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ORIGINAL ARTICLE

Liver transplantation in adults with portal vein thrombosis: Data from the China Liver Transplant Registry

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Summary

Objectives: Portal vein thrombosis (PVT) is a common complication in patients with liver cirrhosis. During liver transplantation (LT), PVT may complicate the procedure and lead to a poor prognosis. The aim of this study is to evaluate patients enrolled in the China Liver Transplant Registry, to understand the influence of PVT to the LT recipients.

Methods: We collected data from patients who underwent LT and were entered into the China Liver Transplant Registry. All data of medical records and follow-up were retrospectively reviewed. The preoperative condition, duration of surgery, intraoperative blood loss, postoperative early and late PVT, and survival rates were compared between patients with PVT and those without PVT. Multivariate Cox analysis and survival analysis were used to determine the influence of PVT.

Results: A total of 20,524 cases were recruited into the study. In all, 1810 (8.82%) patients were diagnosed with preoperative PVT of various severities. All patients were followed up for an average of 30.25 ± 33.25 months (up to a maximum of 171.68 months). Patients with PVT had a significantly longer operating time, more intraoperative blood loss and a higher rate of post-LT PVT ($P < 0.001$). Multivariate Cox analysis showed that PVT did not reduce the recipients' survival rate (HR = 0.89, 95% CI: 0.774—1.024, $P = 0.103$). There was no significant difference in cumulative survival rate ($P = 0.059$) between patients without PVT, and patients with PVT.

Conclusions: PVT increases the difficulty of LT, but doesn't reduce the survival rate. Therefore, PVT is not an absolute contraindication for LT in experienced transplantation centers.

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Introduction

Since Prof. Starzl implemented the first LT in 1963 [1], over the past century LT has been universally recognized as an effective way to treat various end-stage liver diseases [2,3]. However, for patients with PVT, the difficulty of portal vein reconstruction is significantly increased [4]. Portal vein anastomosis stenosis can easily lead to relapse of postoperative PVT, causing inadequacy in perfusion of the liver graft and gastrointestinal congestion. This can seriously affect the function of the transplanted liver, and is life-threatening for patients [5,6]. Therefore, PVT used to be an absolute contraindication to LT [6,7].

In recent years, with the continuous progress in operative and perioperative processing technology, more and more patients with PVT have successfully undergone LT [5]. At present, PVT is no longer an absolute contraindication for LT [4,8—12]. According to the severity and range of PVT, removing thrombus, portal vein intima denudation, vascular bypass, and inferior vena caval portal hemitransposition can be chosen for reconstruction of the portal vein during LT [13—18].

Although the majority of articles have reported that there is a similar prognosis between patients with and without PVT [7,19], a number of articles also indicate that there is a significantly increased incidence of postoperative complications in patients with PVT, particularly in patients with diffuse PVT [4,10,12]. At present, LT for patients with diffuse PVT remains a formidable technical challenge [20]. Due to the threat to the safety of the transplant graft and recipient, it is necessary to conduct a large-scale observational analysis of the outcome of patients with PVT who received a liver transplant.

The purpose of this study is to analyze the influence of PVT to the LT proceeding and the outcome of the recipients. We speculate that PVT increased the difficulty of LT, but did not reduce the survival rate.

Methods

Patient population

Liver transplant recipients entered into the China Liver Transplant Registry were eligible for participation in this retrospective study. Key inclusion criteria included age older than 16 years and with detail PVT information. Exclusion criteria were with portal vein tumor thrombus or hepatocellular carcinoma (HCC) related PVT. All data of medical records and follow-up were retrospectively reviewed.

Ethics statement

This study was approved by the Scientific Committee of the China Liver Transplant Registry. The current regulation of the Chinese Government and the Declaration of Helsinki were strictly followed for each organ donation. All data were analyzed anonymously.

Diagnosis of PVT

Diagnosis of PVT was confirmed in all cases during the operation and graded as 1—4 according to the venous thrombosis classification method proposed by Yerdel et al. [21], as follows. Grade 1: partial PVT (< 50% of the lumen) with or without minimal extension into the superior mesenteric vein (SMV). Grade 2: > 50% occlusion with or without minimal extension into the SMV. Grade 3: complete thrombosis of both PV and proximal SMV. Distal SMV is open. Grade 4: complete thrombosis of the PV and proximal and distal SMV. Patients with HCC related PVT or portal vein tumor thrombus were excluded.

Study design

The number of patients with preoperative PVT and PVT recurrence was calculated. Patients with PVT were divided into 4 groups according to the severity of the PVT. The operating time, intraoperative blood loss, early and late postoperative PVT formation, and survival were compared among patients with various grades of thrombosis and patients without PVT.

Statistical analysis

Statistical analyses were performed using SAS 9.2 software. Continuous, normally distributed variables were presented as means ± SD. Student's test, chi-square test, Fisher's exact test, and the Wilcoxon procedure were used as appropriate to compare categorical and continuous variables. For the univariate models, clinically relevant patient variables were analyzed including patient age, gender, with hepatitis B, with HCC, with PVT, MELD score, operating time, blood loss. The variables reaching statistical significance by univariate analysis were then included for multivariate analysis to understand the effect of PVT on survival rate. Kaplan-Meier method was applied for survival analysis. $P < 0.05$ was considered to be statistically significant.

Results

From January 1, 1993 to June 7, 2013, data from 24,397 patients who underwent LT on the Chinese mainland was entered into the China Liver Transplant Registry. 20,524 cases were recruited into the study after excluding 449 cases (1.84%) with doubtful data, 16 cases (0.07%) without PVT data, 755 (3.09%) children and 2653 cases (10.87%) with portal vein tumor thrombus or HCC related PVT (Fig. 1). The mean follow-up time of all patients was 30.25 ± 33.25 months, and the longest follow-up time was 171.68 months.

Clinical characteristics of the study population

These patients included 17,069 male patients (83.19%), 3450 female patients (16.81%), and 5 cases without gender data. The mean age was 48.65 ± 9.95 years (18 to 86.9 years). The most common etiologic diagnosis was hepatitis B (Fig. 2). A total of 8592 cases had complicating