

Thrombosis in the portal venous system after elective laparoscopic splenectomy

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Abstract

Background: The occurrence of thrombosis in the portal system is an underappreciated complication of splenectomy. Presenting symptoms are usually mild and non-specific. The short hospital stay associated with the laparoscopic approach could delay the early diagnosis of this condition unless routine imaging controls are planned after discharge.

Methods: The records of 40 patients who underwent laparoscopic splenectomy at our institution were reviewed for clinical signs of thrombosis in the portal system and associated factors. All patients were also enrolled in a color Doppler ultrasound surveillance program.

Results: Nine patients (22.5%) developed thrombosis of the splenic vein, progressing to the portal vein in five cases (12.5%). Six patients (15%) were symptomatic. Thrombosis occurred even as late as 4 months after splenectomy. Spleen weight was the only significant factor predictive of postoperative thrombosis. The combination of splenomegaly and an elevated preoperative platelet count was associated with a 75% incidence of this complication.

Conclusion: The high risk of thrombosis after the laparoscopic resection of large spleens should prompt strict postoperative imaging surveillance, combined with a more aggressive anticoagulation prophylaxis.

Key words: Thrombosis — Portal system — Laparoscopic splenectomy — Spleen — Platelet count — Color Doppler ultrasonography

Thrombosis of the veins of the portal system is a well-recognized complication of elective splenectomy, both laparotomic [3, 17] and laparoscopic [2, 14]. Various investigators have described this event as an “uncommon” [8] or “rare” [16] complication, although the more extensive use of radiologic imaging now seems to indicate that it probably occurs more often than previously suspected [4]. Indeed, unless the surgeon has a high index of suspicion and a policy of routine radiologic surveillance is adopted, this complication may go undetected because presenting symptoms are often vague and nonspecific [17]. Nonetheless, progression of the thrombus to occlude the portal and mesenteric veins could cause acute hypertension in the splanchnic circulation and intestinal infarction [12] or have a significant impact on the late outcome of these patients, due to the development of portal cavernoma and extrahepatic portal hypertension. For these reasons, the early recognition of splenic or portal vein thrombosis is of great importance, because complete resolution of the clot can be achieved after immediate systemic anticoagulation [2, 4, 12, 17].

With the advent of the laparoscopic approach, which is now increasingly being applied to the removal of very large spleens [1, 6, 13], the postoperative stay of the patient has been shortened considerably. As a consequence, thrombosis in the portal system may occur after discharge, further reducing the chances of its early diagnosis.

The aim of this study was to assess, by postoperative color Doppler ultrasonography, the incidence of thrombosis within the portal system in a consecutive series of patients undergoing elective laparoscopic splenectomy at our institution and to analyze the specific pattern of occurrence of this complication. Analysis of associated factors was also expected to provide useful indications for the prophylactic strategy, diagnosis, and management of this condition in specific subgroups of patients.

Materials and methods

The study was conducted in a consecutive series of 40 patients undergoing elective laparoscopic splenectomy at our institution over the 3-year period from March 2000 to March 2003. Preoperative intravenous gamma globulins were given to four patients with severe thrombocytopenia, interrupting the treatment ≥ 2 weeks before surgery. Low-dose subcutaneous unfractionated heparin prophylaxis was given in every patient (3000 units every 8 h beginning the evening before operation for 7 days).

In 28 cases, the technique was purely laparoscopic, whereas in 12 a hand-assisted laparoscopic surgery (HALS) approach was the preferred option. All procedures were accomplished with a carbon dioxide pneumoperitoneum maintained at 12 mmHg. Transection of the isolated splenic vein was always achieved laparoscopically by firing a linear stapler loaded with a vascular cartridge close to the hilum of the spleen. This step was performed after previous isolation and separate ligation of the splenic artery as an early phase of the procedure. Three purely laparoscopic cases (7.5%) were converted to laparotomy: one for a splenic lymphoma infiltrating the colonic flexure, the other two for intraoperative bleeding.

Age, sex, body mass index (BMI), indication for splenectomy, spleen weight, surgical technique (pure laparoscopy or HALS), preoperative platelet count, postoperative (day 3) platelet count, and operating time were prospectively recorded. Clinical signs and symptoms suggestive of thrombosis in the portal system (fever, abdominal pain, anorexia, nausea, leucocytosis) were looked for and recorded.

In addition, every patient underwent pre- and postoperative color Doppler ultrasonography at 3 days, 1 week, and then monthly up to 6 months after operation to assess the patency of the splenic, superior mesenteric, and portal veins. This exam was also performed in the presence of symptoms to confirm the clinical suspicion of venous thrombosis.

A database was used for comparative analysis between subgroups. Continuous data are shown as mean \pm SD and were compared by the Student *t*-test. Fisher's exact test was adopted for proportional data. A *p* value of < 0.01 was considered significant.

Results

Postoperative thrombosis of the splenic vein occurred in nine patients (22.5%). In five of them (12.5%), the thrombus extended further to occlude the portal vein. The complication was symptomatic in six patients, who showed variable combinations of fever (67%), a white cell count $> 12,000$ (67%), abdominal pain (44%), and anorexia (22%). Diagnosis in most patients was made within 10 days after splenectomy, but in one case the patient developed sudden abdominal pain and fever 3 months after her operation. In the three remaining cases, the thrombosis was an ultrasonographic surprise in a totally nonsymptomatic patient at 2, 3, and 4 months after splenectomy, respectively.

Systemic heparinization was established in all cases of documented thrombosis, followed by warfarin treatment for ≥ 6 months. This treatment was successful in reversing the clot in three patients (all belonging to the group diagnosed in the early postoperative period); in three it remained stable, whereas in the other three it progressed and eventually developed a portal cavernoma. In two patients with a postoperative platelet count $> 1,000,000$, repeated sessions of plasma exchange therapy were also used.

Data from our patient group with reference to postoperative development of thrombosis in the portal system are shown in Table 1. There was no significant difference between patients who developed the compli-

Table 1. Patient characteristics and relationship with occurrence of portal system thrombosis

	Absence of thrombosis in the portal system (<i>n</i> = 31)	Presence of thrombosis in the portal system (<i>n</i> = 9)	<i>p</i> value
Age (yr)	44.3 \pm 22.3	55.0 \pm 19.6	0.2 NS
Male sex	14	5	0.7 NS
Body mass index	24.3 \pm 6.0	24.9 \pm 3.4	0.8 NS
Spleen weight (kg)	1.1 \pm 0.7	2.4 \pm 1.4	0.0005 ^a
Operating time (min)	190 \pm 70.8	208 \pm 46.9	0.5 NS
Preoperative platelet PLT count ($\times 1000$)	192.4 \pm 157.7	251.8 \pm 190.0	0.3 NS
Postoperative platelet PLT count ($\times 1000$) (3 rd d)	208.4 \pm 280.4	275.0 \pm 163.6	0.3 NS
HALS	7	5	0.3 NS

HALS, hand-assisted laparoscopic surgery

^a Significant at *p* < 0.01

Table 2. Relationship between weight of removed spleens and portal system thrombosis

	Absence of thrombosis in the portal system (<i>n</i> = 31)	Presence of thrombosis in the portal system (<i>n</i> = 9)	<i>p</i> value
< 500 g	3	0	1.0 NS
500 g–1 kg	15	0	0.06 NS
1–2 kg	10	5	0.5 NS
> 2 kg	3	4	0.08 NS

cation and those who did not in terms of age, sex, BMI, operating time, pre- or postoperative platelet count, or surgical technique (HALS vs no HALS). Comparison of the two groups (those who developed thrombosis vs those who did not) showed that the only significant factor was a spleen weighing on average 2.4 ± 1.4 kg. Table 2 shows the relationship between the weight of the removed spleens and the development of portal system thrombosis. Not surprisingly, the larger the spleen, the higher the risk to develop this complication. Although no statistically significant threshold could be identified within our small series of patients, it is noteworthy that all of the thrombotic episodes occurred after the removal of spleens that weighed > 1 kg. In addition, of four patients with a platelet count $> 251,000$ and a spleen weight ≥ 1 kg, three (75%) developed postoperative thrombosis in the portal system.

Analysis of the various indications for splenectomy vis-avis the respective occurrence of thrombosis in the portal system showed that no specific disease in this series was correlated with the postoperative occurrence of this event. Nonetheless, a relative prevalence of myeloproliferative disorders among our patients (22/40) was noted.

Two patients underwent laparoscopic reoperation to control postoperative bleeding, but none required transfusion. The postoperative hospital stay for patients without symptoms of thrombosis was 4.9 ± 2.8 days.

When this diagnosis was made before discharge, the mean stay was prolonged to 17.7 ± 12.5 days.

Discussion

Venous thrombosis in the portal system has occasionally been described after open and laparoscopic splenectomy [2, 3, 14, 17]. Because many patients remain asymptomatic, the true incidence of this complication may have been underestimated. Chaffanjon et al. reported a 7% incidence of portal vein thrombosis in a consecutive series of 60 splenectomies studied systematically with Doppler ultrasonography before and after operation [3]. The same incidence was found by Petit et al. in a series of 119 splenectomies [11], and similar figures were reported by Winslow et al., who encountered an 8% rate of this complication in a series of 101 patients [17]. The incidence of thrombosis observed in our patients (22.5%) is much higher than that reported in these series. However, it can perhaps be explained by considering four relevant factors specific to this study:

- In the first place, the high proportion of very large spleens weighing > 1 kg (22/40);
- Second, the elevated number of patients with underlying myeloproliferative disorders (18/40) (both factors are known to be associated with postoperative thrombosis [3]);
- Third, whereas most of the other investigators focused only on thrombosis of the portal vein (12.5% incidence in our patients), we also recorded—and managed—any thrombosis occurring in branches of the portal system (splenic, superior mesenteric, or portal vein);
- Finally, the diagnostic role played by routine postoperative ultrasonographic assessment, which enabled the detection of thrombosis in totally asymptomatic patients. Indeed, in another retrospective review of splenectomies for myelodysplastic disorders, a 50% incidence of portal vein thrombosis was found on postoperative imaging studies [9].

Our analysis showed that spleen weight was the sole significant factor predictive of postoperative thrombosis. This finding is in accord with previous multivariate analysis [10] showing that patients with spleens weighing > 1 kg were 14 times more likely to develop postoperative complications, including thrombosis. One possible explanation for this phenomenon is the rapid drop of flow in a large splenic vein that occurs after surgical occlusion of this vessel, combined with the usual rebound in the platelet count, which is expected to be proportional to the volume of the removed spleen. These two factors, alone or in combination, have the potential to initiate the formation of a thrombus.

Moreover, experimental evidence [7] suggests that the combination of carbon dioxide pneumoperitoneum with the head-up tilt, which is sometimes necessary to complete a laparoscopic splenectomy, results in a sig-

nificant decrease of portal vein blood flow, which will further reduce the velocity of blood cells in the splenic vein. The extent of the reduction in volume flow is related to the level of intraperitoneal pressure [5]. Although these observations could suggest a theoretical role for the laparoscopic approach in initiating the thrombosis in the portal system, the occasional late occurrence of this complication—weeks or even months after surgery—points instead to a multifactorial origin.

The elevated platelet count does indeed represent a major risk factor. Thrombocytosis is frequently encountered in hematologic patients who are candidates for splenectomy, and a significant rebound in the platelet count is usually seen after operation. The risk of a thrombotic event is particularly elevated when the count is $> 1,000,000$. In this circumstance, plasma exchange therapy is indicated. Frequent monitoring of platelet levels is therefore advisable in the weeks that follow a splenectomy, particularly in patients with preoperative thrombocytosis, for the early detection and management of this dangerous condition. A more aggressive perioperative anticoagulation prophylaxis with low-molecular-weight heparin and the subsequent long-term use of antiplatelet drugs is also advisable in these patients.

The need to enroll these subgroups of high-risk patients in a postoperative program of close observation—clinical, ultrasonographic, hematologic—is at variance with the current attitude that laparoscopic surgery enables patients to go home a few days after their procedure. We believe that an outpatient surveillance program should be offered to patients along with the option of laparoscopic treatment. Although most of the thrombotic episodes in this series were diagnosed within 10 days after operation, when close attention to patient outcome is most necessary, the possibility of a late occurrence, even as late as 4 months after the splenectomy, can only be obviated by a much longer postoperative surveillance.

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