Laparoscopic splenectomy in benign splenic lesions: Tanta University experience

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Background
Elective splenectomy is a surgical treatment for a wide range of diseases, including unexplained splenomegaly, autoimmune, malignant, hereditary, and congenital disorders.
Aim
The aim was to evaluate the outcomes of laparoscopic splenectomy (LS) in different benign splenic disorders.
Materials and methods
This prospective cohort study was conducted on 40 patients prepared for splenectomy in the Gastrointestinal, Liver and Laparoscopic Surgery Unit, General Surgery Department, Tanta University Hospitals, through 2 years. The authors included all patients with age more than 18 years with benign splenic lesions with splene size up to 24 cm. The authors excluded all patients with suspicion of malignancy.
Procedure
LS with posterolateral approach was performed.
Conclusion
LS is a safe procedure in the treatment of benign splenic lesions.

Keywords:
benign, laparoscopic, splenectomy

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Introduction

Open splenectomy (OS) has been performed for hypersplenism since 1950, but it is excessively invasive in terms of blood loss and wound pain. For patients with hypersplenism who have poor liver function, splenectomy is associated with high rates of morbidity and mortality [1].

Laparoscopic splenectomy (LS) has rapidly become the surgical approach of choice for patients who require elective splenectomy in the treatment of hematologic disorders, as LS has less postoperative pain, a shorter length of hospital stay, and faster recovery when compared with patients undergoing OS [2].

The advancement in medical technology had led to the use dissecting and hemostatic vessel sealing tools in the laparoscopic procedures such as, LigaSure produced by Covidien (Massachusetts, United States) and HARMONIC scalpel produced by Ethicon (Somerville, New Jersey, United States). As they operate on the basis of ultrasound wave vibrations that are transmitted from it to the tissue causing cutting and hemostasis simultaneously, making the laparoscopic operations easier and dereasing the operative time [3].

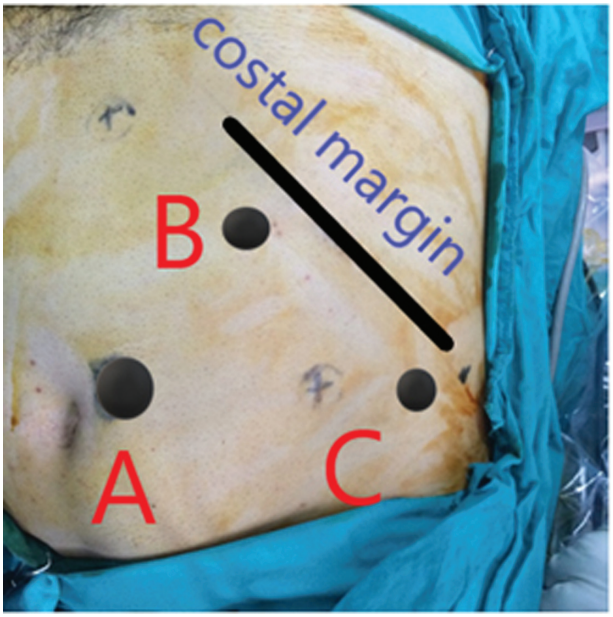
Materials and methods

This prospective cohort study was conducted on 40 patients prepared for splenectomy in the Gastrointestinal, Liver and Laparoscopic Surgery Unit, General Surgery Department, Tanta University Hospitals, from January 2017 to January 2019. The study was approved by Research Ethics Committee of Faculty of Medicine, Tanta University. A detailed informed consent, with guarantee of confidentiality, was obtained from all participants. We included all patients with age more than 18 years with benign splenic lesions with splenic size up to 24 cm. We excluded all patients with suspicion of malignancy.

All 20 patients underwent LS through the posterolateral approach.

The incision of initial 12 mm trocar was made on the left side of the umbilicus off the midline. A 5–12 mm visiport was introduced, and CO_2 pneumoperitoneum was achieved, followed by introduction of the 30′ camera. A 5 mm port was positioned below the costal margin on the left hypocondrial region depending on the size of the spleen for the left working hand. A 12 mm port was placed along the anterior axillary line in the left subcostal region for the right working hand. The fourth trocar was usually introduced upon needed (Fig. 1).

Fig. 1



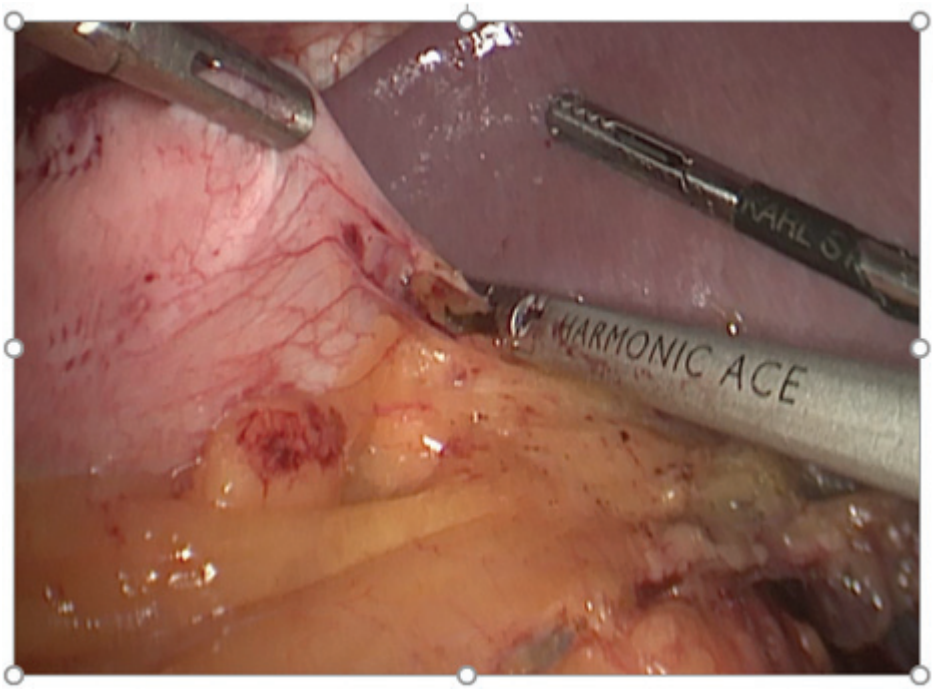
Port sites: (a) 12-mm port site for cameraman just on the left side of the umbilicus off the midline; (b) 5-mm port site in the left hypochondrial region below the costal margin; (c) 12-mm port site along the left anterior axillary line.

Dissection of the splenocolic ligament was commenced inferiorly by mobilizing the splenic flexure of the colon with the introduction of the final 5 mm trocar. Dissection of the splenic hilum was commenced from the lower pole and was carried out. Once entry into the lesser sac was facilitated, short gastric vessels could be controlled by applications of clips (either metallic or hemo-clips) then divided by the LigaSure produced by Covidien or HARMONIC scalper produced by Ethicon. Then splenic pedicle was well exposed and could easily be accessed (Fig. 2). Many ways were used to control hilar vessels. In some cases, clips and sutures were applied. Individual hilar vessels were isolated and controlled by clips or tie sutures before division (Fig. 3). Pfannenstiel incision was done for extraction of the large spleen owing to the long axis of the spleen. Blood collection bag was fashioned as retrieval bag for some cases (Fig. 4).

Outcome measurements and statistical analysis

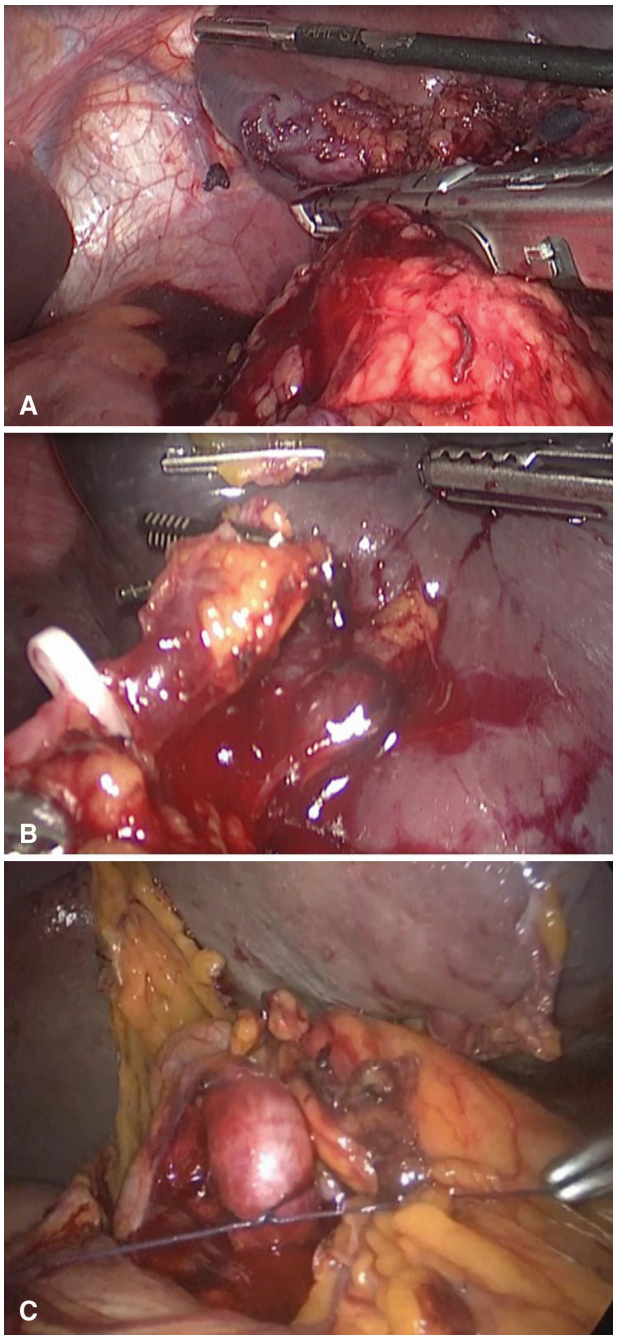
All data were demonstrated as mean±SD, range and median, or percentages. Statistical analysis was carried out using χ^2 tests. *P* value was significant if less than 0.05.

Fig. 2



Entry of the lesser sac by HARMONIC scalper.

Fig. 3



Different ways for splenic hilar control: (a) endovascular stapler, (b) hemoclip, and (c) tie intracorporeal ligation.

Results

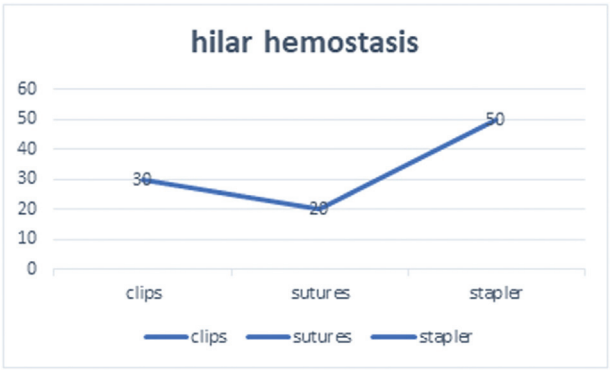
Preoperative data

A total of 40 patients were included, comprising 24 (60%) males and 16 (40%) females. Their age ranged from 19 to 51 years, with a mean age of 34.05 years. The selected 40 patients were diagnosed preoperatively: 10 cases with autoimmune hemolytic anemia (25%), eight (20%) cases with hypersplenism owing to portal hypertension, and 22 (55%) cases with immune thrombocytopenic purpura. The size of the spleen was measured preoperatively by ultrasound. The size ranged from 9 to 24 cm, with a mean±SD of 16.5 ±2.83 as described.

Fig. 4

Retrieval of the spleen through Pfannenstiel incision.

Fig. 5



Variation in splenic hilar control.

Intraoperative Data

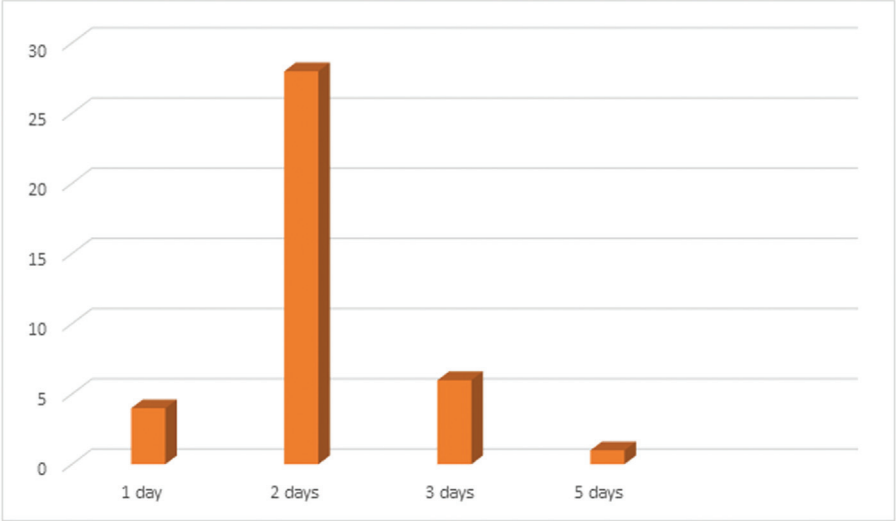
The operative time from skin incision to skin closure ranged from 80 to 140 min, with a mean±SD of 110 ±11.37 min. Intraoperative blood loss ranged from 50 to 700 ml, with a mean of 200±150.4 ml. Regarding blood transfusion, four of our patients received 2 blood units intraoperatively. Six patients received 12 units of platelet, eight patients received 18 units, and eight patients received 24 units, whereas 18 patients had not received any platelets intraoperatively.

Splenic hilum control was done by the endovascular staplers in half of the studied cases (50%), and in eight cases, intracorporeal ligation was performed (20%), and 12 cases were controlled by hemoclips, as demonstrated in Fig. 5.

Regarding the extraction of the spleen, one case was converted to OS, where the spleen was 11 cm (2.5%).

Seven cases were extracted from the port site by extraction bag, where the spleen size was 9 cm.

Fig. 6



Postoperative hospital stay.

In the other 32 cases, the spleen was extracted through Pfannenstiel incision where the spleen size ranged from 13 to 18 cm, with a SD of 2.83 (85%).

Postoperative data

Postoperative hospital stay ranged from 1 to 5 days. Overall, 28 (70%) cases were discharged after 2 days, four (10%) cases were discharged after 1 days, and six (15%) cases were discharged after 3 days, and two (5%) cases were discharged after 5 days, as described in Fig. 6.

In the first 24 h postoperatively, drain output ranged from traces to 150 ml bloody serosanguinous discharge, with a mean of 75 and a SD of 35.36, as shown in Fig. 7.

Two of our studied patients presented postoperatively with portal vein thrombosis (5%).

Discussion

The most common underlying diagnosis in our study was Ideopathic Thrombocytopenic Purpura (ITP), which matches with Pattenden *et al.* [4], who performed their study on 104 cases with benign splenic diseases, where 68 (65%) cases were ITP, five (4.8%) cases were autoimmune hemolytic anemia, and one (0.2%) case of hypersplenism.

The mean operative time was 110 min. Podevin *et al.* [5], performed their study on 84 patients with a mean operative time of 130 min. Indications were hereditary spherocytosis (57 patients), idiopathic thrombocytopenic purpura (16 patients), lymphomas (four patients), sickle-cell disease (three patients), and miscellaneous (four patients).

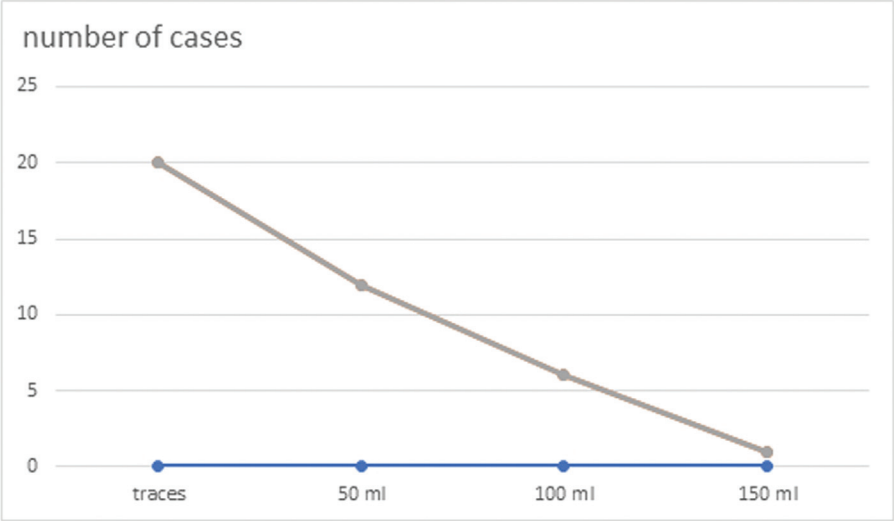
In our study, the mean intraoperative blood loss was 200 ml. Zhe *et al.* [6], performed their study on 80 patients with a mean blood loss of 191 ml. Shin *et al.* [7], also performed their study on 22 patients with a mean blood loss of 720 ml for moderate splenomegaly and a mean blood loss of 600 ml for massive splenomegaly for 26 patients.

Regarding blood transfusion intraoperatively, four cases received 2 units of packed red blood cells (1000 ml). This finding matches with the study done by Bai *et al.* [8] who performed their study on 58 patients, where two patients only received blood units (3.4%) with a mean blood loss of 200 ml with SD of 34.5. This also matches with the study by Fathi *et al.* [9], which was performed on 40 patients, where only four patients of ITP received intraoperative blood transfusion (10%).

Several methods of hilar hemostasis were performed. In half of the selected cases, we used the endovascular staplers (50%), and in eight cases., intracoropreal ligation was performed (20%) and 12 cases were controlled by hemoclips (30%). In cases with tie sutures, selective splenic hilum dissection was done. Splenic vein was ligated individually, with the branches of the splenic artery being separated, and each one was ligated.

This is matched with Uranüs [10], who reported using endoscopic vascular staplers for hilar dissection in 89 patients who underwent laparoscopic total splenectomy,

Fig. 7



Postoperative drain amount in the first 24 h.

within their cohort of laparoscopic total or partial splenectomy. They stated that performing hilar resection with endoscopic vascular staplers and 60 mm cartridges was quite faster, safer, and more effective as compared with using hemolock clips.

Gajbhiye *et al.* [11], observed the use of vessel sealer with shorter operative time and blood loss with the use of LigaSure produced by Covidien.

Shabahang *et al.* [12], studied 20 patients who underwent laparoscopic spleenectomy using clip ligation and 20 patients using LigaSure produced by Covidien and concluded that hemostasis is simply and easily achieved with little dissection using the LigaSure.

One case was converted to OS (2.5%). This was a 28-year-old female patient with ITP with splenic size 11 cm. She received 3 units of pletelets intraoperatively before skin incision. Blood loss was ~700 ml, and she received 2 units of packed red blood cells during the operation. After the use of endovascular stapler, there was uncontrolled bleeding from the pancreatic tail, which could not be controlled laparosopically. Subcostal incision was done, and the spleen was removed, repair of the pancreatic tail was done, splenic bed drain was inserted with another pelvic drain, and the wound was closed in layers. In the postoperative follow-up, no detectable pancreatitis or pancreatic fistula was detected.

Vecchio *et al.* [13], performed their study on 107 cases, in 13 of which LS was converted to open procedure. Causes for conversion included in 10 cases invasion of the splenic malignant disease to surrounding structures (diaphragm, pancreatic tail, stomach, and splenic flexure) and in four patients intraoperative bleeding.

This matches with Zafar H *et al.* [14], who perfomed their study on 103 patients, with only four patients converted to open owing to bleeding (3.8%).

In the study done by Boone *et al.* [15], on 26 patients admitted for laparoscopic spleenectomy, eight cases were operated with single incision and 18 cases with conventional laparoscopic spleenectomy, with five cases were converted to open spleenectomy with standard laparoscopic spleenectomy.

Thirty-two cases were extracted from Pfannenstiel incision, and the spleen size ranged from 9 to 18 cm, with a mean of 12.5 (85%).

Tsamalaidze *et al.* [16], reported that it is difficult to place the spleen into a retrieval bag intracorporeally in cases of enlarged spleen. For that reason, it is better to retrieve the specimen through an accessory incision.

Habermalz *et al.* [17], suggested extracting an intracorporeally fragmented spleen through a Pfannenstiel incision without using an endobag. This method is not accepted widely owing to the risk of developing splenosis. Owera *et al.* [15], reported that extraction of the specimen through a small incision prolongs the operation time by a median of 47 min.

The mean postoperative hospital stay was 2.2±0.83 days. Twenty-eight (70%) cases were discharged

after 2 days, four (10%) cases were discharged after 1 day, six (15%) cases were discharged after 3 days, and two (5%) cases were discharged after 5 days. Long hospital stay in the two cases was due to close follow-up of drain amount after intraoperative blood loss of more than the usual amount, and this led to delayed removal of tha abdominal drain.

In the study done by Tsamalaidze *et al.* [16], who performed LS for 27 patients with a mean hospital stay of 3 days,it is noticed that there was a significant relationship between drain amount and hospital stay. Cases with drain amount of 50 ml and traces were discharged home within 2 days, whereas cases with 100 ml bloody serosanguinous discharge in the first 24 h which showed traces in the drain in the second postoperative day were discharged on the third day. The only case with drain amount of 150 ml in the first day showed 100 ml serosanguinous discharge in the second day then traces in the third day and the patient was discharged in the fifth day.

Two cases of this study presented postoperatively with portal vein thrombosis (5%). The first case was diagnosed preoperatively as ITP and discharged postoperatively within 2 days on prophylactic dose of aspirin two tablets once daily. After 1 month, the patient came to our outpatient clinic experiencing abdominal pain. The ultrasound showed homogenous thrombus occupying the portal vein with picture of portal vein thrombosis, and the CBC showed thrombocytosis with platelet count of 1 000 000/cm^3. The patient received anticoagulant in the form of enoxaparin 80 international unit subcutaneously twice daily and warfarin 5 mg was started with close follow-up after that.

The second case was diagnosed preoperatively as hypersplenism, and the patient was discharged postoperatively within 2 days on aspirin 75 mg two tablets daily. The patient presented to the outpatient clinic after three weeks with abdominal pain and vomiting. The platelet count was 2 000 000/cm^3 and the ultrasound showed complete thrombosis of portal vein and the splenic vein. The patient admitted that he did not receive the recommended antiplatelet drug. The patient was instructed to receive enoxaparin 60 international unit twice daily and Hydra once daily, and the patient did not show up to our outpatient clinic in the recommended appointment.

Vecchio *et al.* [18], reported that laparoscopy has been evaluated as a risk factor for postoperative portal vien thrombosis (PVT) in patients whose spleen is removed by this mini-invasive approach, as it reduces blood flow in the portal system veins during the performance of the procedure, owing to the pneumoperitoneum. Kuroki *et al.* [19], performed their study on 56 patients who underwent laparoscopic spleenectomy. A total of 30 patients developed PVT (53.6%). The formation of splenic vien thrombosis (SVT) was associated with portal or splenic vien thrombosis (PSVT). However, the precise mechanism underlying the development of PSVT is unclear. A dilated splenic vein may be related to the induction of PSVT after LS owing to decreased blood flow, blood stasis, and blood turbulence. This study showed that a splenic vein diameter greater than 10 mm is a predictor with high sensitivity and high specificity for PSVT after LS. Evaluating the preoperative splenic vein diameter on enhanced computed tomography is useful for detecting patients at high risk of developing PSVT after LS.

Pietrabissa *et al.* [20], reported that spleen weight was the sole significant factor predictive of postoperative thrombosis. This finding is in accordance with a previous study done by Patel *et al.* [21], which showed that patients with spleens weighing greater than 1 kg were 14 times more likely to develop postoperative complications, including thrombosis.

Ikeda *et al.* [22], reported 22 patients who underwent laparoscopic spleenectomy for different etiologies. Portal vein thrombosis was detected in 12 (55%) patients. A possible reason for the high incidence of PSVT is the surgical technique itself. The two major differences in the operative technique between laparoscopic and OS in this study were pneumoperitoneum and ligation of splenic hilar vessels. In the OS group, splenic hilar vessels were ligated conventionally, whereas these vessels were divided with an endoscopic vascular stapler in the LS group. Previous studies showed that pneumoperitoneum may cause a hypercoagulable state during laparoscopic surgery. Changes in intraabdominal pressure during splenectomy decrease portal vein blood flow and induce stasis. Both stasis of venous flow and resulting congested coagulation factors may induce PSVT.

All cases with portal thrombosis received anticoagulant therapy through intravenous infusion or subcutaneous heparin. All patients received anticoagulant therapy with warfarin; the dose was adjusted to achieve an international normalized ratio between 1.5 and 2.0 until resolution of PVT.

Conclusion and recommendations

LS is a safe way for benign splenic lesions. We recommended the use of endovascular stapler as an easy method for splenic hilar control, and with increased experience, the intracoropreal ligation and suturing are usually used. For extraction, Pfannenstiel incision is the safest extraction with good cosmetic outcome. The use of the postoperative fast-track protocol has a good role in enhanced recovery and shorter hospital stay. We also recommended a low dose of antiplatelet drug to avoid portal vien thrombosis combined with selective ligation of splenic vein branches.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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