Complication Follow-up With Ultrasonographic Analyses of 91 Cases With Donor Gallbladder Preservation in Living Donor Liver Transplantation of Left Lateral Sectionectomies

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ABSTRACT

Background. Preserving the donor's gallbladder during living donor liver transplantation (LDLT) is a better method for liver transplantation surgery, but not enough is known about gallbladder complications after the operation.

Methods. We retrospectively investigated postsurgical donor gallbladder complications in clinical LDLT with gallbladder preservation. The feasibility of retaining the gallbladder during liver graft procurement is discussed. Ninety-one donors with retained gallbladder after LDLT with the hepatic left lateral sectionectomy (from June 2013 to October 2015) were retrospectively analyzed. Donors were followed for 12.6 to 40.7 months after surgery (median 26.1 months). Sonography was used to evaluate gallbladder characteristics before and after surgery.

Results. Gallbladder function had recovered to almost normal 1 month after transplantation. Four donors (4.40%) experienced gallbladder enlargement that resolved after 3 days. Thickening of the gallbladder wall in 31 donors (34.07%) was restored within 2 to 75 days. Biliary sludge appeared in 9 donors (9.89%); 6 of them recovered within 3 to 34 days. Three (3.30%) and 1 donor (1.10%) suffered gallstone and gallbladder polyps, respectively, which persisted until the last follow-up.

Conclusion. The rate of postoperative complications of the gallbladder in donors was relative low. Preserving the gallbladder in liver transplantation donors during liver graft procurement is feasible and safe.

LIVER transplantation is the most effective treatment for end-stage liver disease. Currently, cholecystectomy, or surgical removal of the gallbladder, is conventionally performed during living donor liver transplantation (LDLT) in many centers. This is because damage to the gallbladder and its function may occur during the procedure [1,2]. However, the gallbladder has diverse physiological functions, including bile storage, concentration, and secretion; maintenance of bile acid enterohepatic circulation; and immunologic regulation. The absence of the gallbladder after cholecystectomy may lead to symptoms such as nausea, indigestion, bile reflux gastritis, immune dysfunction, abdominal distention, diarrhea, and mental disorders, and there is greater risk in developing colon, pancreatic, and periampullary cancers [3–7]. Moreover, postcholecystectomy syndrome, including abdominal pain and other biliary symptoms, may be related to sphincter of Oddi dysfunction [8–11]. Because liver donors are healthy people, it is extremely important to minimize injury and preserve organ function. So in some liver transplantation centers, the gallbladder preserved in left lateral

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Table 1. Patients Characteristics

Variable	
Age (y)	30.48 ± 5.82
Hospital stay (d)	10 (8, 12)
Operation time (min)	306.19 ± 61.68
Liver resection weight (g)	240.13 ± 41.44
Liver resection time (min)	100 (90, 120)
Bleeding volume (mL)	100 (100, 200)
Height (m)	1.64 ± 0.08
Weight (kg)	60.32 ± 11.06
Body mass index	22.21 ± 3.13
Recipients' primary disease (n)	
Congenital biliary atresia	79
Hyperammonemia	4
Glycogen storage disease	3
Congenital hepatic fibrosis	2
Hepatic bean nucleus deformation	1
Citrullinemia	1
Primary biliary cirrhosis	1

sectionectomy during LDLT. Our center improved the surgical procedure to preserve the donors' gallbladder in left lateral sectionectomy. Yet, studies are lacking to determine the effect of gallbladder preservation during liver graft procurement.

This study used ultrasound imaging to evaluate the gallbladder postsurgical complications and prognosis of liver transplantation donors with left lateral sectionectomy and analyzed systemically the feasibility of gallbladder retention during liver graft procurement.

METHODS

Study Design

The study enrolled 91 individuals (subject donors) who underwent left lateral sectionectomy during LDLT with gallbladder preservation in our hospital between June 2013 and October 2015 (Table 1). There were 31 men and 60 women (mean age, 30.5 ± 5.8 years; range 20–49 years). The median follow-up time was 33.13 months (range 18.6–46.8 months).

All the donors conformed to the following criteria for inclusion in this study: underwent LDLT with gallbladder preservation; had complete ultrasonography follow-up data; and were in compliance with the relevant ethical laws and had passed the ethical review. Individuals with gallbladder disease before LDLT or incomplete information were excluded from the study.

Examination Method

Gallbladder ultrasonography examinations were performed by 2 radiologists (E.H.H., L.X.Q.) with 10 years' experience in ultrasonography. The Phillip iU22 ultrasound system (Philips Healthcare, Andover, Mass, United States) equipped with the C5-1 convex-array transducer was used, with frequency at 3.5 MHz.

The donors received abdominal ultrasonography every day for a week after hepatic left lobectomy, then they were examined at 1, 3, 6, and 12 months after surgery. After the first year, they receive ultrasound examinations about every 6 months and appropriately based on the subject's condition. All the donors were fasting more than 4 hours before they received the examination. The gallbladder was scanned under the right costal margin or right intercostal and the section with the largest portion of the gallbladder was selected. The long and short diameters of the gallbladder were measured. The thickness of the gallbladder wall was measured on the long axis of the largest section at the right intercostal. Continuous scanning was adopted to observe the intraluminal echo characteristics.

Image Analysis

The sonographic image of the gallbladder was reviewed by 2 radiologists with >5 years' experience in ultrasound diagnosis. Observation indexes included the size of gallbladder (short diameter >4 cm was considered enlargement) [12], the thickness of the gallbladder wall (thickness >3 mm was defined as thickening), and intraluminal echo characteristics. The lumen echo of the portal vein was selected as reference to observe the echo intensity of the gallbladder.

Statistical Analysis

Continuous variables in normal distribution are depicted as mean ± standard deviation. Variables in non-normal distribution are presented as median (first quartile, third quartile). The paired *t* test was adopted to compare the short diameter of the gallbladder before and after the surgery. The nonparametric test was performed to compare the gallbladder thickness. All statistical analyses were performed using SPSS 22.0 software (IBM, SPSS, Chicago, Ill, United States). $P < .05$ was considered statistically significant.

RESULTS

There were 122 individuals who underwent left lateral sectionectomy during LDLT in our hospital between June 2013 and October 2015. Among the 122 individuals, 13 underwent cholecystectomy because of preoperative gallbladder disease or the intraoperative contrast demand, and 18 were lost to follow-up. So 91 individuals were involved in our study.

Postoperative Gallbladder Change

The short diameter and wall thickness of the gallbladder of each liver donor was compared after surgery with the presurgery dimensions (baseline; Table 2). Both the short diameter and wall thickness of the donors' gallbladders significantly increased within the first week after surgery, but were comparable with preoperative status after 1 month.

The main gallbladder changes after surgery included gallbladder enlargement and gallbladder wall thickening, and the main complications included biliary sludge, gallstone formation, and polypoid lesion of the gallbladder (Table 3 and Fig 1).

Gallbladder Enlargement. The short diameter of the gallbladder was measured on the first day after surgery.

Table 2. Gall Bladder Dimensions Before and After Surgery

	Short Diameter, cm	*P*	Wall Thickness, cm	*P*
Presurgery	2.33 ± 0.44		0.24 (0.21, 0.26)	
Postsurgery				
1 d	2.72 ± 0.62*	.00	0.35 (0.30, 0.41)*	.000
1 wk	2.48 ± 0.49*	.008	0.30 (0.20, 0.35)*	.000
1 mo	2.41 ± 0.55	.148	0.25 (0.20, 0.30)	.261

*Statistically significant compared with presurgery ($P < .05$).