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Original Research Article

Splenectomy for haematological diseases: comparison between laparoscopic and open procedures

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ABSTRACT

Background: In some hematological diseases, the spleen may become enlarged, inflamed and causes destruction of normal blood elements. Laparoscopic splenectomy (LS) was first prescribed in 1991 by Delaitre et al and since that date, it gained a steadily increasing worldwide agreement as an option for splenectomy in patients with hematological diseases. It was reported that this can be performed safely and effectively, with lower incidence of morbidity and mortality. The objective of the study was to compare laparoscopic with open splenectomy as regard its benefits and hazards in haematological diseases.
Methods: This prospective study had been conducted in General Surgery Department, Sohag Faculty of Medicine. The study included patients with haematological diseases indicated for elective splenectomy, during the period from January 2015 to June 2017. Twenty patients were included for open surgery (OS) and 20 cases were included for laparoscopic splenectomy (LS).
Results: Surgical time was significantly longer in LS than OS group. There was significant correlation between surgical time and splenic size in both groups. Most of the LS patients had been operated upon using the anterior approach (65%). Hospital stay after operation in the LS group was much less than the OS group. Return of off-bed activities, bowel movements, oral intake and drain removal were longer but not significantly different compared to LS figures.
Conclusions: Laparoscopic splenectomy for haematological indications can be done safely for the properly selected patients with less blood loss and hospital stay but it requires more operative time as compared to conventional splenectomy.

Keywords: Hematological, Laparoscopic, Splenectomy

INTRODUCTION

In some hematological diseases, the spleen may become enlarged, inflamed and causes destruction of normal blood elements. When patients fail medical therapy, they are referred for surgical removal of the spleen.[1] Laparoscopic splenectomy (LS) was first prescribed in 1991 by Delaitre et al, and since that date, it gained a steadily increasing worldwide agreement as an option for splenectomy in patients with hematological diseases. It was reported that this can be performed safely and effectively, with lower incidence of morbidity and mortality.[2,3] The term "laparoscopic splenectomy" means the surgical removal of the spleen via the laparoscope. In contrasts to the traditional 'open' technique, LS is performed through small skin hole, allowing faster recovery, less pain and better cosmetic outcome.[4]

Although there have not yet been prospective randomized controlled studies to support the hypothesis that laparoscopic splenectomy is better that open splenectomy (OS) for benign and malignant hematological causes, the laparoscopic approach has rapidly become very popular and accepted for splenectomy in hematologic diseases with normal size or moderately enlarged spleens.[5] However, the advantages of the laparoscopic over open splenectomy for hematological indications were not stated sufficiently and clinical trials to evaluate the role and efficacy of the approach are still mandatory.[1]

LS via the anterior approach is the strategy done by most surgeons. This provides laparoscopic surgeons with a direct view of the spleen anatomy, as in conventional OS.[6] However, this approach has some limitations, with special concern regarding the poor visualization of the splenic hilum, which may increase the risks of bleeding and bleeding-associated complications.[7,8] In these cases, LS can be performed using a posterolateral approach, in which patients are usually placed in the right lateral decubitus position for better exposure of the spleen.[9,10] The objective of the study was to compare laparoscopic with open splenectomy as regard its benefits and hazards in haematological diseases.

METHODS

Design of the study was comparative clinical study.

Patients

This study included patients with hematological disorders necessitating splenectomy, planned to have LS in Sohag University Hospital in the period from January 2015 to June 2017. A total of 20 cases were included in the study.

Another 20 cases with similar indications for splenectomy operated with open splenectomy were included in the study as a control group.

Inclusion criteria

LS were indicated for elective resection in patients with haematological disease including:

- Idiopathic Thrombocytopenic Purpura (ITP) failed long term medical treatment
- Hereditary Spherocytosis
- Haemoglobinopathies
- Hypersplenism
- Thrombotic Thrombocytopenic Purpura
- Hodgkin's disease
- Myelofibrosis.

Exclusion criteria

Patients with the following were excluded from the study:

- Liver cirrhosis and Portal hypertension
- Massive splenomegaly (size >20 cm)
- Other indications for splenectomy than hematological cases (splenic trauma, infection or carcinoma)
- Associated disorders necessitate laparotomy
- Uncontrollable coagulopathy
- Pregnancy.

Preoperative workup

All patients had Preoperative diagnostic evaluation include:

- Complete history taking, physical examination
- Laboratory examinations including complete blood picture, coagulation profile and other investigations for fitness were done routinely for all patients. Bone marrow aspiration was indicated in suspected hypersplenism cases
- Imaging studies to determine splenic size.

Preoperative preparation

Patients were assessed for haematological disorders with correction of blood cell abnormalities. Patients presenting with haematological disorders were worked up appropriately by the referring hematologists and corrected using blood platelets or plasma transfusion. Young Patient received a polyvalent vaccine at least two weeks prior to surgery as prophylaxis against pneumococcal and meningococcal infection. Treatment of any concurrent infection. Pre-emptive analgesia given.

Operative technique (for LS group only)

We check the instrument set personally to ensure that everything is available. An open tray was available in case the case needed to be converted to open surgery. Harmonic shears (Ethicon Endosurgery Inc.) were also available which are especially useful because they can reduce the number of clips used during division of the short gastric vessels, and can also function as a grasper.

Patient positioning

The patient is safely held on a bean-bag with the left side up at a 60° angle in inverse Trendelenburg position. This allows gravity to pull in the abdominal organs and maximize the working space.

Port placement

Following insufflation using a Veress needle.

A standard four-trocar placement was used to establish access ports for either approach following the establishment of pneumoperitoneum, a 10mm port was inserted in the left upper quadrant, approximately 5 finger-breadth below the costal margin, and a 300

laparoscope (KARL STORZ, Germany) was introduced. A 5mm port was positioned to the left of the falciform ligament underneath the xiphoid, thus allowing exposure of the splenic hilum using a grasper. A 10mm port was placed on the left midclavicular line as the main port. An additional 5 mm port was sited at the inferior pole of the spleen on the left midaxillary line to retract the spleen.

Surgical principles

Anterior approach

The procedure follows these key steps:

- Division of the short gastric vessels and opening the lesser sac
- Exposure of the tail of the pancreas
- Division of the splenocolic ligament
- Lateral and superior retraction of the inferior pole of the spleen and division of the inferior pole vessels
- Division of the hilar vessels
- Division of the phrenic attachments
- Extraction of the spleen in a bag.

Posterior approach

The procedure followed these key steps:

- Division of the splenocolic ligament
- Division of the inferior pole vessels
- Division of the phrenic attachments
- Exposure and division of the hilar vessels
- Division of the short gastric vessels
- Extraction of the spleen in a bag.

Outcome measures

The primary outcome measures were operation time; intra-operative blood loss/transfusion; rate complications, frequency of conversion to an open procedure, time to restart off-bed activities, bowel movement and oral intake, time to drain removal and length of hospital stay.

Statistical analysis

Statistical package for social sciences (IBM-SPSS), version 24 IBM-Chicago (May 2016), USA was used for statistical data analysis. Student t and ANOVA tests were used to compare means of two or more groups. Pearson correlation test was used to compare two quantitative variables. Chi square was used for qualitative data. P value is considered significant when <0.05, and highly significant when <0.001.

RESULTS

Demographic and basic patients' data

Our study participants were divided into two groups. Group 1 for were scheduled for elective laparoscopic splenectomy (LS; 20 patients) and group 2 who were operated on with open splenectomy (OS; 20 patients). Group LS included 13 females and 7 males. Their age ranged from 10 to 28 years, with a mean of 16.6±4.71 years. Out of the 20 patients, 14 patients (70%) were indicated for splenectomy due to ITP, 3 patients (15%) had hypersplenism and another 3 patients (15%) had hereditary spherocytosis.

Table 1: Demographic and basic data.

Data		Group 1 (LS)	Group 2 (OS)	P value
Age (years)	Mean±SD	16.6±4.71	16.25±3.54	0.792(NS)
	Median(range)	15(10-28)	15.5(10-25)	
Sex	Male	7(35%)	8(40%)	0.744(NS)
	Female	13(65%)	12(60%)	
Indications of splenectomy				
ITP		14(70%)	15(75%)	0.481(NS)
Hereditary spherocytosis		3(15%)	1(5%)	
Hypersplenism		3(15%)	3(15%)	
TTP		0	1(5%)	
Splenic size	Mean±SD	15.1±2.382	15.8±1.963	0.317(NS)
	Median(range)	15(12-20)	15.5(13-20)	
Laboratory data				
HB (gm/dL)		10.09±0.898	10.02±1.08	0.825(NS)
Anemia		20(100%)	20(100%)	
PLT (x1000/mm2)		223.8±98.47	228.5±79.25	0.870(NS)
Thrombocytopenia		8(40%)	7(35%)	
WBCs (x1000/mm2)		7.25±1.33	7.40±1.09	0.688(NS)
PT (seconds)		12.58±1.84	12.57±2.16	0.981(NS)
PC (%)		81.24±13.65%	81.86±15.47%	0.895(NS)

Table 2: Operative data.

Data		Group LS	Group OS	P value
Surgical time (hours)	Mean±SD	3.51±0.38	1.35±0.34	<0.001(HS)
	Median(range)	3.5(3-4)	1.25(1-2)	
Blood loss (ml)	Mean±SD	190.5±164.3	302.5±167.4	0.0.039(S)
	Median(range)	130(100-750)	250(200-800)	
Blood transfusion	Non	17(85%)	15(75%)	0.428(NS)
	One unit (500 cc)	2(10%)	3(15%)	
	Two units (1000 cc)	1(5%)	2(10%)	
Approach	Anterior approach	13(65%)	-	-
	Posterior approach	7(35%)	-	
Conversion to open	No conversion	17(85%)	0	-
	Conversion	3(15%)	0	
	Open from the start	0	20(100%)	

Table 3: post-operative follows up (days).

Data		Group LS	Group OS	P value
Return of off-bed activities	Mean±SD	1.28±0.60	1.43±0.59	0.427(NS)
	Median(range)	1(1-3)	1.13(1-3)	
Return of bowel movements	Mean±SD	1.6±1.14	2.01±0.89	0.208(NS)
	Median(range)	1(1-5)	2(1-4)	
Return of oral intake	Mean±SD	1.25±0.47	1.4±0.48	0.324(NS)
	Median(range)	1(1-2.5)	1.25(1-2.5)	
Time of drain removal	Mean±SD	2.18±0.37	2.25±0.34	0.512(NS)
	Median(range)	2(2-3)	2(2-3)	
Hospital stay (in hours)	Mean±SD	73.2±15.53	206±25.61	<0.001(HS)
	Median(range)	72(24-96)	206(168-240)	

Table 4: Correlations between different variables in LS patients.

Variables	Mean±SD	Frequency	p value
Approach and blood loss			
Anterior approach	136.15±34.04	-	0.040 (S)
Posterior approach	291.43±254.72		
Approach and blood transfusion			
Anterior approach	-	0/13	0.031 (S)
Posterior approach	-	3/7	
Splenic size and blood loss	-	-	0.120 (NS)
Splenic size and blood transfusion			
No blood transfusion	14.81±2.46	17	0.226 (NS)
Blood transfusion	16.67±1.16	3	
Approach and surgical time			
Anterior approach	3.41±0.28	13	0.088 (NS)
Posterior approach	3.71±0.49	7	

In OS group out of the 20 patients, 15 patients (75%) were indicated for splenectomy due to ITP, 3 patients (15%) had hypersplenism, 1 patient (5%) had hereditary spherocytosis and 1 patient had TTP. There were non-significant differences between LS and OS groups regarding baseline demographic and clinical data (Table 1). Assessment of splenic size by ultrasonography and by CT showed that the splenic size in the study group ranged from 12-20 cm, with a mean of 15.1±2.382 cm among LS group and 15.8±1.9 cm among OS group. Large sized spleen was associated with hypersplenism. Laboratory investigations showed that, regarding CBC, all patients showed normal WBCs count, and normal or near normal platelet count, with somewhat normal distribution of the individual values. On the other hand, all patients fell in the (mild anaemia) zone, with hemoglobin ranges from 8.1-11.7 gm/dL, and a mean of nearly 10 gm/dL. Regarding PT and PC, most cases were normal, with a PC ranging from 70-110%, and only 3 cases showed mild impairment, with a PC range from 57-70% (Table 1).

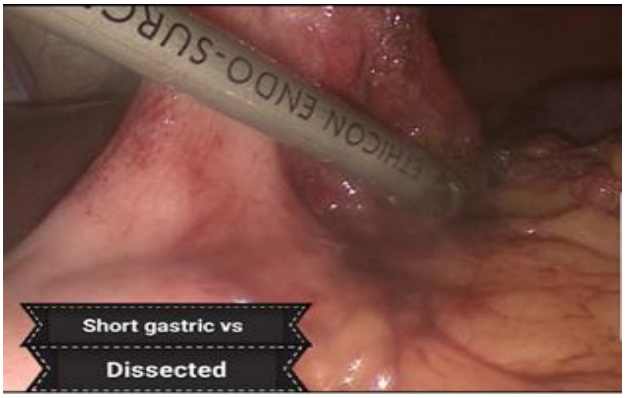

Figure 1: Dissection of short gastric vessels.

Operative data

Surgical time was around 3.5±0.4 hours in LS group, which is significantly longer than that of the OS group (1.4±0.3 hours). There was positive, moderate, significant correlation between surgical time and splenic size in both groups. Blood loss showed high variation among cases, with a 8 fold difference, ranging from 100 to 750 ml among LS group and from 200-800 ml among OS group, with higher and significant blood loss among OS group compared to LS one (p=0.039). As expected, the three cases with the highest blood loss in the LS group were the three cases who were converted to open surgery. In fact, all other LS cases showed blood loss ranging only from 100-200 ml. Only 5 cases (2 in LS group and 3 in OS group) needed one bag (500 cc) of blood and 3 cases (1 in LS group and 2 in OS group) needed 2 units (1000 cc) of blood. Most of the LS patients had been operated upon using the anterior approach, and only 7 cases operated with the posterior approach (Table 2).

Figure 2: Lower lobe dissection.

Post-operative data

Hospital stay after operation in the LS group ranged from 1-4 days, with a mean of 73.2 hours. These figures were much less than those recorded in the OS group, whose hospital stay ranged from 7-10 days, with a mean of 206 hours (9 days). Return of off-bed activities ranged from 1-3 days, with a mean of 1.275±0.595 days in LS group. Also, return of bowel movements needed more wide ranged period from 1-5 days, with a mean of 1.6±1.138 days. Return of oral intake ranged from 1-2.5 days, with a mean of 1.25±0.473. Time of drain removal ranged from 2-3 days, with a mean of 2.175±0.373 days. Recovery after operation needed from 1-2 weeks, with a mean of 9.85±2.13 days. In the OS group, Return of off-bed activities, bowel movements, oral intake and drain removal were longer but not significantly different compared to LS figures (Table 3).

Figure 3: Dissection of the hilum.

Follow up Ultrasound showed that no major collection was seen in any of the study population. Blood loss was found to be higher with hypersplenism and less with other pathologies. There is positive, weak, non-significant correlation between blood loss and splenic size (r=0.359, p=0.120).

Also, there is positive, significant correlation between splenic size and blood transfusion (r=0.321, p=0.168). Hypersplenism was associated with blood transfusion in 66.7% of cases, ITP in 7.1% of cases, and none in hereditary spherocytosis. Anterior approach was associated with less blood loss, compared to posterior approach, with a significant difference. Posterior approach needed more surgical time compared to anterior, but with non-significant difference (Table 4).

Figure 4: Dissected hilum.

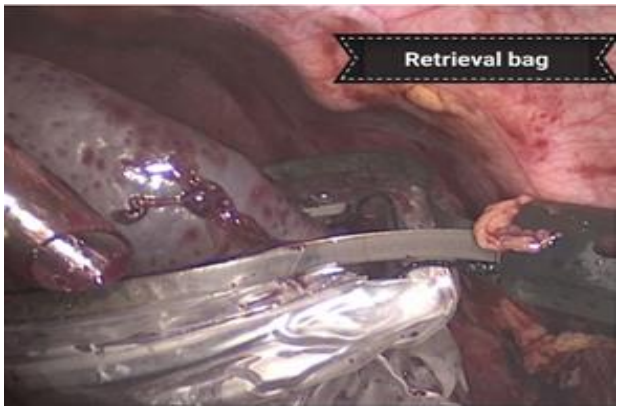

Figure 5: Retrieval bag.

DISCUSSION

Our study included 40 patients (20 patients in each of LS and OS groups), in the childhood and young adulthood age groups, with the range of age between 10-28 years. Our cases were older than those of Macedo et al (with mean age of 6.2 years) but younger than those of Al-Khuzaie.[11,12] The study done by Ardestani et al to compare open versus laparoscopic splenectomy was done on much older patients with a mean age of 55-59 years.[13] A study done by Sapucahy et al to compare laparoscopic versus open splenectomy for hematological indications included older patients than ours (with a mean age around 40 years).[14] Females were slightly higher than males in our study population, which is similar to Sapucahy et al, but opposite to the study done by Ardestani et al.[14,13] ITP was the most common indication of splenectomy, followed by hypersplenism and hereditary spherocytosis. This was agreed with Al-Khuzaie and Sapucahy et al who found this predominance of ITP cases among patients indicated and suitable for splenectomy.[12,14] On the other hand, among Macedo et al cases, the main indication for splenectomy was for sickle cell disease (SCD) with splenic sequestration crises.[11]

Surgical time was around 3.5 hours, with a range of 3-4 hours in LS group; which is significantly higher than that of OS group (1.35 hours, range 1-2 hours). This result was somewhat shorter than that reported by Mahatharadol et al who found that the mean operative time was 230 minutes with a range from 100-320 minutes for laparoscopic splenectomy.[15] On the other hand, Macedo et al study showed a shorter operative time of around 160 minutes, but with a very wide range from 70-320 minutes.[11] Our results showed higher difference than that reported by Ardestani et al who stated that the mean operative time for open splenectomy was 108 minutes, compared to 142 minutes for laparoscopic splenectomy cases; also with a significant difference.[13] The study done by Sapucahy et al reported a mean operative time of more than 4 hours (261 minutes) among laparoscopic splenectomy; compared to 3 hours (181 minutes) among open splenectomy.[14]

Blood loss showed high variation among cases, with an 8-fold difference, with higher and significant blood loss among OS group compared to LS one. As expected, the three cases with the highest blood loss in the LS group were the three cases who were converted to open surgery. In fact, all other LS cases showed blood loss ranging only from 100-200 ml. This wide variation was seen also by Su et al who found that the blood loss had a mean of 189±155 ml, with a range from 50-920ml.[16] Our study confirmed the study done by Ardestani et al which stated that blood loss was significantly higher (500 cc) among open splenectomy compared to laparoscopic splenectomy (200 cc).[13] On the other hand, Sapucahy et al found that open splenectomy was accompanied by higher but non-significant blood loss than laparoscopic splenectomy.[14]

We found a positive correlation between splenic size and blood loss and between splenic size and surgical time. Also, the need for blood transfusion was significantly related to splenic size, with a mean splenic size of 14.8 cm among those did not need blood transfusion compared to 16.7cm among those who needed transfusion. These were, however, non-significant. This may be explained by the limited number of our case population. Our results agreed with that of Ardestani et al who found that there was significant relation between splenic size and each of operative time, hospital stay and blood loss.[13]

Also, blood loss was found to be higher with hypersplenism and less with other diseases. This was reflected by the significant correlation between indication of splenectomy and the need for blood transfusion, being 66.7% among cases with hypersplenism, compared to only 0-7 % among other diseases. Only 3 cases needed conversion to open surgery, due to massive bleeding. The conversion rate was around 15%, which was similar to the conversion rate stated by Sapucahy et al (13.3%).[14] However, this was higher than that seen by Swanson et al who found only a 5% incidence of conversion to open laparoscopy.[17]

Hospital stay after operation in the LS group showed a mean of around 3 days; which is much less than those recorded in the OS group (9 days). The study of Ardestani et al showed that the median hospital stay among laparoscopic splenectomy was much lower (3 days) than open splenectomy (5 days).[13] Also, the study done by Sapucahy et al, showed that the mean hospital stay among laparoscopic splenectomy was 5 days, which is much lower than that of open splenectomy (8 days).[14] Mahatharadol et al found that the hospital stay is from 2-24 days, with a mean of 3 days, a result which is somewhat similar to our findings.[15] Macedo et al found that the hospital stay was ranging from 2-21 days with a mean of 3.2 days.[11]

In LS groups, return of off-bed activities had a mean of 1.275±0.595 days; return of bowel movements had a mean of 1.6±1.138 days; return of oral intake 1.25±0.473; time of drain removal 2.175±0.373 days and recovery

after operation 9.85±2.13 days. In the OS group, return of off-bed activities, bowel movements, oral intake and drain removal were longer but not significantly different compared to LS figures. The study done by Sapucahy et al, showed that laparoscopic splenectomy had a significant shorter time needed to return to oral intake compared to open splenectomy.[14] Follow up ultrasound showed no major collection seen in any of our study population. No major complications were recorded in our cases. Our results were somewhat similar to Macedo M et al, who found one case (out of 86) complicated with pneumothorax, and another 3 cases complicated with intra-abdominal collection.[11] Anterior approach was done in 13 cases, and posterior approach was done in only 7 cases. Anterior approach was found to be better than posterior approach, and this was approved by less blood loss and less blood transfusion need (both with significant differences), less surgical time (with a non-significant difference). The non-significant difference between the two approaches may be due to the limited number of cases, and specially the limited number of posterior approach (only 7 cases). Ardestani et al showed that anterior approach showed better results compared to posterior one, with a significant difference (P<0.001).[13]

CONCLUSION

Laparoscopic splenectomy for haematological indications can be done safely for the properly selected patients with less blood loss and hospital stay but it requires more operative time as compared to conventional splenectomy.

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