CLINICAL STUDY

Long-Term Outcome of Portal Vein Stent Placement in Pediatric Liver Transplant Recipients: A Comparison with Balloon Angioplasty

Dong Jae Shim, MD, Gi-Young Ko, MD, PhD, Kyu-Bo Sung, MD, PhD, Dong Il Gwon, MD, PhD, and Heung Kyu Ko, MD, PhD

ABSTRACT

Purpose: To evaluate the long-term efficacy of stent placement versus balloon angioplasty for portal vein (PV) stenosis in pediatric liver transplant (LT) recipients.

Materials and Methods: Fifty patients (<18 years old; median, 14 months) who underwent percutaneous transhepatic balloon angioplasty (n = 12), transhepatic stent placement (n = 18), or intraoperative transmesenteric stent placement (n = 20) between 1994 and 2015 were retrospectively analyzed. The median intervals from LT to percutaneous transhepatic angioplasty, stent, and intraoperative stent were 145 days (range, 27–2072), 98 days (range, 5–2289), and 0 days (range, 0–14), respectively. The primary study endpoint was the primary patency of each group. Secondary study endpoints included procedural complications, functional stent stenosis, and stent fractures.

Results: The median clinical follow-up periods were 81 months (range, 13–179), 118 months (range, 65–181), and 112 months (range, 47–168) in each group, respectively. In the angioplasty group, the 1-, 5-, and 10-year primary patency rates were all 75% ± 13%. The corresponding rates were all 100% in the percutaneous transhepatic stent group and 90% ± 7%, 90% ± 7%, and 85% ± 8%, respectively, in the intraoperative transmesenteric stent group ($P = .103$). Major procedural complications occurred in 4 patients, including 1 case with PV tear after percutaneous transhepatic post-stent angioplasty, and 3 cases with acute PV thrombosis after intraoperative transmesenteric stent. Functional stent stenosis and stent fractures occurred in 1 and 2 patients, respectively.

Conclusions: No statistically significant difference was observed between the 3 groups in terms of the long-term primary patency rates. Therefore, angioplasty should be considered first to treat PV stenosis in pediatric LT recipients.

ABBREVIATIONS

IMV = inferior mesenteric vein, LT = liver transplant, PV = portal vein, SMV = superior mesenteric vein

INTRODUCTION

Portal vein (PV) stenosis remains a cause of graft failure and postoperative morbidity in liver transplant (LT) recipients (1–6). Since the first report of PV angioplasty and stent placement after LT by Olcott et al,(7) these techniques have been widely used for PV stenosis treatment (2,5,8–10). However, stent is restrictively applied to children to mitigate the risks of several potential adverse effects, including in-stent restenosis, thrombosis, difficult PV anastomosis during repeat LT, and functional stent stenosis (1,2,6,8,10,11). Nevertheless, several reports with various follow-up durations (11 months–5 years) have demonstrated the effectiveness of stent for PV stenosis treatment in pediatric patients (2,8,9,12,13). However, pediatric populations have much longer life expectancies, requiring longer periods of

From the Department of Radiology (D.J.S.), Incheon St. Mary's Hospital, The Catholic University of Korea, Incheon, Korea; and Department of Radiology and Research Institute of Radiology (G.-Y.K., K.-B.S., D.I.G., H.K.K.), Asan Medical Center, University of Ulsan College of Medicine, 88, Olympic-ro 43-gil, Songpa-gu, Seoul, Korea, 05505. Received July 28, 2017; final revision received November 8, 2017; accepted November 19, 2017. Address correspondence to G.-Y.K.; E-mail: kogy@amc.seoul.kr

None of the authors have identified a conflict of interest.

From the SIR 2016 Annual Scientific Meeting.

J Vasc Interv Radiol 2018; ■:1–9

https://doi.org/10.1016/j.jvir.2017.11.019

Table 1. Demographics of the Percutaneous Transhepatic Balloon Angioplasty, Transhepatic Stent, and Transmesenteric Stent Groups

	Balloon angioplasty (n = 12)	Transhepatic stent (n = 18)	Transmesenteric stent (n = 20)	*P* value
Men vs. Women	7 vs. 5	9 vs. 9	12 vs. 8	0.811
Median age (range, months)	21 (10–237)	25 (8–199)	11 (5–180)	0.298
LDLT vs. DDLT	9 vs. 3	12 vs. 6	15 vs. 5	0.811
LL or LLS vs. whole graft	11 vs. 1	15 vs. 3	18 vs. 2	0.741
Median body weight (range, kg)	10 (6–57)	13 (6–53)	9 (6–57)	0.298
PV anastomosis				
E-E vs. interposed graft*	11 vs. 1	18 vs. 0	19 vs. 1	0.499
Symptoms or signs				
Yes vs. no	9 vs. 3	16 vs. 2	20 vs. 0	0.073
Abnormal liver enzymes	5	5		
Ascites	4	6		
Splenomegaly	4	5		
Thrombocytopenia	0	3		
Melena/hematochezia	1	2		
Prolonged prothrombin time	1	1		
Abnormal PV flow on venogram	n/a	n/a	20	
Underlying disease				
Biliary atresia vs. others	7 vs. 5	16 vs. 2	16 vs. 4	0.136

DDLT = deceased-donor liver transplantation; E-E = end-to-end; LDLT = living donor liver transplantation; LL = left lobe; LLS = left lateral segment; PV = portal vein.
*One patient each received cadaveric iliac vein and donor ovarian vein interposed between the recipient superior mesenteric vein and donor portal vein.

follow-up data collection. In this study, the long-term outcomes of stent versus angioplasty for PV stenosis treatment were retrospectively evaluated in pediatric LT recipients.

PATIENTS AND METHODS

This study received institutional review board approval. Informed consent was obtained from the legal guardians of all patients before the procedure.

Patient Population

Between December 1994 and December 2015, 55 of 296 pediatric LT recipients (<18 years) at our institution underwent angioplasty or stent for PV stenosis treatment. One patient who had undergone LT at another hospital also underwent stent at our institution. Of these 56 patients, 12 and 41 underwent initial angioplasty and stent with/without angioplasty, respectively. Six patients were excluded from the study because of failed negotiation of the occluded PV (n = 3) and a limited follow-up period (≤3 months, n = 3). Demographics of the remaining 50 patients are shown in Table 1. Eight patients overlapped with the population from our previous study (12). This previous study addressed the efficacy of stent to treat PV stenosis in a small number of LT recipients, whereas in this study we report on the long-term outcomes of stent versus angioplasty.

Stenosis was diagnosed if computed tomography (CT) revealed PV narrowing to >50% of the adjacent extrahepatic PV diameter (n = 33) and if ultrasonography (US) revealed PV narrowing to a <2.5-mm diameter (n = 14), an absence of flow or flow rate acceleration in the stenotic segment of >3 times the rate in the pre-stenotic PV (n = 22). In patients who underwent intraoperative procedures, the indications were a poor PV inflow with kinking at the PV anastomosis (n = 6), a size discrepancy between donor and recipient PVs (n = 10), and a history of early (<4 weeks) post-transplant main PV thrombosis (n = 4).

Balloon Angioplasty

All procedures were performed via percutaneous transhepatic access under general anesthesia. The intrahepatic PV was punctured using a 21-gauge Chiba needle (Cook, Bloomington, Indiana) under US and fluoroscopic guidance. The needle was exchanged for a 6–7-Fr sheath (Terumo, Tokyo, Japan). A 5-Fr cobra (Cook)/Kumpe catheter (AngioDynamics, Queensbury, New York) was then inserted into the intrahepatic PV. The catheter and a .035-inch guidewire were used to negotiate the PV stenosis, and a venogram and pressure gradient across the stenosis were obtained.

Angioplasty was continued until the waist deformity of the balloon catheter was lost. Each balloon inflation lasted for <60 s with 2–3 inflation procedures. Balloons (Mustang; Boston Scientific, Galway, Ireland) with the same diameter as the pre-stenotic extrahepatic PV were used. After the procedure, a venogram and pressure gradient were obtained.