid and Simulect. The regimen consisted of tacrolimus and cellcept from the fourth day postoperatively. Initial rejection was treated by adding steroid.

The decision of discharge from hospital was based on patient's general condition, clinical parameters, absence of complication, and imaging study.

Follow-up and data collection

Donors and recipient were followed up after hospital discharge with laboratory investigation, abdominal US, and Magnetic Resonance Cholangiopancreatography (MRCP) in selected cases every month for the first month, then every 6 months, and then every year postoperatively. Follow-up visits included clinical examination, laboratory investigation, doses of

immunosuppressive, radiological examination, and DUS. All preoperative, operative, and postoperative data were recorded retrospectively from a prospectively maintained database on internal web-based registry system completed by paper records.

Data analysis

Continuous variables are expressed as median. Categorical variables were expressed as numbers and percentages. Analysis was performed with SPSS program 17 for Windows (SPSS Inc., Chicago, Illinois, USA). Comparison of variables was done by independent student *t*-test for continuous variables and χ^2-test for categorical variables. A *P* value less than 0.05 was considered statistically significant. Variables with *P* less than 0.1 were entered into a logistic regression model to determine independent risk factors for postoperative complications.

Results

From May 2004 to July 2015, 375 cases of living donor liver transplantation (LDLTx) for adult were done in Gastroenterology Surgical Center, Mansoura University, Egypt. Single arterial anastomosis was done in 372 cases, and double arterial anastomosis was performed in three cases. The median diameter of donor HA is 2 mm (1–3 mm). A total of 326 cases were anastomosed to right HA branch and 49 to left HA branch. Preoperative data of patients with HA ID are shown in Tables 1 and 2.

HA ID was found in 21 (5.6%) cases. Trimming of the edge of recipient HA was performed in five cases had mild ID and two cases had moderate ID and were reconstructed with graft HA. Revision of anastomosis was carried out in the same setting in four cases of them, as DUS showed no flow. Intimal fixation using 8/0 Prolene double needle of 6 mm was done in 11 (52.4%) cases (six cases had moderate ID and five cases had severe ID). Intimal fixation was done as four fixation sutures in five cases, three fixation sutures in one case, and the remaining five cases by two fixation sutures. Revision of anastomosis was performed after intimal fixation (IF) in two cases of them, as DUS showed no flow. Trial splenic artery replacement was done in four cases when HA was severely damaged and was successful in three of them. In case of failed splenic artery replacement because splenic artery, in this case, was short and unsuitable, soothe left HA was used after IF (Tables 3–5).

All cases showed excellent Doppler wave intra-operatively, with average resistive index of 0.69. Long-term follow-up using Doppler and in suspected cases computed tomography angiography showed good patency in all cases. HAT, stenosis, or pseudoaneurysm did not occur in any case. No graft failure or mortality occurred.

A total of five patients developed biliary complications. Biliary stricture developed in two patients who had severe ID and was managed by IF: one of them requiring seven sets of ERCP for dilatation and US-guided tubal drainage for the biliary collection, and the other one developed very tight stricture and failed to pass the guide wire by ERCP, so hepaticojejunostomy was done for him. Moreover, three patients (one had severe ID and was managed by IF, the second had severe ID and was managed by splenic artery replacement, and the third had mild ID and was treated by trimming the edge) developed transient bile leak; two of them were managed conservatively and one by ERCP (Tables 4 and 5)

The severity of ID affected the surgical outcome and development of biliary complications, as four of five cases that developed biliary complications had severe ID (P=0.06) (Tables 5 and 6).

Discussion

HA reconstruction is a challenging point in LDLT because the artery has small caliber and short stump and is a technically complicated procedure [7–10]. Complications of HA reconstruction are one of the leading causes of graft failure and mortality after LDLT. HA complication after LDLT includes HAT, HA stenosis, and HA pseudoaneurysm [8–14]. The early complications of HA are usually because of technical, anatomical, or pathological factors including small diameter, pediatric recipient, prolonged clamping of the artery, kinking of a long artery, hematoma of the artery wall, severe hypotension, prolonged cold ischemia, acute rejection, and ID [7–11].

ID is one of the risk factors of development of complications after HA reconstruction[9,14,15]. The intima of HA may be injured owing to atherosclerosis, prolonged clamping, vigorous traction, and grasping of HA during dissection or during pretransplant TAC for hepatocellular carcinoma [13–17]. To minimize the incidence of ID, careful atraumatic dissection and preparation of artery is mandatory. The management of ID is performed according to the extent of intimal injury, by either trimming the edge until a healthy part of artery is reached, fixation of the intima, or by using alternative vessels to replace the injured native HA

Table 1 Preoperative patient details

Patients nos	Age (years)		Sex		BMI		Diameter of HA (mm)		Primary disease
	D	R	D	R	D	R	D	R	
12	20	40	Male	Male	29.7	25.6	2	3	HCV cirrhosis
40	21	52	Male	Male	28.7	27.7	2	3	HCV cirrhosis
96	41	47	Male	Male	29	31.8	3	3	HCV cirrhosis
103	24	56	Male	Male	19.4	28.7	2	4	HCV cirrhosis
104	41	49	Male	Male	27.1	29.1	3	3	HCC on HCV cirrhosis
110	35	45	Female	Male	29.6	32	3	2	HCV cirrhosis
116	25	57	Male	Male	22.2	28.4	2	4	HCV cirrhosis
120	24	59	Male	Male	22	23.9	2	2	HCV cirrhosis
132	31	47	Male	Male	26.8	25.5	3	2	HCC on HCV cirrhosis
140	34	49	Male	Male	24.2	32	2	3	HCV cirrhosis
147	39	49	Male	Male	30.3	40	2	3	HCV cirrhosis
166	26	58	Male	Male	23	36.6	2	4	HCV cirrhosis
211	24	48	Male	Female	25.9	36.9	2	2	HCV cirrhosis
257	23	53	Male	Male	21	28.1	3	3	HCV cirrhosis
267	26	58	Male	Male	24.5	24.4	2	2	HCV cirrhosis
289	20	51	Male	Male	20.4	33	2	2	HCC on HCV cirrhosis
291	34	43	Female	Female	28.3	32	2	2	HCV cirrhosis
312	22	46	Male	Female	20.4	23.9	2	2	HCV cirrhosis
334	27	45	Male	Female	32.2	40	3	3	HCC on HCV cirrhosis
345	20	45	Male	Female	20.4	23.9	2	2	HCV cirrhosis
369	23	55	Female	Male	28.5	26	2	3	HCV cirrhosis
Median/ frequency	25 (20–41)	49 (40–59)	Male/female: 18/3	Male/female: 16/5	25.9 (19.4–32.2)	28.7 (23–40	2 (2–3)	3 (2–4)	HCV: 17 (80.95%)HCC on top of cirrhosis: 4 (19.05%)

HA, hepatic artery; HCV, hepatitis C virus.

Table 2 Demographic data

Variables	Number of cases [*n* (%)]/median (range)
Number of cases with hepatic artery intimal dissection	21/375 (5.6)
Median age (years)	
Donor age	25 (20–41)
Recipient age	49 (40–59)
Sex	
Donor male/female	18/3
Recipient male/female	16/5
Median BMI	
Donor BMI	25.9 (19.4–32.2)
Recipient BMI	28.7 (23–40)
Median hepatic artery diameter (mm)	
Donor hepatic artery diameter	2 (2–3)
Recipient hepatic artery diameter	3 (2–4)
Primary disease	
Hepatitis C virus	17 (80.95)
Hepatocelullar carcinoma on top of cirrhosis	4 (19.05)

including splenic, right gastroepiploic, left gastric, or gastroduodenal artery [14–19].

Lin *et al*. [15] classified the ID into three grades according to the extent of ID, and their management depended on the grade of ID. In mild and moderate ID, the HA can be used after trimming the edge till reaching a healthy part, but in severe ID, alternative recipient arteries other than HA were used. They found that 23 of 40 (57.5%) patients developed ID after TAC. Overall, nine patients had mild ID and six had moderate ID, and they were managed by trimming of the edge; eight had severe ID, and they were managed by alternative vessels other than HA. Two incidences of HAT developed postoperatively. No graft failure or mortality occurred.

Banshodani *et al*. [9] reported that when ID occurred, intimal fixation was performed at four points, and all stitches were carried out from inside to outside of the artery to facilitate good intimal fixation (intraluminal stitching technique). Intraoperative DUS was used to confirm adequate blood flow. Postoperative anticoagulant was given for 3 days. This technique was used in eight cases with ID, except in two cases with severe ID, and the recipient's right gastroepiploic artery was used. Reanastomosis in primary operation was done in three cases, thrombectomy using Fogarty catheter was performed in one case, and thrombolytic agent was used in one case.

For ideal arterial reconstruction, careful dissection and preparation of recipient artery with intimal adaptation must be done. When there is neither an atherosclerotic change nor ID, each stitch is performed from the

Table 3 Intraoperative data

Patient nos	Artery used	Grade of ID	Site	Management	CIT 35 (14–120)	WIT 37 (25–93)	Duration 165 (75–350)	Number of revision
12	RHA to SA	Severe	Recipient	Failed IF Using SA	120	60	250	2
40	RHA to LHA	Severe	Recipient	Trial SA IF (4)	80	70	350	2
96	RHA to RHA	Severe	Recipient	IF (4)	60	65	120	0
103	RHA to RHA	Severe	Recipient	IF (4)	35	35	110	0
104	RHA to RHA	Moderate	Recipient	IF (2)	48	44	130	0
110	RHA to RHA	Severe	Recipient	IF (4)	29	31	165	1
116	RHA to RHA	Moderate	Recipient	IF (2)	30	36	78	0
120	RHA to RHA	Severe	Recipient donor	IF (4)	25	37	75	0
132	LHA to RHA	Mild	Recipient	Trimming the edge	39	45	140	1
140	RHA to RHA	Mild	Recipient donor	Trimming the edge	40	93	119	0
147	RHA to RHA	Moderate	Recipient	Trimming the edge	35	27	170	1
166	RHA to RHA	Mild	Recipient	Trimming the edge	35	27	110	0
211	RHA to RHA	Moderate	Recipient	Trimming the edge	36	43	170	0
257	RHA to LHA	Mild	Recipient	Trimming the edge	30	49	271	3
267	RHA to RHA	Mild	Recipient	Trimming the edge	35	75	318	1
289	RHA to LHA	Moderate	Recipient	IF (2)	40	33	135	0
291	RHA to LHA	Moderate	Recipient	IF (2)	40	29	128	0
312	RHA to SA	Severe	Recipient	Failed IF Using SA	30	25	220	2
334	RHA to LHA	Moderate	Recipient	IF (2)	14	43	207	0
345	RHA to SA	Severe	Recipient	Failed IF Using SA	30	31	315	2
369	RHA to CHA	Moderate	Recipient	IF (3)	44	26	276	0

CHA, common hepatic artery; CIT, cold ischemia; ID, intimal dissection; LHA, left hepatic artery; RHA, right hepatic artery; SA, splenic artery; WIT, warm ischemia duration.

Table 4 Postoperative data

Patient number	Doppler US	Postoperative complications	Management
12	Patient with normal RI	No	–
40	Patient with normal RI	No	–
96	Patient with normal RI	Biliary stricture	Seven sets of ERCP for US tubal drainage
103	Patient with normal RI	Biliary stricture	Failed ERCP hepaticojejunostomy
104	Patient with normal RI	No	–
110	Patient with normal RI	Biliary leakage	ERCP
116	Patient with normal RI	No	–
120	Patient with normal RI	No	–
132	Patient with normal RI	Biliary leakage	Conservative
140	Patient with normal RI	No	–
147	Patient with normal RI	No	–
166	Patient with normal RI	No	–
211	Patient with normal RI	No	–
257	Patient with normal RI	No	–
267	Patient with normal RI	No	–
289	Patient with normal RI	No	–
291	Patient with normal RI	No	–
312	Patient with normal RI	No	–
334	Patient with normal RI	No	–
345	Patient with normal RI	Biliary leakage	Conservative
369	Patient with normal RI	No	–

RI, resistive index; US, ultrasound.

outside to the inner side of the artery using an 8/0 Prolene suture. In case of ID, double needle 6-mm 8/0 Prolene suture was used from inside out to fix the intima to adventitia, and then ligation outside. All interrupted stitches of the anastomosis were carried out from the inside of the artery to the outside [9,15]. In the present study, five cases had mild ID and two cases hade moderate ID, and they were reconstructed with the graft HA after trimming the edge till reaching a health segment. Moreover, six cases had moderate ID and five cases had severe ID, and they were reconstructed with the graft HA after intimal

Table 5 Operative and postoperative data

Variables	Number of cases [*n* (%)]/median (range)
Number of cases with hepatic artery intimal dissection (ID)	21/375 (5.6)
Severity of ID	
Mild	5 (23.8)
Moderate	8 (38.1)
Severe	8 (38.1)
Management	
Trimming the edge	7 (33.3)
Intimal fixation	11 (52.4)
Using Splenic artery	3 (14.3)
Number of revision	
0	12 (57.14)
1	4 (19.05)
2	4 (19.05)
3	1 (4.8)
Median duration of hepatic artery reconstruction (min)	165 (75–350)
Median cold ischemia duration (min)	35 (14–120)
Median warm ischemia duration (min)	37 (25–93)
Median resistive index	0.67 (0.59–0.71)
Postoperative patency	21 (100)
Postoperative complications	
Biliary complication	5 (23.8)
Biliary stricture	2 (9.5)
Biliary leak	3 (14.3)
Hepatic artery thrombosis	0 (0)
Hepatic artery stenosis	1 (4.8)

Table 6 Univariate and multivariate analyses of variables affecting postoperative surgical outcome

Variables	Univariate analysis (*P* value)	Multivariate analysis (*P* value)
Age (years)	0.33	–
Sex of the donor	0.67	–
Sex of recipient	0.82	–
BMI of the donor	0.81	–
BMI of recipient	0.44	–
Severity of ID	0.06	0.81
Type of management of ID	0.75	–
Number of revision	0.83	–
Duration of hepatic artery reconstruction (min)	0.68	–
Cold ischemia duration (min)	0.74	–
Warm ischemia duration (min)	0.73	–
Hepatic artery diameter of the donor	0.08	0.75
Hepatic artery diameter of the recipient	0.69	–

ID, intimal dissection.

fixation of dissected HA. A total of three cases had severe ID and failed intimal fixation and were reconstructed with the recipient splenic artery.

ID of HA may be a risk factor that leads to severe arterial complications such as HAT and subsequent graft failure and mortality [15,19,20]. In recent years, the arterial complications rate in LDLT was reduced to 3.5–6% owing to improvement of techniques, careful atraumatic dissection and preparation of the artery, introduction of microsurgical techniques [7–9,13,20]. Early diagnosis of HA complications based on serial DUS, even in asymptomatic patients, during the first 14 days is very important to decrease the incidence of biliary complications and graft failure because of early intervention. Urgent thrombectomy and revascularization have replaced retransplantation for early HAT [18–21].

Iida *et al*. [12] reported that HA complications occurred in 43 (6.4%) of 673 adult recipient. Postoperative biliary complications after hepatic arterial complications were found in 17 (39.5%) of the 43 cases. They were seven patients who developed biliary leak, six had hepatic pyogenic abscesses, and four patients had biliary strictures. Wang *et al*. [19] reported that five patients of 126 patients required an HA alternative using gastric arteries owing to ID of the recipient HA, which was found during primary transplant. Biliary complications developed in three patients: one patient had biliary stricture requiring percutaneous biliary drainage and two patients had bile leak. The indication of one bile leak recipient resolved conservatively. The other one had graft failure owing to leak and sepsis. In our study, five patients developed biliary complications. Biliary stricture was developed in two patients. One of them required seven sets of ERCP for dilatation. The other one developed very tight stricture and failed to pass the guide wire by ERCP, so hepaticojejunostomy was done for him. Three patients developed transient bile leak, two of them managed conservatively and one by ERCP.Several studies found that extra-anatomical HA reconstructions are strategy in cases with severe ID of HA and can save hepatic graft using other arteries, such as recipients' gastric arteries, gastroduodenal artery, and splenic artery, instead of unusable HA [9,17,21,22]. However, the anatomical anastomosis must be the first choice for the HA reconstruction because extra-anatomical HA anastomosis was a risk factor for development of HA complications, biliary complications, and for taking longer time [12–15,17]. When using splenic artery, ligation of the distal part of the artery may lead to splenic infarction in some cases [23]. In the current study, trial splenic artery replacement was done in four cases with severe ID and was successful in three of them. Biliary complication developed in

one case of them in the form of transient bile leakage and passed conservatively.

Conclusion

ID is one of the risk factors of development of complications after HA reconstruction in LDLT. To minimize the incidence of ID, careful atraumatic dissection and preparation of the artery is mandatory. Intimal fixation technique proved to be a simple and effective technique in most cases, with good short- and long-term follow-up and decreased shift to extra-anatomical reconstruction. In severe ID or failure of intimal fixation, alternative recipient arteries other than HA can be used.

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Conflicts of interest

There are no conflicts of interest.

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