

Feasibility and Midterm Results of Endovascular Treatment of Hepatic Artery Occlusion within 24 Hours after Living-Donor Liver Transplantation

In Joon Lee, MD, Seong Hoon Kim, MD, Seung Duk Lee, MD, Jae Hwan Lee, MD, and Hyun Beom Kim, MD

ABSTRACT

Purpose: To evaluate the feasibility and midterm results of endovascular treatment of hepatic artery occlusion within 24 hours after living-donor liver transplantation (LDLT).

Materials and Methods: From January 2012 to June 2014, 189 consecutive patients at a single institution underwent LDLT with right-lobe grafts. Among them, 10 were diagnosed with hepatic artery occlusion within 24 hours after LDLT. All 10 underwent endovascular treatment, including drug-eluting stent placement ($n = 2$), intraarterial thrombolysis ($n = 5$), or both ($n = 3$). Every patient received regular follow-up with multidetector computed tomography (CT). Data on primary technical success, primary and assisted primary patency, and biliary complications were analyzed.

Results: Primary technical success was achieved in all 10 cases. Primary patency rates at 1 week, 3 months, and 6 months were all 70% (7 of 10), and the respective assisted primary patency rates were all 80% (8 of 10). Bleeding at the anastomotic site developed in 2 failed cases, prompting repeat liver transplantation. All 8 successfully recanalized cases showed hepatic artery patency on CT throughout follow-up (mean, 643.6 d; range, 236–1,081 d). Six of these cases had anastomotic biliary stricture, 4 of which were successfully treated by multisession biliary intervention. One patient had nonanastomotic biliary stricture and died of hepatic failure despite lifelong external drainage.

Conclusions: Endovascular treatment could be an alternative therapeutic option for patients with hepatic artery occlusion within 24 hours after LDLT. It could help achieve long-term patency of the hepatic artery, but biliary stricture can potentially occur, and bleeding at the anastomotic site is a serious complication.

ABBREVIATIONS

HCC = hepatocellular carcinoma, LDLT = living-donor liver transplantation

In recent years, living-donor liver transplantation (LDLT) has increased because of the lack of cadaveric liver donors (1,2). However, it is still an operation that

carries significant morbidity and mortality risks. Hepatic artery stenosis and hepatic artery thrombosis are the most common vascular complications of LDLT, with incidences estimated between 2.5% and 11% (3–5). Early hepatic artery occlusion in particular has a higher mortality rate compared with late occlusion; the mortality rate has been reported as 55.6% with early occlusion, compared with 15%–22.6% with late occlusion (5,6). Therefore, revascularization needs to be performed as soon as possible to avoid graft loss.

Traditionally, the standard treatment of hepatic artery stenosis and thrombosis has been open surgical revision of the hepatic artery or urgent repeat liver transplantation (7). However, endovascular treatments, including intraarterial thrombolysis, balloon angioplasty, and stent placement, have been suggested as alternatives to

From the Departments of Radiology (I.J.L., H.B.K.) and Surgery (S.H.K., S.D.L.) and Center for Liver Cancer (I.J.L., S.H.K., S.D.L., H.B.K.), National Cancer Center, Goyang, Republic of Korea; and Department of Radiology (J.H.L.), Seoul National University Hospital, Seoul, Republic of Korea. Received February 18, 2016; final revision received June 23, 2016; accepted June 25, 2016. Address correspondence to H.B.K., Department of Radiology, National Cancer Center, 323 Ilsan-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do 10408, Republic of Korea; E-mail: dockimhb@naver.com

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open surgical repair (8–10) because these techniques are less invasive, are associated with less morbidity and mortality, and have shown similar rates of overall patient survival at 5 years (11–13). Several studies (14–16) have reported on the endovascular treatment of patients with early hepatic artery occlusion, although all of these were retrospective analyses of small numbers of patients. Li et al (14) analyzed nine cases of endovascular treatment of early hepatic artery occlusion 2–12 days after liver transplantation. Six of these nine cases were treated successfully; significant complications were intraabdominal hemorrhage during thrombolysis and biliary-tract complications (14).

Hepatic artery occlusion within 24 hours after liver transplantation has not yet been well described. Therefore, the purpose of the present study was to evaluate the feasibility and midterm results of the endovascular treatment of hepatic artery occlusion within 24 hours after LDLT.

MATERIALS AND METHODS

Patients

Approval of this study was obtained from our institutional review board, and the requirement for informed consent was waived. Between January 2012 and June 2014, 189 patients (141 male and 48 female; mean age, $53.2 \text{ y} \pm 9.4$; age range, 16–74 y) underwent LDLT with a right-lobe graft at a single institution, and acute hepatic artery occlusion within 24 hours after LDLT was diagnosed in 10 patients (5.3%; six men and four women). The mean age of these 10 patients was $58.3 \text{ years} \pm 5.14$ (range, 52–69 y). Every patient initially received endovascular treatment.

The medical records of these patients were retrospectively reviewed (Table 1), and it was found that the causes of liver cirrhosis were hepatitis B virus ($n = 8$), hepatitis C virus ($n = 1$), and alcohol ($n = 1$). LDLT was performed for the treatment of hepatocellular carcinoma (HCC; $n = 9$) and liver cirrhosis with variceal bleeding ($n = 1$). Seven patients had a medical history of HCC treatments such as surgical resection, chemoembolization, and radiofrequency ablation. Three patients had HCC that did not meet the Milan criteria for transplantation when they underwent LDLT.

Hepatic Artery Anastomosis in LDLT

The hepatic artery was reconstructed by using surgical microscopy with end-to-end anastomosis between the hepatic artery of the right-lobe graft and the recipient right hepatic artery ($n = 3$) or another small branch such as the left main hepatic artery ($n = 2$) or left lateral hepatic artery ($n = 3$; Table 1). When there was no small hepatic artery in good condition for reconstruction, the proper hepatic artery ($n = 1$) or common hepatic artery after ligation of the gastroduodenal artery ($n = 1$) was

Table 1. Demographic and Operative Data in LDLT Recipients with Hepatic Artery Occlusion within 24 Hours after Operation

Pt. No./ Sex/Age (y)	Cause of LDLT	Cause of LC	Initial HCC Staging		Treatment of HCC before LDLT	Milan Criteria Met Just before LDLT	Hepatic Artery Anastomosis in LDLT
			mUICC	BCLC			
1/M/59	HCC	HBV	III	Advanced	Chemoembolization	No	RHA to interposed LHA to CHA; end to end
2/M/69	HCC	HBV	II	Early	HR	Yes	RHA to RHA stump; end to end
3/F/63	HCC	HBV	II	Early	HR	Yes	RHA to LLHA; end to end
4/F/54	HCC	HBV	II	Early	None	Yes	RHA to CHA after GDA ligation; end to end
5/M/52	HCC	HBV	I	Very early	Chemoembolization	Yes	RHA to LLHA; end to end
6/M/59	HCC	HBV	II	Early	HR	No	RHA to PHA; end to end
7/M/53	HCC	HBV	II	Early	None	Yes	RHA to LLHA; end to end
8/M/57	HCC	Alcohol	II	Early	HR, chemoembolization	Yes	RHA to MHA; end to end
9/F/61	Variceal bleeding	HCV	-	-	None	Yes	RHA to RHA; end to end
10/F/56	HCC	HBV	II	Early	RF ablation, chemoembolization	No	RHA to RHA; end to end

CHA = common hepatic artery; GDA = gastroduodenal artery; HBV = hepatitis B virus; HCC = hepatocellular carcinoma; HCV = hepatitis C virus; HR = hepatic resection; LDLT = living-donor liver transplantation; LHA = left hepatic artery; LLHA = left lateral hepatic artery; MHA = middle hepatic artery; mUICC = modified Union for International Cancer Control; PHA = proper hepatic artery; RF = radiofrequency; RHA = right hepatic artery.

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