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ORIGINAL ARTICLE

Effects of donor steatosis on liver biochemistry and significance of body mass index in predicting steatosis

Rohan C. Siriwardana[1], See Ching Chan[1,2], Kenneth S.H. Chok[1], Chung Mau Lo[1,2] & Sheung Tat Fan[1,2]

[1]Department of Surgery, and [2]State Key Laboratory for Liver Research, the University of Hong Kong, Hong Kong, China

Abstract

Background: Hepatic steatosis is a major concern in living donor liver transplantation. Factors affecting hepatic functional status after a donor right hepatectomy (with the middle hepatic vein included in the graft) with a focus on changes owing to steatosis were retrospectively studied.

Methods: Donors ($n = 325$) were categorized into three groups: G0 (no steatosis, $n = 178$), G1 (< = 10% steatosis, $n = 128$) and G2 (>10% steatosis, $n = 19$). Donors with >20% steatosis were excluded. Changes in aspartate aminotransferase (AST), alanine aminotransferase (ALT), bilirubin levels and prothrombin time (PT) were assessed. Factors predicting steatosis were also assessed. A liver biopsy was performed on selected donors.

Results: The ALT level rose until day 3 in G1 and day 6 in G2 ($P < 0.05$). The AST level rose until day 7 in G2 ($P < 0.05$) but stayed unchanged in G1. The bilirubin level was higher only on day 1 in G2 ($P < 0.05$). By day 30, no significant difference between any groups was noted. Receiver-operating characteristic (ROC) area under the curve for body mass index (BMI) on predicting steatosis was 0.75 [confidence interval (CI) = 69–80]. Among donors with a BMI > 23.5 kg/m^2, 75% had steatosis. Five donors had >20% steatosis and were not assessed.

Conclusion: Using a liver with up to 20% steatosis in right liver donation, even if the middle hepatic vein is included in the graft, is safe. For Asian donors, a BMI > 23.5 kg/m^2 is a guide in deciding whether to perform a liver biopsy for steatosis.

Keywords

fatty change, living donor, liver transplantation, donor hepatectomy, steatotic donor, body mass index

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Correspondence

Chung Mau Lo, Department of Surgery, The University of Hong Kong, 102 Pok Fu Lam Road, Hong Kong, China. Tel: +852 22554748. Fax: +852 28162765. E-mail: chungmlo@hku.hk

Introduction

Owing to the severe scarcity of deceased-donor organs for transplantation in the region, living donors supply most of the liver grafts for transplantation in Asia.[1] Apart from technical complexity, donor safety is a key issue in living donor liver transplantation. Appropriate donor selection optimizes both donor safety and recipient outcomes. Hepatic macrosteatosis is common in the general public and has been reported to have a prevalence of around 30%.[2,3] Poor initial graft function, poor overall graft survival and other complications have been reported with the use of steatotic grafts in living donor liver transplantation as well as deceased donor liver transplantation.[4–6] Therefore, most centres, including the present, limit the acceptance of liver donors with hepatic steatosis up to 20%.[7] Assessment of the degree of steatosis is an important part of donor evaluation. It was reported that recipients of steatotic liver grafts had transient deterioration of results of liver function tests.[8,9] To date, very few authors have focused on the issue of post-operative change in liver enzymes after a donor hepatectomy.[8,9] In the present study, the patterns of changes in the results of liver function tests of a cohort of donors who underwent a right-liver donor hepatectomy were studied and factors analyzed predicting steatosis in them. Hopefully, the

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Table 1 Baseline parameters of the three groups of steatosis

	No steatosis (n = 178)	< = 10% steatosis (n = 128)	>10% steatosis (n = 19)	P[a]
Age (years)	34 (18–58)	34.5 (18–58)	41 (22–47)	0.09
Body weight (kg)	52 (41–74)	60 (39–95)	63.5 (43.5–84)	<0.001
BMI (kg/m^2)	20.26 (16.5–29)	22.7 (16–32)	24.4 (18–28.6)	0.001
Remnant left liver (%)	36 (23.6–49.5)	34.6 (26–47.7)	33.5 (26–42)	0.001
Graft weight (g)	565 (320–890)	637.5 (390–1020)	670 (550–1140)	<0.001
Blood loss (cc)	318.5 (42–1600)	373 (80–1400)	545 (240–1000)	0.003
Post-operative ICU stay (days)	1 (0–4)	1 (0–5)	2 (1–8)	0.03
Post-operative hospital stay (days)	7 (4–30)	7 (4–22)	9 (5–38)	0.12
Total operation time (min)	437.5 (260–810)	470.5 (310–870)	525 (355–932)	0.001

[a]Kruskal–Wallis test.
BMI, body mass index; ICU, intensive care unit.

results of the present study may be useful in the selection and post-operative management of liver donors.

Patients and methods

The present study covered the period from 1999 to 2009. Three hundred and twenty-five donors who underwent a donor right hepatectomy with the middle hepatic vein (MHV) included in the graft were the subjects of the study. All potential donors had to undergo intensive workup for donor selection. A detailed description has been given elsewhere.[10] In summary, a basic medical history of a potential donor was assessed to exclude any contraindication to donor surgery. If there was no contraindication, the possible candidate was then subjected to a blood test, radiological assessment and psychological evaluation.

Evaluation of donors with suspected steatosis

Potential donors with hyperlipidaemia, deranged liver enzymes and a body mass index (BMI) of 27 or above were suspected of having a fatty liver. Results from ultrasonography and computed tomography were also considered. In the absence of other potential donors, these high-risk candidates were further evaluated. A biopsy was performed in 21 selected candidates after considering the results of the initial assessment on an individual basis. The maximum degree of steatosis accepted for liver donation was 20%. All recipients underwent an intra-operative core biopsy of the graft before wound closure. The core of the tissue was examined under haematoxylin and eosin stain.

For the present study, only macrovesicular steatosis was considered significant. The donors were categorized into three groups according to the degree of macrovesicular steatosis: the first group (G0) had no steatosis (n = 178, 54.77%), the second group (G1) had up to 10% steatosis (n = 128, 39.38%) and the third group (G2) had more than 10% and up to 30% steatosis (n = 19, 5.85%). In G2, five donors had more than 20% steatosis, which was detected in a routine post-transplant biopsy.

Hepatectomy and post-operative care

All donors underwent a right hepatectomy with the MHV included. A hepatic parenchymal dissection was done with a Cavitron Ultrasonic Surgical Aspirator (Valleylab, Boulder, Colorado, USA). The abdomen was closed without any drains. The initial post-operative care took place in the intensive care unit (ICU). The donors were transferred to the general ward on post-operative day 1 if there were no adverse events. Daily biochemical assessment of liver functions and blood count were performed. The donors were discharged upon stabilization of clinical status and followed up in the outpatient clinic initially weekly and subsequently with a decreasing frequency. In each follow-up session, a liver function test and blood count were performed.

The three groups (G0, G1 and G2) were compared in terms of serum aspartate aminotransferase (AST) level, serum alanine aminotransferase (ALT) level, total serum bilirubin level and prothrombin time (PT) before surgery and on post-operative day 1 to day 7 and day 30. The upper limit of the reference value was set at 28 u/l for AST, 31 u/l for ALT and 19 μmol/l for bilirubin. The baseline parameters of the three groups are shown in Table 1.

Statistical analysis

Values were presented as medians with range. Comparison analysis was performed using the Kruskal–Wallis test and the Mann–Whitney U-test for continuous variables and the chi-squared test for categorical variables. A logistic regression model was used in the analysis to detect risk factors. A P-value below 0.05 stood for statistical significance. SPSS software Version 15.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

Results

When the three groups were compared (Table 1), there was a significant increase in donor weight ($P < 0.001$), BMI ($P = 0.001$), graft weight ($P < 0.001$), blood loss ($P = 0.003$), ICU stay ($P = 0.03$), ALT level ($P < 0.001$) and operating time ($P = 0.001$) with