International Journal of Surgery 30 (2016) 143–149

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Predictors of portal vein system thrombosis after laparoscopic splenectomy and azygoportal disconnection: A Retrospective Cohort Study of 75 Consecutive Patients with 3-months follow-up

Guo-Qing Jiang [a, 1], Dou-Sheng Bai [a, *], Ping Chen [a, 1], Bing-Lan Xia [b], Jian-Jun Qian [a], Sheng-Jie Jin [a]

[a] Departments of Hepatobiliary Surgery, Clinical Medical College of Yangzhou University, 98 West Nantong Rd, Yangzhou, Jiangsu 225000, China
[b] Departments of Ultrasound, Clinical Medical College of Yangzhou University, 98 West Nantong Rd, Yangzhou, Jiangsu 225000, China

HIGHLIGHTS

- This study clarify the incidence of portal vein system thrombosis (PVST) after laparoscopic splenectomy and azygoportal disconnection (LSD).
- This study investigated negative and positive predictors of PVST after LSD.
- Early anticoagulation with warfarin was safe and effective for the prevention of PVST after LSD.

ARTICLE INFO

Article history:
Received 28 December 2015
Received in revised form
27 April 2016
Accepted 28 April 2016
Available online 4 May 2016

Keywords:
Warfarin
Portal vein thrombosis
Laparoscopy
Splenectomy
Azygoportal disconnection

ABSTRACT

Introduction: Portal vein system thrombosis (PVST) is an alarming and potentially life-threatening complication of laparoscopic splenectomy and azygoportal disconnection (LSD). The objective of this study was to investigate negative and positive predictors of PVST after LSD in patients receiving anticoagulant regimens with aspirin or warfarin.

Methods: Seventy-five consecutive patients who underwent LSD from 2013 to 2014 were retrospectively reviewed. Patients received anticoagulant regimen with warfarin (n = 35) or aspirin (n = 40) according to individual preference. International normalized ratio (INR) and the incidence of PSVT were compared in patients received anticoagulant regimen with warfarin or aspirin on postoperative days (POD) 7, 30, and 90, and factors associated with PVST at these time points were determined by univariate and logistic multivariable regression analyses.

Results: Portal vein diameter was an independent negative predictor of PVST on PODs 7, 30, and 90. Anticoagulation with warfarin was an independent positive predictor of PVST on PODs 30 and 90, and INR was an independent positive predictor of PVST on POD 90. Dynamic changes in the incidence of PVST on the day of admission and on PODs 7, 30, and 90 differed significantly between the warfarin and aspirin groups ($P = 0.002$). No patient experienced perioperative bleeding.

Conclusions: Portal vein diameter was an independent negative predictor, while anticoagulation therapy with warfarin and INR were independent positive predictors, of PVST after LSD. Early anticoagulation with warfarin is safe and effective for the prevention of PVST after LSD.

1. Introduction

In Asia, open splenectomy and azygoportal disconnection (OSD) have been widely used in the surgical treatment of cirrhotic patients with portal hypertensive esophagogastric variceal bleeding (EGVB) and secondary hypersplenism. In recent years, however, the development of laparoscopic techniques and laparoscopic instruments has led to the use of laparoscopic splenectomy and

* Corresponding author. Department of Hepatobiliary Surgery, Clinical Medical College of Yangzhou University, 98 West Nantong Rd, Yangzhou, Jiangsu 225000, China.
E-mail address: bdsno1@hotmail.com (D.-S. Bai).
[1] Guo-Qing Jiang and Ping Chen contributed equally to the work.

http://dx.doi.org/10.1016/j.ijsu.2016.04.047
1743-9191/

azygoportal disconnection (LSD) in these patients. LSD has been shown to be associated with many clinical advantages in patients with EGVB and secondary hypersplenism, including minimal surgical trauma and faster recovery.

Portal vein system thrombosis (PVST) is a frequent and potentially life-threatening complication in patients with advanced cirrhosis after open splenectomy (OS) or OSD, especially after laparoscopic splenectomy (LS) or LSD. Indeed, PSVT is a more frequent complication after LSD than OSD [1], and is more frequent after LS than after OS [2].

The rates of PSVT in patients with liver cirrhosis after OS and OSD have been reported to range from 24% to 29% [3,4] and from 30% to 48% [1,5,6], respectively. These outcomes may due to the special pathophysiological characteristics of cirrhotic portal hypertension and changes in postoperative hemodynamics.

A prospective study found that the incidence of PSVT was higher in patients who underwent LS (55% [12/22]) than OS (19% [4/21]) [2], whereas a study in 33 patients who underwent elective LS reported that 17 (52%) of these patients developed PSVT from postoperative day (POD) 3–11 [7]. In addition, a comparative study found that the PVST rate was significantly higher in patients with LSD (50.0%, 40/80) than OSD (30.1%, 22/71) [1].

The 10-year survival rate among adults with PSVT is reportedly 38%–60%, and the mortality rate from variceal bleeding in patients with PSVT with cirrhosis is 30%–70%; this is significantly higher than the 5% mortality rate from variceal bleeding in patients with PSVT without cirrhosis [8]. PVST may cause liver function to deteriorate, increase the risk of variceal bleeding due to portal hypertension, or lead to ischemic intestinal necrosis [9–12]. Furthermore, PVST may reduce the ability to perform future liver transplantation [13,14].

The mechanism by which LSD contributes to a higher rate of PVST than OSD has not yet been determined. Differences in operative procedures may be potential causes of PVST. To date, however, the optimal anticoagulation therapy that can effectively prevent postoperative PVST in cirrhotic patients with hypersplenism remains unclear. To investigate the safety and effectiveness of warfarin in preventing PVST after LSD, patients in this study who received anticoagulation with warfarin and aspirin were compared.

This study aimed to clarify the incidence of PVST and its dynamic changes for 3 months after LSD. We also aimed to investigate negative and positive predictors of PVST, and determine whether anticoagulation regimens with warfarin can safely and effectively prevent PVST following LSD in cirrhotic patients with portal hypertension.

2. Materials and methods

2.1. Patients

From February 2013 to October 2014, 75 cirrhotic patients with EGVB and secondary hypersplenism successfully underwent LSD in our department, as described [15]. Patients were included if they were aged 18–75 years, had been diagnosed with cirrhosis of any etiology; had Child–Pugh A or B liver function, a history of EGVB, and splenomegaly with hypersplenism; did not have PVST, as shown by ultrasound evaluation at admission; and successfully underwent LSD without conversion to laparotomy.

Patients were excluded if they had hepatocellular carcinoma or any other malignancy; a baseline international normalized ratio (INR) > 2.0; a hypercoagulable state other than that related to liver disease; were being treated with oral contraceptives, anticoagulation agents, or antiplatelet drugs; recently had peptic ulcer disease; had uncontrolled hypertension, a history of hemorrhagic stroke, or human immunodeficiency virus infection; or were pregnant. This study was approved by the Ethics Committee of the Clinical Medical College of Yangzhou University. All patients provided written informed consent.

The selection of anticoagulation regimen was based on each patient's decision, with 35 patients selecting warfarin and 40 selecting aspirin. Starting on postoperative day (POD) 3, patients in the warfarin group received 2.5 mg of oral warfarin (Harvest, Shanghai, China) once daily for 1 year, with the dose titrated to maintain a target INR of 2.0–2.5, whereas patients in the aspirin group received 100 mg enteric coated aspirin tablets (Bayer, Leverkusen, Germany) once daily for 1 year. Patients in both groups were treated with subcutaneous injections of 4100 IU of low-molecular-weight heparin (LMWH) (CS Bio, Hebei, China) once daily for 5 days and 25 mg oral dipyridamole (Henan Furen, Henan, China) three times daily for 3 months.

Retrospectively collected preoperative data included age, sex, etiology of cirrhosis, Child–Pugh classification, D-dimer concentration, INR, white blood cell (WBC) count, hematocrit (HCT), platelet (PLT) count, concentrations of serum albumin (ALB), total bilirubine (TBIL), alanine transaminase (ALT), blood urea nitrogen (BUN), and creatinine (CER), longitudinal diameter of the spleen, thickness of the spleen, splenic vein diameter, portal vein diameter, and velocity of portal blood flow. Intraoperative data included operation time, estimated intraoperative blood loss, and volume of intraoperative blood transfused. Postoperative data included WBC count, HCT, PLT count, concentrations of ALB, TBIL, ALT, BUN, and CER on POD 7 and the occurrence of PVST, as monitored by Doppler ultrasound screening, on PODs 7, 30, and 90. Ultrasound measurement was described in the previous article [16,17]. According to the report of Doppler ultrasound, the patients were divided into a non-PVST complication group and a PVST group.

2.2. Statistical analysis

Data are presented as mean (standard deviation), median (interquartile range), or percentage, as appropriate. Group means were compared using Student's *t*-test or the Mann–Whitney *U* test, as appropriate. Percentages were compared using the chi-squared test. Multivariate regression analysis was performed with forward stepwise elimination of non-significant variables. The incidence of PVST in the warfarin and aspirin groups on PODs 7, 30, and 90 were compared by two-way repeated-measures analysis to determine the dynamic changes in the two groups at different times. A P value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS 16.0 software (SPSS, Inc., Chicago, IL, USA).

3. Results

Of the 75 patients, 36 (48.0%) had PVST complications on POD 7 after LSD, including 17 (22.7%) with main portal vein thrombosis (MPVT), five (6.7%) with intrahepatic portal branch thrombosis (IPVT), and 14 (18.7%) with splenic vein thrombosis (SVT). On POD 30, 48 (64.0%) of the 75 patients had PVST complications, including 25 (33.3%) with MPVT, four (5.3%) with IPVT, and 19 (25.3%) with SVT. On POD 90, 39 (52%) patients had PVST complications, including 16 (21.3%) with MPVT, six (8.0%) with IPVT, and 17 (22.7%) with SVT. The details of PVST in the warfarin and aspirin groups are shown in Table 1.

3.1. Negative and positive predictors of PVST on POD7

A comparison of demographic and preoperative clinical characteristics in patients who did and did not develop PVST on POD 7 showed significant differences in portal vein diameter, velocity of