

Comparison of two minimal invasive techniques of splenectomy: Standard laparoscopy versus transumbilical multiport single-site laparoscopy with conventional instruments

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Abstract

BACKGROUND: Laparoendoscopic single-site (LESS) splenectomy which is performed on small number of patients, has been introduced with better cosmetic outcome, less postoperative pain, greater patient satisfaction and faster recovery compared to standard laparoscopy. **MATERIALS AND METHODS:** Thirty six patients were included in the study comparing standard laparoscopic splenectomy (LS, 17 patients) transumbilical multiport splenectomy performed with conventional laparoscopic instruments (TUMP-LS, 19 patients). Two groups of patients were compared retrospectively by means of operation time, intra- and postoperative blood loss, perioperative complications, packed red cell and platelet requirements, length of hospitalization, pain scores and patient satisfaction. **RESULTS:** There was no mortality in any of the groups, and no significant differences determined in operative time ($P = 0,069$), intraoperative blood loss ($P = 0,641$), patient satisfaction ($P = 0,506$), pain scores ($P = 0,173$) and the average length of hospital stay ($P = 0,257$). Umbilical incisions healed uneventfully and no hernia formation or wound infection was observed during follow-up period (2-34 months). There were no conversions to open surgery. **CONCLUSIONS:**

Transumbilical multiport splenectomy performed with the conventional laparoscopic instruments is feasible and could be a logical alternative to classical laparoscopic splenectomy by combining the advantages of single access techniques and standard laparoscopy.

Key words: Laparoscopy, single incision, spleen, splenectomy

INTRODUCTION

Laparoscopic splenectomy (LS) has been used for the management of surgical diseases of the spleen since early 1990s and is considered the “gold standard” with its effectiveness, low-complication rate, alongside patient comfort, shorter hospital stay and faster recovery.^[1] As consequence of the trend to reduce the invasiveness of minimally invasive procedures, laparoendoscopic single-site (LESS) splenectomy, performed on small number of patients, has been introduced with better cosmetic outcome, less postoperative pain, patient satisfaction and faster recovery than standard laparoscopy.^[2]

Its popularity has led to the development of novel instruments and techniques to facilitate LESS procedure, which may offer advantages. However, the use of specially designed instruments increases the cost and may not be necessary in all the LESS procedures.^[3]

Herein, we present our study comparing standard laparoscopic splenectomy and transumbilical multiport splenectomy

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performed with conventional laparoscopic instruments (TUMP-LS).

MATERIALS AND METHODS

Patients

Thirty six patients were included within the study between May 2009 and June 2012. Of these patients, 34 had medically refractory chronic ITP, one had hereditary spherocytosis, and one had autoimmune hemolytic anemia. Informed consent was obtained prior to the procedure. The patients consisted of 19 women and 17 men with a mean age of 54.5 (range 22-66 years). Preoperative platelet counts were under $50.000/\text{mm}^3$ in all patients (range 1.000-48.500). Pneumococcus (Pneumovax 23, Merck & Co Inc., Whitehouse Station, NJ, USA) and Haemophilus influenza type B (Hiberix, GlaxoSmithKline) vaccines were administered two weeks before the operations. The risk of operative bleeding was reduced with IV prednisolone (1 mg/kg) and intravenous IgG (1 g/kg) medication. TUMP-LS was performed in 19 patients and standard LS in 17 patients by the same surgeon. Two groups of patients were compared retrospectively by means of operation time, intra- and postoperative blood loss, perioperative complications, packed red cell and platelet requirements, length of hospitalization, visual analog scale (VAS) pain scores and patient satisfaction (Likert Scale). Umbilical incisions and blood tests of patients were checked on postoperative day 10, 1st, 3rd, and 6th month. Additionally, ultrasonography (USG) was performed in sixth month and first year of follow-up to assess if there was any incisional hernia.

Operative Technique

All patients were placed in the standard right lateral decubitus position with the table flexed at the flank. A 25 mm vertical skin incision was made within the umbilical pit [Figure 1a], and a skin flap was created by detaching subcutaneous fat towards the left superolateral direction about 3 cm from the umbilicus [Figure 1b]. The abdominal cavity was insufflated with a Veress needle, and a 10 mm trocar was introduced in the middle of the incision. After exploration of the abdominal cavity, an additional 10 mm and a 5 mm trocars were introduced from the left lateral and superior sides, respectively, each of them 3 cm apart from the first trocar constituting the working triangle [Figure 1c]. A complete exploration for accessory splenic tissue was performed. Standard dissection techniques of laparoscopic splenectomy were performed. The spleen retracted medially and the diaphragmatic attachments was freed from the lower pole to the upper by using LigaSure Vessel Sealing System (Valleylab, Boulder, Co, USA), harmonic scalpel (Harmonic Ace, Ethicon Endo-Surgery) and hook dissector.

The superior attachments were left uncut to keep the spleen hanged up. Then, the splenocolic ligament was dissected to liberate the lower pole [Figure 2]. The spleen was retracted superolaterally by keeping the residual part of splenocolic ligament [Figure 3]. This maneuver facilitates the exposition of the hilum. The dissection proceeded by

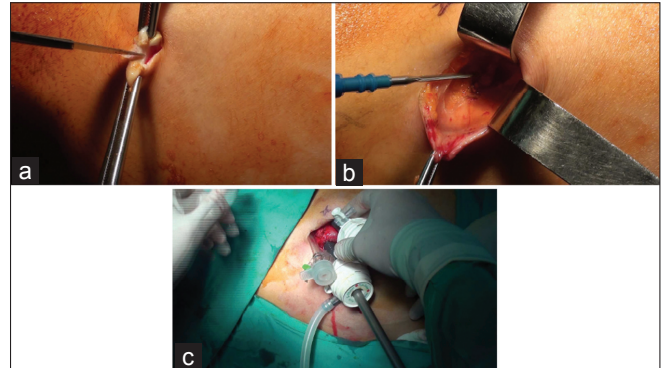


Figure 1: (a) Vertical skin incision within the umbilical pit (b) Creating a skin flap by detaching subcutaneous fat (c) Constituting the working triangle with separate fascial incisions

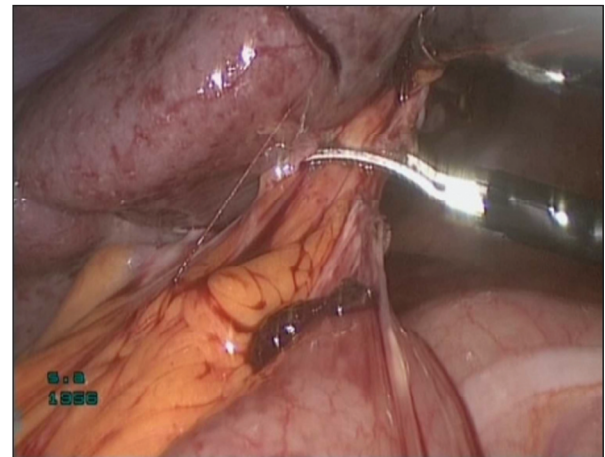


Figure 2: Dissection of the splenocolic ligament

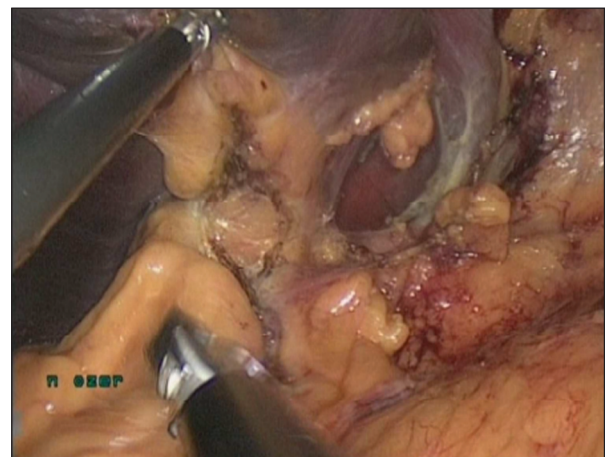


Figure 3: Retracting the spleen superolaterally by keeping the residual part of splenocolic ligament

using LigaSure™ from the hilus to upper pole. Splenic artery and vein were ligated twice and transected. Then the next step was the ligation of the short vessels of the stomach and the mobilization of the gastrosplenic ligament through the splenic hilum [Figure 4]. The division of short gastric vessels was performed by using LigaSure™ and Harmonic Ace™ especially in narrow plane between the stomach and upper splenic pole. After complete splenic mobilization and hemostasis, the scope was moved into the left lateral trocar, and the midline trocar was removed and substituted with a 15 mm endobag (Endocatch II, Covidien, Mansfield, MA). The spleen was placed into the endobag, morcellated carefully through the umbilical incision and extracted. The trocars were removed, the abdomen was desufflated, all fascial openings were reapproximated and the skin was closed. In all cases, only conventional laparoscopic instruments were used.

The LS procedures were performed with four trocars in 17 patients. The same dissection techniques were used in this group.

The analysis was performed with the statistical package SPSS 17 (SPSS, Chicago, IL, USA).

Differences between variables were compared using the nonparametric Mann-Whitney U test and the chi-square test. Results were considered statistically significant when the two-tailed *P* value was less than 0.05.

RESULTS

There were no significant differences in operative time ($P = 0,069$) and intraoperative blood loss ($P = 0,641$) between LS and TUMP-LS procedures. All patients were mobilized 8 hours after recovery and advanced to a regular diet on

postoperative day one. The average length of hospital stay was same in both groups ($P = 0,257$). In two cases of TUMP-LS group, one additional trocar was used due to obesity and scoliosis, which caused the difficulty of reaching the spleen, but there were no conversions to open surgery. Suction drain was placed in one of TUMP-LS patients and in two patients of the LS group. The accessory spleen was detected in seven patients (5 in TUMP-LS and 2 in LS group). Among these, only one had previously been detected by preoperative computerized tomography (CT) scan.

There was no mortality in either group. Subcutaneous hematoma at the incision site occurred in two patients of both groups. The other morbidities of LS group were pleural effusion and diffuse atelectasis on right lower lob in one patient, seroma in splenic fossa in one, and wound infection in one. Two patients of TUMP-LS group had weakness and fever on postoperative day 6 and ameliorated with antibiotics, two patients had subcutaneous seroma. Umbilical incisions healed uneventfully [Figure 5] and no hernia formation or wound infection was observed during follow-up period (2-34 months). The platelet counts of all patients were $> 100.000/\text{mm}^3$ after procedures. Two patients who had no accessory spleen in either pre- and post-operative imaging or peroperative exploration had recurrent thrombocytopenia within the follow-up period.

The mean splenic weight was 486 g (range, 330-610 g) in TUMP-LS and 460 g (range, 300-580 g) in LS.

Patient satisfaction was evaluated with Likert Scale ($P = 0,506$), and pain scores was evaluated with VAS ($P = 0,173$). No significant differences were determined between the groups.

The patient demographics, operative, and postoperative data are showed in the Table 1.

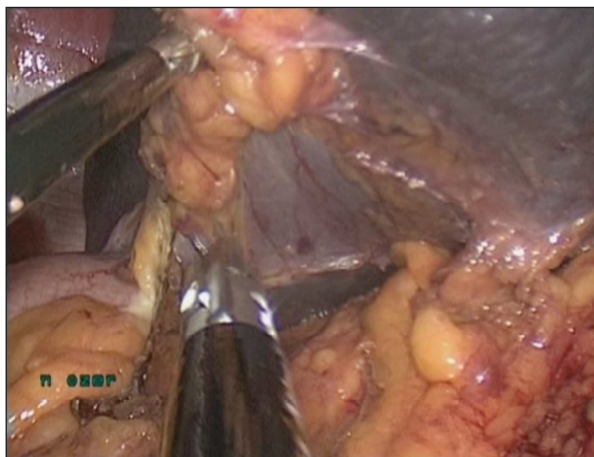


Figure 4: Mobilization of the gastrosplenic ligament through the splenic hilum



Figure 5: Incision on postoperative day 5

Table 1: The patient demographics, operative and postoperative data

	TUMP-LS (n = 19)	LS (n = 17)	P value
Indication for operation	17 Chronic ITP 1 Hereditary spherocytosis 1 Autoimmune hemolytic anemia	17 Chronic ITP	
Operative time (min)	62-150 (100)	70-170 (105,5)	NS
Intraoperative blood loss (ml)	60-480 (120,5)	50-140 (87,6)	NS
Morbidity (n)	3	4	
Length of hospitalization (day)	1-3 (1,84)	1-7 (2,35)	NS
Weight of spleen (g)	330-610 (486)	300-580 (460)	
Mortality (n)	0	0	
Conversion to open surgery (n)	0	0	
Additional trocar requirements	2	0	
Hilus dissection	19 Liga Sure™	13 Liga Sure™ 2 Vascular stapler 2 Liga Sure™ + Hemolock clip	
Ligation of short gastric vessels	16 Liga Sure™ 3 Harmonic Ace™	17 Liga Sure™	
Accessory spleen	5 (in splenic hilus 3, on greater omentum 2)	2 (on greater omentum)	
Preoperative PLT	1.000-48.500 (41.000)	32.000-47.000 (46.000)	
Perioperative platelet transfusion	14 Units	14 Units	
Postoperative follow-up	2-22 months (med. 10.1)	9-34 months (med. 19.1)	
Recurrent thrombocytopenia	0	2	
Incisional hernia (Control Usg in 6 and 12 months)	No	No	

DISCUSSION

Laparoscopic approach is the current standard of surgery for diseases of the spleen. In standard technique, multiple trocars are inserted into the abdominal cavity; the spleen is dissected and then extracted through an incision of proper size. This approach has been proven to be superior compared with the open surgery. Less blood loss and a shorter hospital course have been reported. Bowel function returns more quickly when the splenectomy is performed laparoscopically. There is also decreased narcotic drug requirement for postoperative pain control.^[4]

In recent studies, single site access technique promises less scar formation, less postoperative pain and more patient satisfaction compared to classical multiport laparoscopic surgery.^[4,5] The present study is a further step in assessing whether single access techniques provide all reported advantages and also the extra effort is worthwhile for performing them.

In this clinical study, while applying transumbilical single-site multiport technique, we used conventional laparoscopic instruments, which made the cost comparable to the standard laparoscopy and reduced the requirement of training for novel instruments, which are not available in many centers.

The main limitations of single port access technique, mentioned in the previous studies, are clashing, lack of

triangulation, and lack of space.^[6] Malladi *et al.* suggested that the conflict between the camera and dissection instruments could be eased by the surgeon holding the camera while the assistant would manipulate the retraction instruments. Targarona *et al.*^[2] proposed that a flexible-tipped scope provides a better vision due to angulation possibilities and that the surgeon can use both operative hands.

Another problem of this technique is difficulty of reaching the spleen in obese patients. Transumbilical and subcostal incisions have been used for single-site approach for splenectomy. Targarona *et al.* stated that the transumbilical approach is cosmetically more attractive for the patient, but it implies a greater challenge for the surgeon in the case of a large organ or a heavily built patient.^[2] The single-site insertion, when placed in a subcostal site, improves accessibility to the spleen but it has the disadvantage of a less satisfying cosmetic result.^[7] Rottman *et al.* mentioned that longer instruments with greater articulation may be needed to perform this operation transumbilically.^[6] While articulating, instruments and laparoscopes may offer technical advantages, they are not absolutely necessary for performing TUMP-LS. In the present study, aforementioned problems of single-site insertion technique were minimized with some technical manipulations. Creating skin flaps by performing subcutaneous fat mobilization towards the left superolateral direction and using separate fascial incisions improve the accessibility to the spleen, enable to use conventional equipment and provide adequate

working triangle. Thus, lack of space and triangulation can be managed without any additional flexible or reticulating instruments.

The exposure and dissection of splenic hilum, the division of short gastric vessels and splenic extraction are the other difficulties posed by single-site access technique.

Shirikanth *et al.* offered to use a gastric traction suture which provided wider exposure of lesser sac, facilitated division of short gastric vessels, dissection of the splenic hilum and excellent view of the splenic bed after splenectomy for checking hemostasis.^[8] To avoid the need for a fourth trocar and instrument, Colon *et al.* used a nylon specimen bag for splenic extraction, with a modified bulldog clamp and hook used to secure one edge of the bag to the abdominal wall.^[3] We performed TUMP-LS by retracting the spleen through the left upper quadrant and starting the dissection from splenocolic ligament to the hilum without the need of any additional trocars or instruments.

When performing splenectomy for ITP, care must be taken not to overlook an accessory spleen that may cause recurrence of thrombocytopenia. Current reports have shown that open and laparoscopic approaches are probably equivalent if the surgeons take care to perform a thorough survey of the operative field.^[9,10]

Kumar *et al.* reported that at 3, 6 and 12 months after splenectomy for ITP, time-adjusted complete response rates were 77%, 71% and 74%, respectively. The 5-year relapse-free survival was 75%; all but three relapses occurred within 2 years of splenectomy. In multivariate analysis, younger age and higher peak postsplenectomy platelet counts were significantly associated with a favorable response to splenectomy.^[11] In this study, two relapses occurred in LS group (11.7%) and no accessory spleen were detected in pre- and peroperative investigations. In TUMP-LS group, no relapse occurred during the follow-up period. The reason of having lower rates of relapse in this study compared to the literature may be due to our limited time of follow-up.

In their study comparing laparoscopic and single incision techniques, Gangl *et al.* reported that the rate of incisional hernias was 1.9% in single incision laparoscopic cholecystectomy and 2.1% in laparoscopic cholecystectomy group indicating no significant differences.^[12] Within a median follow-up period of 10.1 months, the umbilical incision was well-healed in all patients. Ultrasonographic control of wounds was performed in postoperative 6th and 12th months and no incisional hernias were detected in any patients.

The data regarding whether single-port access is advantageous with regard to postoperative pain is not uniform. Yim *et al.* compared conventional laparoscopy with single-port access laparoscopy for adnexal surgery and found no differences in pain intensity but detected shorter hospital stay in single-port laparoscopy group.^[13] On the contrary, Bresadola *et al.* compared the transumbilical technique of laparoscopic cholecystectomy with standard laparoscopic cholecystectomy, and they found significantly lower pain scores.^[5] On the other hand, the present study showed no significant difference in pain scores, patient satisfaction or length of hospital stay between two groups. Besides, the average operative time did not differ between the groups, and better cosmetic outcome was obtained in TUMP-LS group.

CONCLUSION

While overcoming the difficulties of single access techniques, namely, the loss of triangulation and collision of the instruments, TUMP-LS procedure maintains the advantages of the classical laparoscopic instruments. Because conventional instruments are available in most centers and are less expensive than current single-site laparoscopic instruments with no need for extra education.

Transumbilical multiport splenectomy performed with the conventional laparoscopic instruments is feasible and could be a logical alternative to classical laparoscopic splenectomy by combining the advantages of single access techniques as well as standard laparoscopy.

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