Tailored Low-Cost Homemade Retrieval Bag for Laparoscopic Splenectomy,A Valid Option in Resource Limited Settings

Abstract

Background: Laparoscopic splenectomy (LS) is the gold standard technique for patients undergoing elective splenectomy currently. The presence of retrieval bag is essential to extract the spleen from the abdomen whether by crushing or morcellation. Commercial retrieval bags are expensive and often not readily available, especially in resource-limited settings. This work assessed the advantages and efficacy ofhomemade retrieval bags including cost assessment in laparoscopic splenectomy.

Methods: This prospective study included 20 pediatric and adolescent patients less than 21 years old who had LS**.** Demographic data, clinical examination, operative time, retrieval time, hospital stay, and complications were documented. Also, effectiveness of the retrieval bag that was tailored from a sterile endoscopy camera cover.

Results: The mean operative time was 67.25 ± 5.69 min, and retrieval time was 24.2 ± 2.93 min. The mean hospital stays were 1.75 ± 0.72 days. Regarding complications, fever occurred in 4 patients (20%) patients, while port site infection occurred in 2 patients (10%) and bagperforation occurred in 1 patient (5%) patient. This home retrieval bag is significantly showed cost reduction.

Conclusions: Using homemade retrieval bags during LS improves LS efficiency and reduces the length of hospital stays and didn't differ in postoperative complications as compared to commercial bags.

Keywords: Laparoscopic splenectomy, Homemade Retrieval Bag, Hospital stay, Complications.

Introduction:

Splenectomy is established as a therapeutic option for treating benign hematological disorders in children [1]. Open splenectomy is not usually technically demanding, except for the treatment of a massively enlarged spleen [2]. However, open splenectomy requires a large incision in the abdomen to access the left upper quadrant, which can lead to longer recovery times and increased risk of complications [3].

Laparoscopic splenectomy (LS) has gained widespread acceptance as the preferred method over the traditional open procedure [4, 5].

LS was first introduced in 1991 and gained popularity by developing new instruments that facilitated dissection, reduced operative time, and minimized blood loss [6].

The technique of LS has been well described [7]. Subsequent modifications were introduced to the initial procedure, encompassing adjustments to the patient's positioning, trocar placement and size, dissection instruments, and specimen retrieval techniques [8].

One of the most significant technical hurdles in LS is specimen retrieval specially with intraperitonealdissemination or splenosis of the same pathology if not considered carefully[9]. The retrieval of the specimen requires a retrieval bag to prevent spillage and minimize the risk of port-site recurrence. Commercially available retrieval bags are expensive and may not always be readily available. In limited resource settings alternatives are needed to minimize the cost on the health care authorities [10, 11].

No conclusive evidence exists on whether homemade retrieval bags affect clinical outcomes, such as operative time, postoperative complications, and hospital stays in LS [12]. Thus, this work assessed the advantages and efficacy including cost assessment of utilizing homemade retrieval bags in LS.

Patients and Methods:

This prospective study included 20 pediatric and adolescent patients under 21 years old who underwent the anterior approach for LS. The study was done from June 2020 to December 2022 in Tanta University Hospital records after approval from the institutional review board (IBR: 33167/06/19).

Exclusion criteria were trauma and splenic abscess during the period of the study.

All patients underwent history taking, complete clinical examination, and laboratory and radiological investigations.

Assessment of splenic volume was done by ultrasound by measuring splenic length (SL), thickness (ST), and width (SW) [13]. The splenic volume was calculated using the standard ellipsoid formula, which considers the SW, SL, and ST, with the formula 0.524 x SW x SL x ST in cm^3 as described by Poddar and Jagadisan [14].

The available commercial retrieval bags cost around 3000 - 5000 Egyptian pound per unit depending on size and brand of the bag.

Tailoring of the retrieval bag

The homemade retrieval bag utilized in this study was tailored from a commercially available sterile endoscopy camera cover (endoscopic camera protection cover). This flexible, single layer, waterproof and foldable bag. The average cost of this bag in the local market is approximately 100-250 Egyptian pound per unit. The bag's durability and resistance to perforation, crushing and retrieval a piecemeal within the bag make it an effective tool for morcellating the spleen. Specimen retrieval bag was prepared on the operation table. Fashioning a double layer part measures 25 cm in length and has a capacity of more than 1000 ml. The opened upper end that sutured by passing polyglactin (Vicryl) thread about one and half to double diameter between two layers and passing through a minute opening in outer layer then sliding knot fashioned to facilitate closure after entering the spleen inside it. Lower end is fashioned by one transfixion suture for inner layer polyglactin (Vicryl) and

another transfixion suture for both layers. After that the retrieval bag folded and inserted through the 12-mm left lumbar trocar site, laparoscopic instruments were used to open the bag and to push the specimen into the bag. The specimen retrieval bag was extracted at the end of the operation by extending the umbilical port wound or 12-mm left lumbar trocar site. Figure 1 depicted the steps of fashioning the homemade retrieval bag in panel (A-H)

Timing of tailoring: at the start of operation before insertion of first port to avoid loss of time.

Operative technique

LS began with peritoneal access through a 10mm peri-umbilical port inserted through a supraumbilical or infra-umbilical incision. The telescope port was used to visualize the peritoneal cavity and establish a working space. The patient was positioned slightly anti-Trendelenburg with elevation of left side of the patientto allow the colon to fall away from the spleen. We divided the splenocolic ligament, the anterior layer of the lienorenal ligament, and the caudal portion of the gastrosplenic ligament using energy devices to avoid injury to the stomach or short gastric vessels.

Hilum control was achieved by ligasure, harmonic, endovascular clips, individualized each segmental splenic vessel and divided the splenophrenic ligament to expose the posterior layer of the lienorenal ligament. After releasing the spleen, the retrieval bag was transformed into a conical shape and inserted into the abdominal cavity folded then unfolded. The homemade retrieval bag was deployed and positioned in the abdominal cavity, with its opening directed towards the splenic fossa, where the released spleen was placed.

The operative field was adjusted by switching to left lowerquadrant port. With the bag anchored, the lower lip of the bag mouth was tucked under the spleen using a 5-mm grasper, allowing for easy opening of the bag. Another grasper was used to push the spleen into the bag.

Once the spleen was inside the bag, grasping thread of sliding knot through port site opposite the abdominal wall to close the bag, and the edges of the bag were brought out of the abdomen to outside. Babcock Forceps or finger was used to break down the splenic tissue in apiecemeal fashion under vision for easier extraction, A drainage tube wasn't a routine. Figure Pannel 2(A-F)

Enhanced recovery protocol was followed, including early ambulation and removal of nasogastric and urinary catheters before discharge. Post operative care included close monitoring of vital data, early oral feeding, and discharge when full activity was established, and serious early post operative complications were excluded. Long-term follow-up included observation of port sites for possible complications and postoperative response to chronic haemolytic anaemia or thrombocytopenia regarding the postoperative need for blood transfusion, platelet transfusion, and/or corticosteroids. Any symptoms of recurrence were assessed and if complication occurred in the bag was reported.

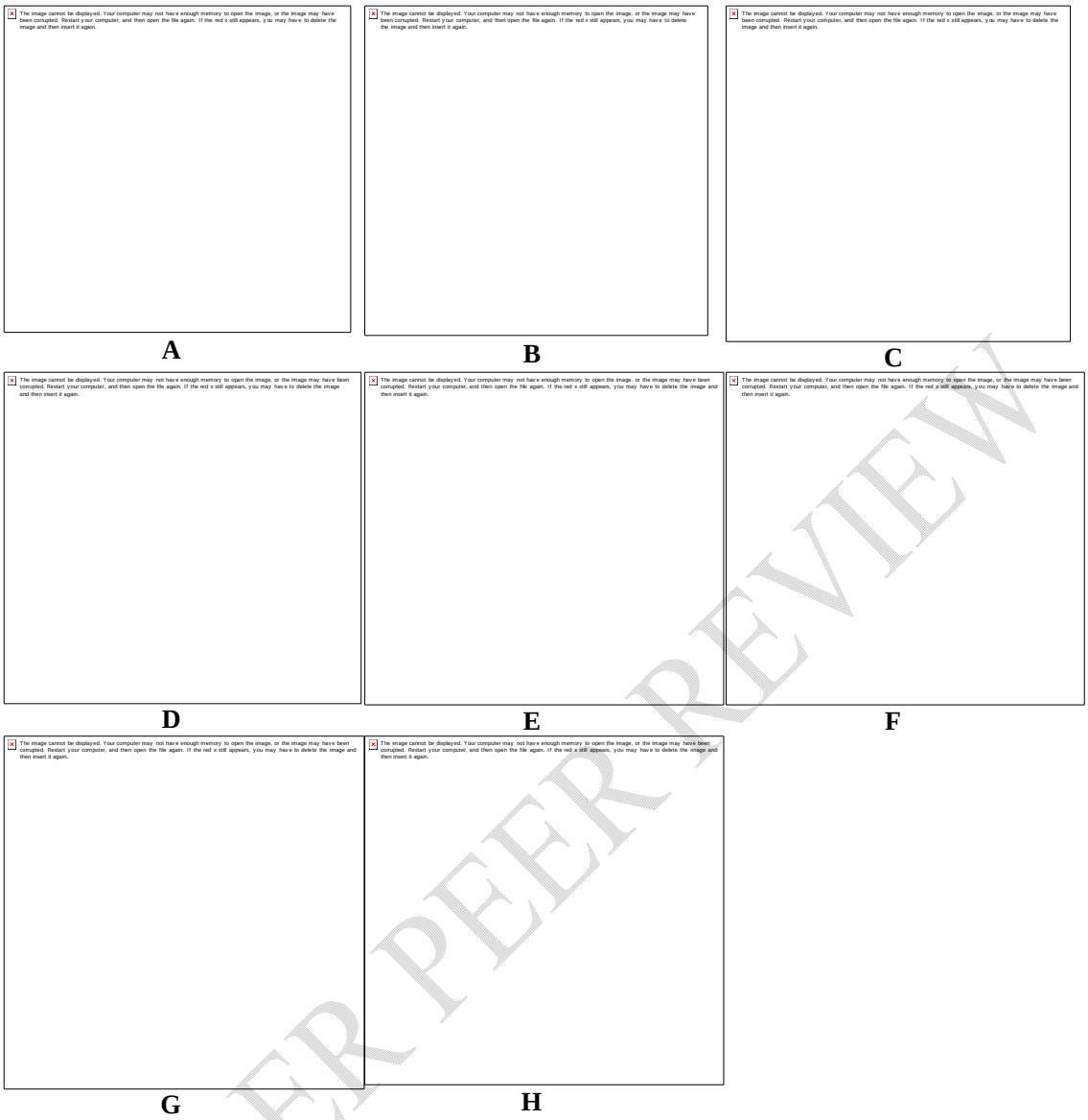

Figure 1: (A) endoscopic camera production cover, (B): homemade retrieval bag length, (C): fashioned upper end, (D): opening upper end, (E): sliding knot of upper end, (F): trans-fixation knot of inner layer of lower end, (G): trans-fixation knot of both layers of lower end, (H): folding of homemade retrieval bag

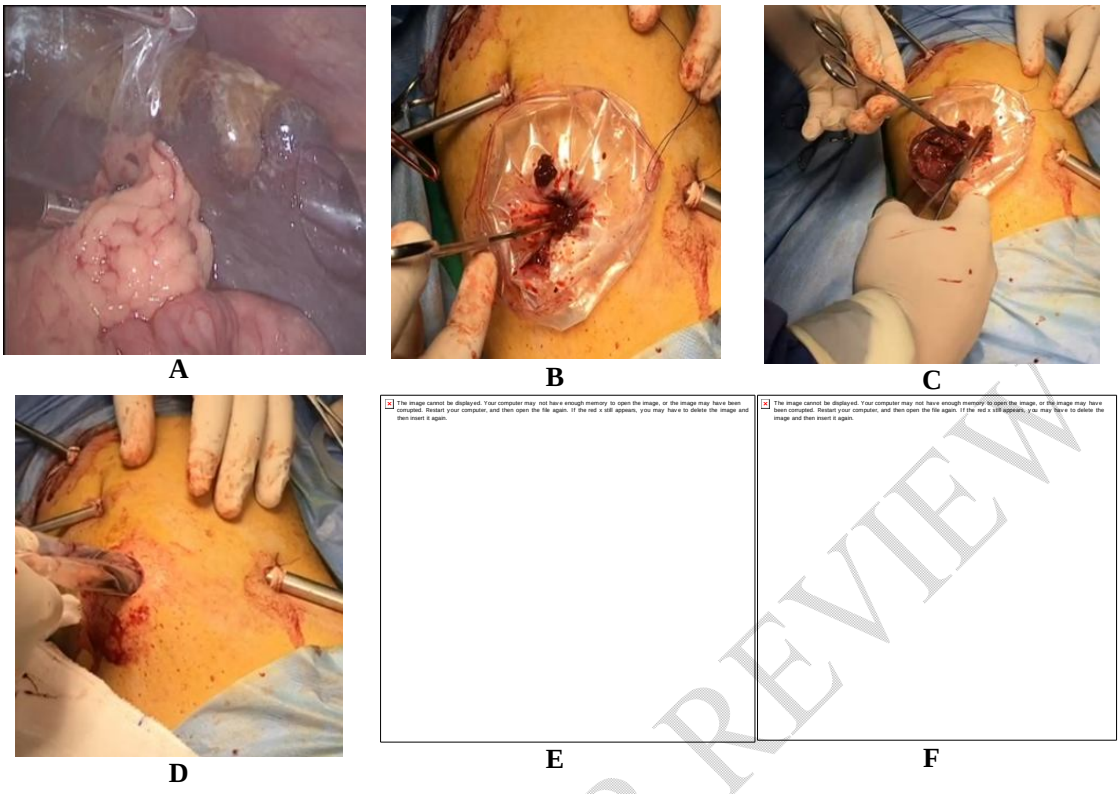

Figure 2: (A): spleen inside homemade retrieval bag, (B): bag upper end at umbilicus, (C): fragmentation of the spleen, (D): bag extraction after complete retrieval of the spleen, (E): pieces of spleen after retrieval, and (F): sites of port and incision

Statistical analysis

Statistical analysis was done by SPSS v27 (IBM©, Armonk, NY, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the data distribution. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by unpaired student t-test. Qualitative variables were presented as frequency and percentage (%).

Results

The mean (±SD) of age was 11.15 (± 4.02) years. 13 (65%) patients were males, and 7 (35%) patients were females. Regarding blood disease, thalassemia was present in 10 (50%) patients, spherocytosis was present in 3 (15%) patients, ITP was present in 3 (15%) patients, sickle thalassemia was present in 3 (15%) patients and sickle cell was present in 1 (5%) patient. The mean (±SD) of splenic length was 13.1 (± 1.25) cm. The mean (±SD) of splenic

width was 9.1 (± 1.45) cm. The mean (±SD) of splenic thickness was 5.7 (± 1.03) cm. The mean (±SD) of splenic volume evaluation by ultrasound was 356 (± 97.73). Table 1

Table 1: Demographic data, characteristics of spleenof the studied patients (N=20)

Age (year)		11.15 ± 4.02
Sex	**Male**	13 (65%)
	Female	7 (35%)
Blood disease	**Thalassemia**	10 (50%)
	Spherocytosis	3 (15%)
	ITP	3 (15%)
	Sickle Thalassemia	3 (15%)
	Sickle cell	1 (5%)
Splenic length (cm)		13.1 ± 1.25
Splenic width (cm)		9.1 ± 1.45
Splenic thickness (cm)		5.7 ± 1.03
Splenic volume evaluation by ultrasound (cm^3)		356 ± 97.73

Data are presented as (mean ± SD), number (%). ITP: Immune thrombocytopenic purpura.

The mean (±SD) of operative time was 67.25 (± 5.69) min. The mean (±SD) of retrieval time was 24.2 (± 2.93) min. The mean (±SD) of hospital stays was 1.75 (± 0.72) days. Table 2

Table 2: Operative time, retrieval time and hospital stay of the studied patients

	N=20
Operative time (min)	67.25 ± 5.69
Retrieval time (min)	24.2 ± 2.93
Hospital stays (day)	1.75 ± 0.72

Data are presented as number (%), Mean ±SD.

There were 4 (20%) patients had fever. There were 2 (10%) patients had port site infection. Bagperforation occur in 1 (5%) patient only for inner layer with leake. Table 3 and Figure 1

Table 3: Complications of the studied patients

	N=20
Fever	4 (20%)
Port site infection	2 (10%)
Bag perforation	1 (5%)

Data are presented as number (%).

Costof our homemade retrieval bag ranged from 100 to 250 L.E with amean (±SD) 175 (± 57.35) L.E. Costofcommercial bagranged from 3000 to 5000 L.E with a mean (±SD) 4000 (± 725.48) L.E.

Cost of bags were significantly lower in the homemade retrieval bag than commercial bag (P value<0.001). Table 4

Table 4: Cost of bags in the studied patients

		Our retrieval bag	Commercial bag	P value
Cost (L.E)	**Mean ±SD**	175 ± 57.35	4000 ± 725.48	**<0.001***
	Range	100 - 250	3000 – 5000	

*: Significant as p value <0.05.

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Discussion

The mean splenic volume evaluated by ultrasound was 356 ± 97.73 cm^3. The mean operative time was 67.25± 5.69 min. Similarly, the mean retrieval time was 24.2 ± 2.93 min. Moreover, the mean hospital stays were 1.75 ± 0.72 days. There were 4 (20%) patients who had fever. There were 2 (10%) patients who had a port site infection, and bagperforation occur in 1 (5%) patient.

Mahmoud et al. [15] demonstrated that the operative time and hospital stay revealed a mean of 149.5 ± 17.9 min and3.1 ± 1.6 days, respectively. Also, only one patient experienced a wound infection.

Ji et al. [16] showed that SL and volume revealed a mean of 28.0 ± 2.8 and324.0 ± 31.2, respectively. The operative time and hospital stay revealed a mean of 95.0 ± 21.3 min and9.0 ± 3.0 days, respectively.

Su et al. [17] found that the operative time and hospital stay revealed a mean of 149 ±31 min and 4.7 ±1.7 days, respectively. Also, 4% had wound infection, and 10% had fever, in agreement with our study.

Differences in the results obtained between the present study and others are related to different sample sizes, populations, and settings.

The use of a retrieval bag is essential to extract the spleen from the abdominal cavity safely.

Our homemade retrieval bag offers benefits similar to commercially available endobags, such as reducing the risk of contamination within the abdominal cavity and the incision site during extraction. Based on our experience, we have found our retrieval bag to be reliable and

durable, with only one case of breakage during use. Additionally, our retrieval bag is an affordable and easily constructed alternative that does not add any additional financial burden to the patient.

Comparing the cost showed lower cost of our tailored bag (2000-5000 Egyptian pound for all cases).Save a burden of average3000-5000 Egyptian pounds per case. The commercially available retrieval bag costs $100 per unit [18]. Our tailored bag did not add time to the retrieval time of the commercial one as compared to other cases of our group or others.The difference of cost is statistically significant with p value of <0.001.

While the study provides valuable insights into the advantages and efficacy of utilizing retrieval bags in LS, the study had several limitations.The study included only 20 patients, a relatively small sample size in a single center. Data used for commercial bags was from retrospective cases. Expanding the study to multiple centers could have strengthened the evidence-based practice of the results of the current study.

Conclusions:

Using tailored homemade retrieval bags during LS improves LS efficiency, reduces the length of hospital stays, coat effectiveness and the chance of postoperative complications

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