Hybrid Procedure in Living Donor Liver Transplantation

A. Soyama, M. Takatsuki, M. Hidaka, T. Adachi, A. Kitasato, A. Kinoshita, K. Natsuda, Z. Baimakhanov, T. Kuroki, and S. Eguchi*

Department of Surgery, Nagasaki University Graduate School of Biomedical Sciences, Nagasaki, Japan

ABSTRACT

Background. We have previously reported a hybrid procedure that uses a combination of laparoscopic mobilization of the liver and subsequent hepatectomy under direct vision in living donor liver transplantation (LDLT). We present the details of this hybrid procedure and the outcomes of the procedure.

Methods. Between January 1997 and August 2014, 204 LDLTs were performed at Nagasaki University Hospital. Among them, 67 recent donors underwent hybrid donor hepatectomy. Forty-one donors underwent left hemihepatectomy, 25 underwent right hemihepatectomy, and 1 underwent posterior sectionectomy. First, an 8-cm subxiphoid midline incision was made; laparoscopic mobilization of the liver was then achieved with a hand-assist through the midline incision under the pneumoperitoneum. Thereafter, the incision was extended up to 12 cm for the right lobe and posterior sector graft and 10 cm left lobe graft procurement. Under direct vision, parenchymal transection was performed by means of the liver-hanging maneuver. The hybrid procedure for LDLT recipients was indicated only for selected cases with atrophic liver cirrhosis without a history of upper abdominal surgery, significant retroperitoneal collateral vessels, or hypertrophic change of the liver (n = 29). For total hepatectomy and splenectomy, the midline incision was sufficiently extended.

Results. All of the hybrid donor hepatectomies were completed without an extra subcostal incision. No significant differences were observed in the blood loss or length of the operation compared with conventional open procedures. All of the donors have returned to their preoperative activity level, with fewer wound-related complaints compared with those treated with the use of the conventional open procedure. In recipients treated with the hybrid procedure, no clinically relevant drawbacks were observed compared with the recipients treated with a regular Mercedes-Benz–type incision.

Conclusions. Our hybrid procedure was safely conducted with the same quality as the conventional open procedure in both LDLT donors and recipients.

APPLICATIONS of less invasive techniques, including laparoscopic procedures, have been reported in the field of living donor liver transplantation (LDLT) [1–3]. We have reported a hybrid procedure that uses a combination of hand-assisted laparoscopic mobilization of the liver and subsequent hilar dissection and parenchymal resection under direct vision in living donor hepatectomy [1,4]. In terms of appearance, sensation, and daily activities, our hybrid procedure had better donor self-assessment compared with those treated with a conventional incision, such as a right subcostal incision or Mercedes-Benz incision [5].

We also introduced the basic concept of the hybrid procedure into recipient surgery in selected cases [6]. We present the current practice of the hybrid procedure and the outcomes of the procedures in LDLT.

*Address correspondence to Susumu Eguchi, Department of Surgery, Nagasaki University Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan. E-mail: sueguchi@nagasaki-u.ac.jp

0041-1345/15
http://dx.doi.org/10.1016/j.transproceed.2015.02.016

Table 1. A Comparison of the Demographics of the Hybrid and Conventional Open Procedures in Living Liver Donors

	Hybrid (n = 67)	Open (n = 137)	*P*-Value
Age (median, range)	41 (21–65)	39 (19–67)	N.S.
Gender (Male:Female)	33:34	57:80	N.S.
BMI (kg/m^2)	21.6 (16.9–29.0)	22.1 (16.4–34.7)	N.S.
Type of procedure			
Right hemihepatectomy	25	59	
Left hemihepatectomy	41	60	
Right posterior sectionectomy	1	6	<.05
Left lateral sectionectomy	0	12	
Estimated GFR (mL/min/1.73 m^2)	85.4 (59.2–139.3)	87.6 (54.1–143.2)	N.S.
Gender mismatches with recipients	39/67 (58%)	68/137 (50%)	N.S.

METHODS

Hybrid Procedure for LDLT Donors

Between January 1997 and August 2014, 204 patients underwent LDLT at Nagasaki University Hospital. Among them, 67 recent donors underwent hybrid donor hepatectomy. Forty-one donors underwent left hemihepatectomy, 25 underwent right hemihepatectomy, and 1 underwent posterior sectionectomy. We compared the surgical outcomes, including the blood loss, length of the operation and postoperative complications classified according to the Clavien-Dindo classification [7] between the donors who underwent hybrid donor hepatectomy and conventional open procedures.

The hybrid procedure is a combination of a laparoscopic procedure and an open procedure. The laparoscopic procedure includes hand-assisted mobilization of the liver and the subsequent open procedure with an upper midline incision comprising vessel management, parenchymal resection, and graft removal. During the procedure, an 8-cm subxiphoid midline incision is first created for inspection of the liver and subsequent hand assistance during mobilization of the liver. After sufficient mobilization of the liver, the aforementioned subxiphoid incision was basically extended to 12 cm for the right hemihepatectomy and 10 cm for a left hemihepatectomy. However, because minimizing the incision is not the main objective of this procedure, if any difficulty was expected for surgery with a 10- to 12-cm incision, the incision was extended without hesitation. Encircling the hepatic veins and hilar dissection were performed under direct vision. Parenchymal resection was performed with the liver-hanging maneuver. Bile duct division was performed after visualization of the planned transection point by encircling the bile duct through the use of a radiopaque marker filament under real-time C-arm cholangiography [8]. Further details of the procedure have been described elsewhere [1,4].

Although we used a vascular clamp when transecting the hepatic veins in the early cases, as a modification of the procedure, we are currently using a triple-lined vascular stapler for transection of the hepatic vein to prevent accidental slipping off of the vascular clamp. The use of the vascular stapler made graft removal even safer while preserving a sufficient length of hepatic vein cuff for anastomosis.

Hybrid Procedure for LDLT Recipients

The hybrid procedure for LDLT recipients was indicated only for selected cases with no history of upper abdominal surgery, significant retroperitoneal collateral vessels, or hypertrophic changes of the liver. Furthermore, patients with a deep location of the venous anastomosis from the body surface were considered difficult to treat with the use of the hybrid procedure. The laparoscopic procedure includes hand-assisted mobilization of the liver and also the spleen when splenectomy is indicated. After the bilateral mobilization of the liver and spleen, the midline incision is extended to just above the navel for subsequent procedures, including total hepatectomy and implantation. In total, 29 patients underwent this procedure during LDLT. The surgical outcomes were evaluated and compared with those in patients who underwent conventional procedures.

Statistics

The Mann-Whitney *U* test or χ^2 test was applied to compare the groups where appropriate. A value of $P < .05$ was considered statistically significant.

RESULTS

Hybrid Procedure in LDLT Donors

All of the hybrid donor hepatectomies were completed without an extra subcostal incision.

When donors with hybrid hepatectomies and open procedures were compared, besides the type of hepatectomy, no significant differences were recognized in their characteristics including age, sex, body mass index, type of procedure, renal function, and sex mismatch with the recipient (Table 1). No donor underwent left lateral sectionectomy by use of the hybrid procedure. The renal function was evaluated on the basis of the estimated glomerular filtration rate, which was calculated by means of a formula for the Japanese population recommended by the Japanese Society of Nephrology [9]. When the findings of the hybrid procedure were compared with those of the open procedure for living donor left hemihepatectomy (hybrid group, n = 41, open group, n = 39) and right hemihepatectomy (n = 25 per group), no significant differences were seen in the duration of the operation or in blood loss (Table 2). The median duration of the operation for the hybrid right hemihepatectomy was 411 minutes (range, 324–581), and that of the left hemihepatectomy was 401 minutes (range, 286–671), with

Table 2. A Comparison of the Surgical Outcomes of the Hybrid and Open Procedures for Living-donor Hemihepatectomy

	Hybrid	Open	*P*-Value
Right hemihepatectomy	n = 25	n = 25	
Duration of surgery (min)	411 (324–581)	415 (350–523)	N.S.
Blood loss (g)*	600 (130–1900)	687 (140–1800)	N.S.
Left hemihepatectomy	n = 41	n = 39	
Duration of surgery (min)	398 (286–671)	400 (310–802)	N.S.
Blood loss (g)*	475 (50-3350)	610 (170–3150)	N.S.

*Including blood from the cuff of the hepatic veins from the graft.