Using saline bags instead of commercial retrieval bags to reduce the cost of splenic retrieval after laparoscopic splenectomy

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BACKGROUND*: Laparoscopic splenectomy (LS) is considered the gold standard treatment in adults with idiopathic thrombocytopenic purpura (ITP) refractory to medical therapy. However, the retrieval of the spleen in LS is still a technical challenge, despite the use of various commercial retrieval bags. This study reports the feasibility and reliability of using a saline bag for spleen retrieval in a reduced port splenectomy.*
METHODS*: Between 2007 and 2020, 55 consecutive patients underwent LS for ITP. Data were collected retrospectively. To retrieve the spleen, a 1 liter sterile saline bag was used.*
RESULTS: *Fifty-five patients underwent LS. There was only one complication related to the saline bag: an iatrogenic ileal injury during the morselization process.*
CONCLUSION: *One-liter saline bag is feasible, and widely available. No additional instruments or cost is required and there is no need to extend the wound for spleen retrieval during LS.*

KEY WORDS: Idiopathic thrombocytopenic purpura, Laparoscopic surgery, Splenectomy, Techniques

Introduction

Since its first description in 1991, the indications for laparoscopic splenectomy (LS) have increased to include benign and malign hematological diseases, hemangiomas and angiosarcomas of spleen, metastasis, primary melanoma, splenic abscesses, cysts, and trauma [1-4].
Currently, LS is considered the gold standard treatment in adults with idiopathic thrombocytopenic purpura (ITP) refractory to medical therapy [1-3,5]. Advantages of LS over open approach include shorter hospital stay, technical safety, reduced costs, less postoperative pain, fewer respiratory complications, lower risk of incisional hernia, and better quality of life [6-9].
Significant progress in laparoscopic skills and advances in surgical instruments have motivated surgeons to reduce invasive procedures. To this end, single port access splenectomy (SPAS) and reduced port access splenectomy (RPAS) techniques were introduced as modifications of original procedure [10,11].

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ABBREVIATIONS

BMI: Body mass index
CT: Computed tomography
LS: Laparoscopic splenectomy
ITP: Idiopathic thrombocytopenic purpura
RPAS: Reduced port access splenectomy
SPAS: Single port access splenectomy

Although LS is clearly considered procedure of choice based on published trials, retrieval of spleen in LS is still a technical challenge [6,7]. Although laparoscopy is also reliable and feasible in patients with splenomegaly, despite use of plastic bags, excessive incisional extension is frequently required to remove larger spleens, negating benefits of minimal access surgery [12,13]. To avoid this, transvaginal extraction of spleen laparoscopically or use of a liposucker and electromechanical morcellator have been introduced [14-16]. Commercial bags used for retrieving spleen in LS include EndoCatch II™ (Autosuture; London, UK), EndoCatch II (Covidien; Mansfield, MA), E200 (Espiner Medical; Bristol, UK), and a reinforced oversized plastic endobag (Cook Medical; Bloomington, IN) [14,17-19]. The ideal endobag should be reinforced so that it is difficult to perforate, suitable for large spleens, does not prolong operating time due to poor maneuverability, and is inexpensive. Unfortunately, improvements in technology are still required.
This study reports feasibility and reliability of a reduced port splenectomy using a saline bag for spleen retrieval. To the best of our knowledge, this is the first reported use of a saline bag to extract splenic tissue in LS.

Materials and Methods

Between November 2007 and November 2020, 55 consecutive patients underwent LS for ITP performed by a single surgeon in Department of General Surgery at Istanbul University, Cerrahpasa Medical Faculty. Collected data included the age, gender, body mass index (BMI), duration of hospital stay, time to resumption of diet, operating time, postoperative complications, and intra-operative iatrogenic injuries were collected retrospectively.
Contraindications to LS included patients who had concomitantly undergone another major surgery, patients with portal hypertension, severe cardiopulmonary disease, ascites, and traumatic injuries to spleen. Spleens extending to the midline or entered pelvis were inappropriate for laparoscopic approach and excluded from the study. Indications for surgery included symptomatic patients who were refractory to steroid therapy or relapsed on interrupting medical treatment qualified for surgery. Splenectomy was also indicated if toxic doses of steroids were required to achieve an adequate platelet count or if platelet count decreased when corticosteroid dose was tapered. Other indications for surgery included obvious bleeding or bleeding tendency due to thrombocytopenia (platelet count < 30×10^9/L) in patients with ITP was an indication for LS.
Preoperative splenic embolization was not used in any patient. Preoperative contrast-enhanced multi-detector computed tomography (CT) of abdomen and pelvis was performed routinely in all cases to determine spleen size, to detect presence of accessory spleens to remove during surgery, and to obtain information about vascular anatomy.
All the patients were vaccinated against *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Neisseria meningitidis* 2 weeks before surgery to protect against post-splenectomy sepsis and lifelong potential increased risk of bacterial infections. Antibiotics were started during induction of anesthesia and continued until 2 days after surgery.
To retrieve spleen after LS, a 1 L sterile saline bag was used instead of a commercial retrieval bag. Operating time was measured from beginning of first incision to skin closure. Patients were allowed to ambulate four-hour after surgery and resume a liquid diet the morning of the postoperative day.

Technique

Under general anesthesiapatient was placed in right semilateral decubitus position (left flank elevated 45° above operating table). Surgeon stood on patient's right side, and camera assistant stood on the surgeon's left side.

Fig. 1: Operative view of trocar placement for the reduced port access splenectomy.

Fig 2: How the saline bag was cut assymetrically. Red line is front edge, yellow is back edge.

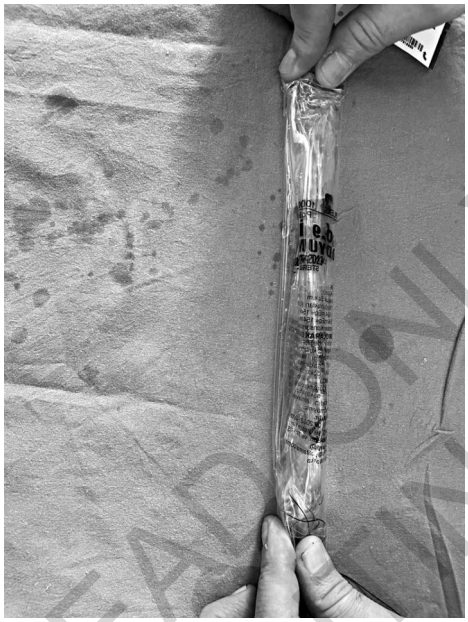

Fig. 3: How the saline bag was rolled along axis.

Fig. 4: Rolled bag exteriorized from the 10 mm trocar site

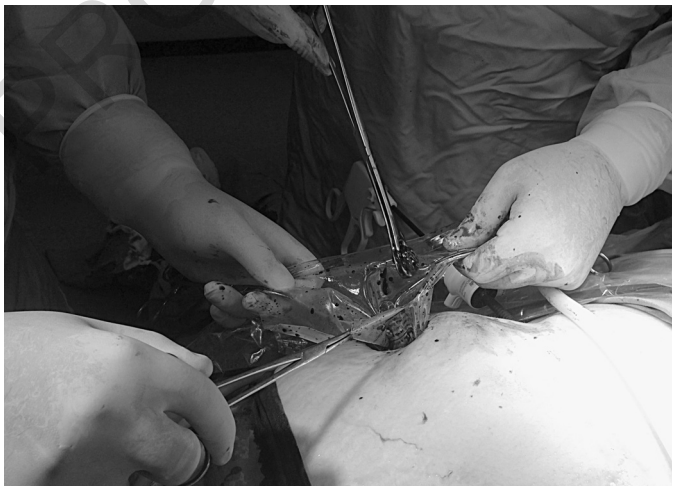

Fig. 5: Morselization procedure.

First assistant was positioned on patient's left side. LS was performed using one 5-mm and two 10-mm ports. A 10-mm 30° laparoscope was used for visualization. Pneumoperitoneum was created with the use of the verres neddle inserted 2 cm below the middle of the left costal margin Water drop and air tests were performed. Then abdomen was insufflated to 12 mmHg of CO_2. Following removal of Veress needle, a 11-mm trocar (Auto Suture, Versaport™ Plus V² 11 mm), which was used for 30° camera, was inserted 3 cm above umbilicus and 5 cm to left of midline. A 11-mm trocar for laparoscopic LigaSure™ Hand-activated Sealer/Divider (Covidien, Mansfield, MA) was placed in left flank under camera visualization. This port was also used for retrieving spleen with the saline bag. Finally, a 5-mm trocar (Auto Suture, Versaport™Plus V² trocar) for laparoscopic clinch grasper to expose splenic hilum was placed in midline subxiphoid area (Fig. 1).

Following careful intra-abdominal exploration to locate accessory spleens elsewhere in peritoneal cavity, an anterior or posterior approach for LS was performed according to surgeon's preference, depending on current situation. After liberating spleen from all attachments, spleen was moved away from left diaphragmatic dome by tilting operating table to patient's right, revealing convex surface of spleen.

A 1L sterile saline bag (dimensions were 17x8cm) was taken on the nurse table. Access end of the saline bag was cut assymetrically and content was emptied (Fig. 2). Then the bag was rolled over itself along its long axis (Fig 3) then inserted through the incision of 11-mm-wide port in left flank after removing the trocar. After insertion of the saline bag, the trocar was re-introduced. The saline bag was un-folded in the abdomen. Due to its thicker material than other commercial bags and asymmetrically cut orifice, it remains unfolded in the abdomen by itself. Spleen was manipulated into saline bag with help of positioning operating table in slight Trendelenburg position while holding only one side of the bag's orifice. Hilar connective tissue was always used for manipulating. A purse-string was not used on the bag. Once spleen was in saline bag, opening of the bag was pulled through the 11-mm port site in left flank and the port was removed (Fig 4). Pneumoperitoneum was released. Mouth of bag was exteriorized and spleen was morselized by inserting ring forceps before complete extraction (Fig. 5). A laparoscopic suction device was used to remove individual fragments. There was no need to enlarge the 11-mm port in left flank to accommodate saline bag inlet. Although it was not very effective, saline bag could be visualized during morselization and extraction to check if there was any leakage from the bag. Saline irrigation was used for a final check of hemostasis. To check for postoperative bleeding or pancreatic leakage, a negative pressure flat silicon drainage tube was placed in left subphrenic area via 11-mm port in left flank. 11-mm port sites were closed in layers with 0 Polyglactin. Nasogastric tube and urinary catheter were removed on completion of operation. Drain tube was removed next day of the operation if drainage volume was <50 mL, and in absence of pancreatic leakage or suspicion of post-operative bleeding.

Results

Fifty-five patients (28 males, 27 females) underwent LS for ITP between November 2007 and November 2020. Their average age was 47.5±15.8 years and average BMI was 27.2±4.0 kg/m^2. One patient, surgery was converted to open due to laparoscopically uncontrollable bleeding from splenic vessels, excluded from the analysis.
Median spleen size on CT was 13 (range 8.5–18.5) cm in the longest dimension. All patients were operated on using three ports (two 10 mm and one 5 mm); none required an additional trocar to complete operation. Median estimated perioperative blood loss was 190 (range 100–1900) mL. Four patients required blood transfusions during surgery, to a maximum of two units of red blood cells. Mean operating time was 61.7±12.9 (range 45–85) min. Mean postsurgical stay was 4.3±1.9 (range 2–8) days. All of patients were started on a soft diet on first postoperative day.

All of patients underwent splenic retrieval with a 1 L saline bag. One patient (1.8%) had bleeding in immediate postoperative phase, which was detected as acute bleeding by anesthesiology staff while the patient was in post-anestehsia care unit of the OR and the patient was taken to operating table for exploration. Following an urgent mini-laparotomy, it was seen that slippage of metal clips and insufficient vessel sealing with LigaSure™ had caused this situation. There was only one (1.8%) complication related to the saline bag: an iatrogenic ileal injury during morselization process. This unfortunate complication was diagnosed by observed small intestine content from the drainage tube on the post operative second day, and was treated with segmental resection and an end-to-end anastomosis laparoscopically. Early postoperative complications included subphrenic fluid collection in two cases, bronchopneumonia in one case, and a pleural effusion in one case. None required percutaneous drainage or reoperation. No pancreas-related complications, such as pancreatitis, pancreatic fistula, or subphrenic abscess, were observed in any patient. There was no mortality in patients. At a median follow-up of 36 (6–72) months, none of patients had developed recurrent thrombocytopenia.
Logistic fit analysis was used to investigate risk factors for postoperative complications, including age, gender, BMI, and spleen size. There was no significant association between these independent factors and occurrence of postoperative complications (p>0.005). In addition, there was no significant correlation between operating time and occurrence of postoperative complications (p=0.89).

Discussion

Many trials comparing open splenectomy and LS have demonstrated that laparoscopic approach is superior to open technique. Currently, LS has gained wide acceptance as choice for almost all spleen-related diseases requiring splenectomy[20-22]. Spleen size is an important factor in decision of laparoscopic or open splenectomy. In patients with a spleen of more than 1000 g, LS has higher conversion rates, a longer operating time, higher complication rate, and greater blood loss than open technique[23,24]. However, Smith et al.[25] reported minimal blood loss and decreased morbidity in LS with spleens weighing 410–3100 g. This reinforced our decision to use 1 L saline bags.
Bleeding, which is a reason for conversion or second-look surgery, is the most common intraoperative complication during LS, reported incidence is 1.9–20% [7. 26]. To reduce risk of bleeding during LS, we suggest ligating splenic artery first and then vein securely using laparoscopic metal clips proximal to hilum (double clips close to tail of pancreas and a single clip close to hilum). Then we transect these vessels using LigaSure™, which is

also used to transect secondary pedicular vessels. In obese patients, we prefer a posterolateral approach, which enables us to see back of hilum when transecting vessels.

Yet no small intestine injury has been reported in LS [27]. Unfortunately, we experienced a small intestine injury in one patient during morselization of the spleen.

There are other techniques to morcellate and facilitate spleen removal other than our simple method.. Although, intracorporeal bags are used widely, extension of port side by creating an enlarged incision,hand-assisted incision, small midline incision, or a transvaginal approach in females are frequently required, negating benefits and philosophy of minimally invasive surgery [16,28]. Hashizume et al. [29] used an electromechanical morcellator to remove spleen, which they put in a nylon sack. However, Jiang et al. [14] had concerns about this technique; they thought that morcellator might break the sack, which might lead to splenosis, or that morcellator might injure organs or tissues surrounding sack. Consequently, they developed an improved electromechanical morcellator (TSCS; Hangzhou, China) with a motor-driven cutting tube that could be inserted directly into abdominal cavity through a 12-mm port. They concluded that their instrument could remove splenic tissue safely without use of an endobag or an enlarged or hand-assisted incision. However, they did not mention associated costs.

EndoCatch II is a polyurethane plastic bag suitable for a 15-mm trocar. As it is made of polyurethane, there is a potential risk of perforation during morselization phase. In addition, although it is easy to operate, there are still placement problems for spleens larger than 15 cm in cross-section. To overcome this, E200 bag was introduced. It is reinforced, as it is manufactured from ripcord nylon used for parachutes, and is suitable for enlarged spleens. As it is larger, deployment is more difficult. Zacharoulis et al. [19] compared the two commercial endobags in their patients and concluded that EndoCatch II had size limitations and poor tensile strength. They reported two EndoCatch II perforations in 45 patients and could not deploy the bag in another two cases.

They also found E200 retrieval bag to be more difficult and time-consuming to insert, deploy, and manipulate in abdomen, as it was bulky. However, we did not have any difficulty in any of these steps, although we also do not know how much time we spent extracting spleen in proportion to total surgery time. Prospective studies should compare spleen retrieval time with saline bags and commercial endobags to determine feasibility of using saline bags in terms of operating time.

Splenic retrieval after LS remains a technical challenge, especially for large spleens. Different commercial endobags and sophisticated devices might increase operating time and costs. We did not use any of these products in our series. A 1 L saline bag is tougher, thicker, and more robust than commercial endobags. Its capacity is sufficient for removing enlarged spleens.

We believe that a 1 L saline bag is feasible, easy to use, and widely available. It requires no additional instruments or cost and there is no need to extend the wound for spleen retrieval during LS.

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The English in this document has been checked by at least two professional editors, both native speakers of English. For a certificate, please see:
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Riassunto

La splenectomia laparoscopica (LS) è considerata il trattamento gold standard negli adulti con porpora trombocitopenica idiopatica (ITP) refrattaria alla terapia medica. Tuttavia, il recupero della milza ormai liberata con la tecnica laparoscopica è ancora una sfida tecnica, nonostante l'uso di varie sacche di recupero commerciali. Questo studio riporta la fattibilità e l'affidabilità dell'utilizzo di una normale sacca per infusione di soluzione fisiologica per il recupero della milza attraverso il ridotto tragitto di un port.

Metodi: Tra il 2007 e il 2020, 55 pazienti consecutivi sono stati sottoposti a LS per ITP. I dati sono stati raccolti retrospettivamente. Per recuperare la milza è stata utilizzata una sacca salina sterile da 1 litro.

Risultati: Cinquantacinque pazienti sono stati sottoposti a LS. C'è stata solo una complicazione correlata alla sacca salina: una lesione ileale iatrogena durante il processo di morcelizzazione.

Conclusione: la sacca salina da un litro è fattibile e ampiamente disponibile. Non sono richiesti strumenti o costi aggiuntivi e non è necessario estendere la ferita per il recupero della milza durante la LS.

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