Effect of donor age on graft function and long-term survival of recipients undergoing living donor liver transplantation

Kai Wang, Wen-Tao Jiang, Yong-Lin Deng, Cheng Pan and Zhong-Yang Shen

Tianjin, China

BACKGROUND: **Donor shortage is the biggest obstacle in organ transplantation. Living donor liver transplantation (LDLT) has been considered as a valuable approach to shortening waiting time. The objectives of this study were to investigate the feasibility of utilizing donors older than 50 years in LDLT and to evaluate the graft function and recipient survival.**

METHODS: **All LDLT cases (*n*=159) were divided into the older (donor age ≥50 years, *n*=10) and younger (donor age <50 years, *n*=149) donor groups. Donor graft and recipient condition pre-, intra- and post-operation were compared between the two groups. In particular, graft functions and recipient survivals were analyzed.**

RESULTS: **The median donor age was 58.5 (52.5-60.0) years in the older donor group and 25.0 (23.0-32.0) in the younger donor group. There was no significant difference in cold ischemic time, anhepatic phase and operation time between the older and younger donor groups (*P*>0.05). However, the volume of red blood cell transfused in operation was greater in the older donor group than in the younger donor group (1900 vs 1200 mL, *P*=0.023). The 1-, 3- and 5-year graft survival rates were 90%, 80% and 80% for the older donor group, and 92%, 87% and 87% for the younger donor group, respectively (*P*=0.459). The 1-, 3- and 5-year survival rates were 100%, 90% and 90% for recipients with older grafts, and 93%, 87% and 87% for those with younger grafts, respectively (*P*=0.811).**

CONCLUSION: **It is safe for a LDLT recipient to receive liver from donors older than 50 years, and there is no significant adverse effect on graft function and long-term patients' survival.**

(***Hepatobiliary Pancreat Dis Int 2015;14:50-55***)

KEY WORDS: **living donor liver transplantation; donor age; graft; liver function; long-term survival**

Introduction

With the rising disparity between the number of transplants needed and the number of organ donors available, many transplant centers have adopted a variety of approaches to expand the donor pool, including living donor liver transplantation (LDLT), split liver transplantation and the utilization of marginal donor livers. Compared with the high proportion of grafts from donors younger than 50 years, the organ discarding rate of donors older than 50 years was around 40%.[1] In recent years, the upper age limit of donors has been elevated from 50 to 65 years in many transplant centers, some of which began to try to use derived grafts from 70-year-old or even 75-year-old donor and obtained excellent results.[2, 3] On the contrary, some researchers reported that patients who received older livers had a higher rate of primary non-function, prolonged graft function recovery, increased graft loss and mortality.[4-7]

Compared with cadaveric donor derived whole liver grafts, grafts from living donor in LDLT are partial and were supposed to regenerate to meet the recipient's functional requirement. Therefore, because of the possible effect of age on liver regeneration, donor age might have an impact on graft function and long-term survival of recipients.

The present study was undertaken to evaluate the effect of donor age on the function grafts and long-term survival of the recipients in LDLT.

Methods

Patients

A retrospective study was conducted by analyzing data

Author Affiliations: Department of Transplant Surgery, Tianjin First Center Hospital, Key Laboratory of Organ Transplantation of Tianjin, Tianjin 300192, China (Wang K, Jiang WT, Deng YL, Pan C and Shen ZY)

Corresponding Author: Zhong-Yang Shen, MD, PhD, Department of Transplant Surgery, Tianjin First Center Hospital, Key Laboratory of Organ Transplantation of Tianjin, Tianjin 300192, China (Tel: +86-22-23626611; Fax: +86-22-23626612; Email: zhongyangshen666@hotmail.com)

doi: 10.1016/S1499-3872(15)60334-4
Published online January 29, 2015.

from all LDLTs performed in our hospital from March 2007 to December 2011, and patient follow-up was ended in July 2013. Among 159 recipients included, 131 were males and 28 females with mean age of 44.9±9.2 years (range 14-65). Patients who were diagnosed as having hepatocellular carcinoma generally met the Milan standard pre-LDLT.

Graft livers were generally implanted in piggy-back fashion, and patients were treated with nucleoside analogues plus hepatitis B immunoglobulin to prevent hepatitis B recurrence post-LDLT. The immunosuppressants were rapamycin+mycophenolate mofetil (MMF)+methylprednisolone or calcineurin inhibitor (CNI) in the first 3-6 months post-LDLT and CNI (or rapamycin)+MMF in the following 6-12 months. In a long-term maintenance, mono-therapy of CNI or rapamycin was applied. The concentrations of these immunosuppressants were 6-8, 150-200 and 5-10 ng/mL for tacrolimus, cyclosporine and rapamycin, respectively.

Among 159 partial liver donors, 128 were males and 31 females, with a median age of 26.0 years (interquartile range: 23.0-36.0). Donor candidates were limited to family relatives of recipients and all of them were healthy and suitable to donate part of their livers without any danger, and blood types of donors and recipients were compatible. Graft/recipient weight ratio was 0.62%-2.02% and the percentage of remnant liver volume to donor liver was generally greater than 30%. Grafts were preserved with histidine-tryptophan-ketoglutarate solution and specimens were routinely preserved for pathology. Donor was defined as steatosis donor when more than 10% hepatocytes were steatotic in pathology.

Grouping criteria

Based on donor age, recipients were divided into the older (≥50 years) and younger donor groups (<50 years). The younger donor group was further divided into the middle-age donor group (≥35 and <50 years) and preferred donor group (<35 years). All subjects signed the informed consent form. All treatments and operations were authorized by the Ethics Committee of Tianjin First Center Hospital. The study was conducted in accordance with the principles delineated in the *Declaration of Helsinki*.

Statistical analysis

The results of measured variables were expressed as mean±standard deviation or median and interquartile range. The data were analyzed by Student's *t* test and non-parametric data were analyzed by the Mann-Whitney *U* test. Sample ratios between the two groups were compared by the Chi-square test. Long-term survival of grafts and recipients were analyzed by the Kaplan-Meier method. All analyses were performed with SPSS version 13.0 (SPSS Inc., Chicago, IL, USA). Data were considered to be significant when a *P* value was less than 0.05.

Results

Donor livers and recipients pre-LDLT

The older donor group comprised 10 donors including 7 males and 3 females; and the younger donor group consisted of 149 donors including 121 males and 28 females (Table 1). In all donors, 35 including 4 from the older donor group and 31 from the younger donor group had mild or moderate steatosis; however, there was no significant difference in percentage of steatosis between the two groups ($P>0.05$). In addition, median cold ischemic time (CIT) in the older and younger donor groups was not statistically different ($P>0.05$).

There was no difference in gender, body mass index and model for end-stage liver disease score between the older and younger donor recipients ($P>0.05$). The average age of recipients in the older donor group was lower than that in the younger donor group ($P<0.01$). Etiological results showed that 77% of the recipients in this cohort had hepatitis B related cirrhosis.

Intra- and post-operation status of recipients and donors

There was no significant difference in intra-opera-

Table 1. Characteristics of donor livers and recipients pre-operation

Characteristics	Older donor group (n=10)	Younger donor group (n=149)	P value
Donor age (yr)	58.5 (52.5-60.0)	25.0 (23.0-32.0)	**0.000**§
Donor gender (M/F)	7/3	121/28	0.411*
Donor steatosis	4 (40.0%)	31 (20.8%)	0.229*
CIT (min)	90.0 (50.0-120.0)	100.0 (60.0-146.0)	0.439§
GRWR (%)	1.17±0.32	1.01±0.22	**0.037**$^{\#}$
Recipients age (yr)	37.4±10.8	45.4±8.9	**0.007**$^{\#}$
Recipients gender (M/F)	6/4	125/24	0.076*
Recipients BMI (kg/m^2)	22.66±2.57	23.51±3.30	0.431$^{\#}$
Recipients MELD score	19.5 (12.5-29.3)	15.0 (11.0-21.0)	0.191§
Recipients diagnosis			
Cirrhosis related HBV	4	118	**0.005***
Cirrhosis related HCV	0	3	0.824*
Autoimmune cirrhosis	3	8	**0.003***
Alcoholic cirrhosis	2	6	**0.025***
Cryptogenic cirrhosis	1	4	0.199*
Wilson's disease	0	5	0.721*
Fulminant hepatic failure	0	3	0.824*
Combined tumor	2	59	0.319*

*: Chi-square test; #: *t* test; §: Mann-Whitney *U* test. GRWR: graft/recipient weight ratio; CIT: cold ischemic time; BMI: body mass index; MELD: model for end-stage liver disease.