Single-port laparoscopic splenectomy with finger fracture extraction, a novel technique in Egypt (the initial experience in Kasr Al Ainy Hospital)

Ahmed Maher Abd Elmonim, Mohammed H. Fahmy, Mohamed Fathy Elshal

Department of General Surgery, Faculty of Medicine, Cairo University, Cairo, Egypt

Correspondence to Ahmed Maher Abd Elmonim, Department of General Surgery, Faculty of Medicine, Cairo University, Cairo, 13 Abogallab st. Giza 3753450, Egypt. Mob.: 00201005759927, 00201124000231;
e-mail: Ahmed_maher_87@hotmail.com

Received: 27 December 2021
Accepted: 09 January 2022
Published: 10 October 2022

The Egyptian Journal of Surgery 2022, 41:425–430

Background
Laparoscopic splenectomy can be practiced safely in the recent few years with standardized steps. One of its main disadvantages is the remaining scar of specimen retrieval wound. Applying single-incision laparoscopic surgery principles with the described finger fracture technique for specimen extraction can add the advantage of scarless procedure in hand with maintaining splenic tissue integrity for histopathological examination. The aim is to evaluate the new technique single-port laparoscopic splenectomy with finger fracture extraction of the removed spleen.

Patients and methods
This case series study was conducted on 13 patients with different spleen pathological conditions. They underwent single-port laparoscopic splenectomy using "GelPoint®" system then removing it through the used port after fracturing it by surgeon's fingers.

Results
Thirteen patients underwent Single port laparoscopic splenectomy (SPLS-SP), the mean operation time ranged between 120 and 180 min. All cases completed laparoscopy without conversion to open procedure; of them, two cases required additional port insertion for assistance and a retrieval Pfannenstiel incision for the large sized spleen. No blood transfusion was required perioperatively with no morbidities or mortalities. Average hospital stay was around 4 days with average narcotic requirements in the postoperative period.

Conclusion
Single-port laparoscopic splenectomy can be done safely through a small, single umbilical incision using "GelPoint®" system. The specimen can be retrieved through the same incision after fracturing it into small pieces by the surgeon's fingers thus preserving the splenic tissues integrity for histopathological examination.

Keywords:
finger fracture, GelPoint system, laparoscopic splenectomy, SILS, single incision, single port, spleen

Egyptian J Surgery 2022, 41:425–430

1110-1121

Introduction

Laparoscopic splenectomy is increasingly performed as a safe method with advantages over open surgery in terms of shorter hospital stay, early recovery, better cosmetic results, and convalescence. Single-incision laparoscopic surgery (SILS) is presumed to be a step toward pure natural orifice transluminal endoscopic surgery (NOTES) [1]. SILS was performed successfully in gall bladder and appendix removal then extended to involve splenectomy since 2009 starting with few case reports and small volume case series in highly selected patients [2].

Intact specimen extraction vs. cosmesis was the main considerable item in the era of laparoscopy. Small specimens can be extracted through one of the working ports incisions, but when extracting larger specimens, many methods can be used as extending one of the incisions, connecting two incisions, using an incision over old scar or making new transverse abdominal incision in a virgin area as Pfannenstiel incision with its main disadvantage; the possibility of incisional hernia development or removed through the same incision after morcellation [3].

Transumbilical surgery can be performed either with one port having three working channels using single access device as "SILS Port®" System (Covidien Inc., USA), "GelPoint®" system (Applied Medical), "TriPort+®" System (Advanced Surgical Concepts,

Ireland), "X-cone®" and the "S-Port®" Systems (Karl Storz, Endoskope, Germany) [1,4,5] or with three separate trocars introduced through the same umbilical incision leaving fascial islands between each port and the others (the simple technique) [1,6]. Each of them has its advantages and disadvantages.

Another major issue in the recruitment of SILS is the used instruments and the availability of ergonomically suitable articulating and flexible expensive instruments vs. the available widespread used traditional less expensive instruments [7].

In this study, we introduced conventional instruments through "GelPoint®" system port for single-port splenectomy and specimen extraction after morcellation.

Assessment of technical feasibility of single-port laparoscopic splenectomy with finger fracture extraction of the specimen was done. In addition, the possibility of using the conventional instruments through single access device "GelPoint®" system was evaluated.

Patients and methods

Patients and study design

This case series study was conducted on 13 patients indicated for laparoscopic splenectomy in Cairo University Hospital in the period between July 2017 and October 2017. Unwilling patients, those with history of previous upper abdominal surgical procedures, pregnant or patients with difficulty achieving a regular follow-up as well as those having any medical condition that may render the surgery hazardous (e.g., cardiac patients) were excluded from the study. It was approved by the Research Ethics Committee of the Faculty of Medicine at Cairo University in July 2017.

Preoperative patient data were collected and recorded. Proper clinical evaluation of the patient (full history taking and thorough clinical examination) was done. Routine preoperative laboratory investigations (complete blood count, bleeding profile, liver functions, and kidney functions tests) and preoperative imaging (abdominal ultrasound) were done. All the patients were consented to a laparoscopic splenectomy. They were informed in details about the operative strategy of having a single incision in the abdomen with a possibility of adding more incisions or a conversion to an open technique.

Surgical technique

(1) Patients were adjusted in the French position with the patient supine making a 15° head up tilt and a left upward tilt about 30° to ensure that the bowel and omentum fall down and medially away from the operative site. The monitor is placed at the head of the bed.
(2) For surgical disinfection of the skin iodopovidone is used. The abdomen is prepped and draped in the usual sterile fashion, with careful attention to the cleaning of the umbilicus.
(3) The operating surgeon stands between the legs, the camera man (first assistant) on the right of the patient, and the nurse near the right hand of the surgeon. Another assistant would stand on the left side of the patient.
(4) An umbilical skin incision of 15 mm was made and deepened to the peritoneum. The GelPoint® double-ring wound protector/retractor, Alexis® (Fig. 1), was inserted through this incision, which in turn stretches the fascial diameter to 20 mm. Establishing the pneumoperitoneum was done through inserting a 5-mm trocar directly through the Gel-cap centrally. A 30° scope was then inserted in the center and two 5-mm operating ports were inserted on its right and left sides. A conventional 5-mm port was inserted at the mid clavicular line two fingers under the costal margin for assistance and would be used later on for drain insertion (Fig. 2).
(5) Conventional laparoscopic instruments were used all over the procedure when there was no need for using any articulating instruments. The splenic flexure of the colon is fully mobilized allowing access to the lesser sac exposing the hilum, making it convenient to proceed (Fig. 3).
(6) The splenic artery was attacked at the upper border of the pancreas with insertion of hemoclips or even its ligation with vicryl sutures to stop the ongoing process of the disease with the spleen distructing blood products and serves to decrease the size of the spleen so it would be easier to retrieve it from the umbilical port. Using the Ligasure device (Covidien, Boulder, CO), the gastrosplenic ligament is divided and secured, including the short gastric vessels. The splenorenal ligament is then ligated leaving intact only the superior most portion of the splenophrenic ligament. Next, the hilum of the spleen was secured with Laparoscopic stapling device (Endo GIA, Covidien Norwalk, CT) using white stapler (Fig. 4).
(7) The spleen is placed into a laparoscopic bag and brought out through the wound protector. The spleen was fragmented using a finger fracture technique with an artery forceps and extracting it in a piece meal way (not morcellated) keeping it in large parts to be easily pathologically assessed for any disease (Fig. 5).

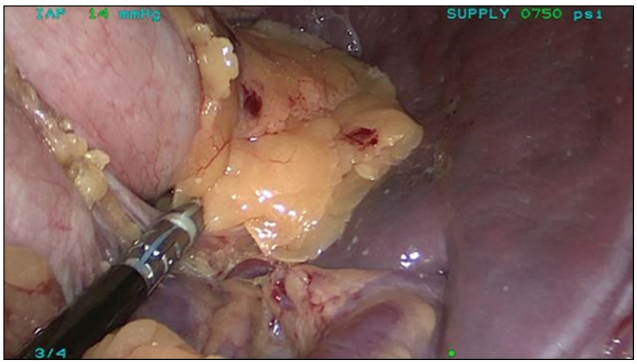
Figure 1

The GelPoint device.

Figure 2

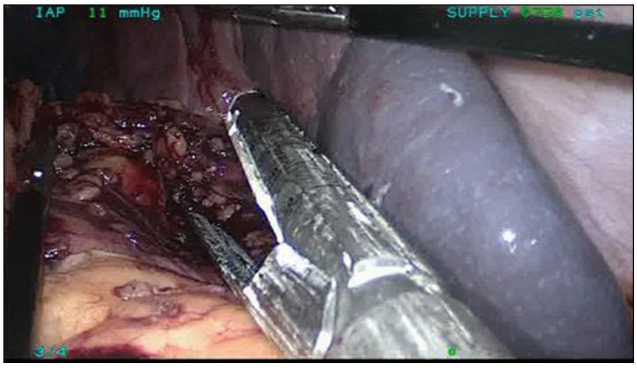
The GelPoint and its ports. To the right side of the port is the accessory 5-mm port.

Figure 3



The lesser sac is opened to expose the splenic vessels.

Figure 4



Securing the splenic hilum with the 45 mm white staple.

(8) The GelPoint is replaced and the abdomen is reinsufflated. We inspect the surgical field for hemostasis. A drain was inserted through the extra port used for assistance. The wound protector and GelPoint are then removed and the abdomen is desufflated. The fascia is approximated with simple interrupted sutures. Skin is closed with absorbable suture.

(9) Postoperative follow-up of the patient and detection of complications—if any—with immediate management. Discharge of the patient after proper improvement was then carried out.

Results

Thirteen patients underwent single-port laparoscopic splenectomy in the period between July 2017 and October 2017. Table 1 shows the patients' characteristics. Their ages ranged between 19 and 39 years with mean age 28 years; 85% of them were females. Hemolytic anemia was the most common splenic pathological diagnosis representing 53.8% of cases. Other diagnoses were immune thrombocytopenic purpura (ITP) and thrombotic thrombocytopenic purpura. The body mass index of patients ranged between 22 and 40 kg/m^2 with a mean of 29.2 kg/m^2. The average spleen size ranged between 12 and 28 cm and preoperative platelets count ranged from 40 to 161×10^3/ml.

The operative data are detailed in Table 2. All patients successfully completed laparoscopy with conversion to open but additional port was used in two cases; one of them was due to large size of the spleen and the other due to extensive adhesions around the spleen. The median operative time was 140 min, with all procedures did not last more than 180 min The average estimated blood loss for the cases was less than 50 cc, with two patients lost more than 100 cc but less than 250 cc without requiring any perioperative transfusion

Figure 5

The spleen was extracted through piece meal technique from the wound protector.

Table 1 Characteristics of the studied patients

Patients' characteristics	Distribution of patients
Sex [*n* (%)]	
Male	2 (15.4)
Female	11 (84.6)
Age [years]	
Mean (average)	28 (19–39)
BMI [kg/m^2]	
Mean (average)	29.2 (22–40)
Spleen size [cm]	
Mean (average)	16.2 (12–28)
Platelets count [×10^3/ml]	
Median (average)	120 (40–161)
Pathology [*n* (%)]	
ITP	5 (38.4)
Hemolytic anemia	7 (53.8)
TTP	1 (7.7)

BMI, body mass index; ITP, immune thrombocytopenic purpura; TTP, thrombotic thrombocytopenic purpura.

of packed red blood cells. The specimens were fractured by finger and retrieved through the same umbilical port incision except in two cases in which a Pfannenstiel incision was made for specimen retrieval due to large size of the spleen more than the size of the bag. The median length of postoperative hospital stay was 3 days. No perioperative complications or mortalities were encountered and not more than three cases required strong pain killers in the form of morphia, whereas others required the usual non steroidal antiinflammatory drugs (NSAIDs) with the average doses.

Discussion

Different types and aspects of surgery dealing with human tissues were always in need to new innovations for minimizing tissue trauma. This was achieved by the introduction of laparoendoscopy, which in a great extent accomplished that goal. Technological advances allowed for more progresses in this aspect with the need to scarless surgery that in turn leads to appearance of natural orifice surgery that being done through transluminal approaches [8].

Because of the flexible body of the videoendoscopes, there is a need to introduce at least one transabdominal port for traction. Pure NOTES is still not feasible and needs further innovation of systems and instruments [8].

With more laparoscopic skills improvements and technological advances, SILS was suggested as an

Table 2 Operative data of the patients

Operative data	Distribution
Operation time [min]	
Median (average)	140 (120–180)
Mean	145.76
Estimated blood loss [*n* (%)]	
<50 cc	7 (53.8)
50–100 cc	4 (30.8)
>100 cc	2 (15.4)
Additional ports [*n* (%)]	
Yes	2 (15.4)
No	11 (84.6)
Retrieval incision [*n* (%)]	
Yes	2 (15.4)
No	11 (84.6)
Conversion to open [*n* (%)]	
Yes	0 (0)
No	13 (100)
Complications [*n* (%)]	
Yes	0 (0)
No	13 (100)
Narcotic requirements [*n* (%)]	
NSAIDs	10 (76.9)
Morphia	3 (23.1)
Hospital stay [*n* (%)]	
<4 days	10 (76.9)
≥4 days	3 (23.1)
Mortalities [*n* (%)]	
Yes	0 (0)
No	13 (100)

NSAIDs: non steroidal antiinflammatory drugs.

alternative to traditional laparoscopy for reducing postoperative pain and gaining better cosmetic results. It was applied for many cases commonly in cholecystectomies, colectomies, and appendectomies [9].

However, SILS procedure is done through single transumbilical incision either with single multichannel port or with different ports from different defects in the fascia performing the standard procedure laparoscopically. The incision is then a hidden one in the umbilical fold with a resulting scarless surgery [8].

SILS splenectomy was reported in many small case series as a safe and feasible procedure confirmed by reporting the operation time and complications rate that occurs mainly due to bleeding or injury to pancreatic tail [8,9].

This series included 13 cases with different etiologies of pathological splenic affection mainly haemolytic anemia followed by ITP. Spleen size ranged between 12 and 28 cm in its longitudinal axis. SILS-SP was done using the traditional instruments that introduced through GelPoint port introduced through the umbilical scar.

The operation time ranged from 120 to 180 min with a mean of 145.76 min and median of 140 min starting from the introduction of first port till full extraction of the specimen and wound closure. The average time needed for specimen finger fracture and extraction ranged between 12 and 25 min influenced mainly by the size of the spleen.

In 2015, Han *et al.* [10] published a study on 29 patients who underwent SILS-SP and the mean operation time was 113.6 ± 39.9 min. Boone *et al.* [2] conducted their study of SPLS-SP on eight patients and the mean time of the operation was 101.6 ± 31.2 min. Also, Barbaros *et al.* [8], in 2015, documented a mean operation time of 112 ± 13 min in their study that was done on 19 patients. Fan *et al.* [11], in 2014, conducted a similar study on 13 cases and found that the median operative time was 165 min. All these studies reported an average time—more or less—similar to that in our study.

In our study, 11 cases completed successfully without a need for more ports or another retrieval incision, whereas in 2 cases, due to larger spleen size, we added another port for assisting in dissection and removal of the spleen then these 2 spleens was extracted through a Pfannenstiel incision. No cases required converting the procedure to open surgery.

Han *et al.* [10] reported that 2 cases out of 29 required adding additional ports for spleen removal and 1 case was converted to open but there was no need for another retrieval incision. Also, Barbaros *et al.* [8] documented that only 1 case was converted to open surgery.

In this study, estimated blood loss did not exceed 100 cc except in two cases but was less than 200 cc and no case required any perioperative blood transfusion. Boone *et al.* [2] reported that two cases required perioperative red blood cells transfusion. Han *et al.* [10] documented that estimated blood loss in their study was 295.8 ± 301.3 cc but there was no need for blood transfusion. The study done by Barbaros *et al.* [8] documented average blood loss 0–400 cc.

In our study, length of postoperative hospital stay did not exceed 5 days with only three cases hospitalized for ≥4 days. Comparing our result with the other similar studies, it was found that our rate is better than that in Fan *et al.* [11], Han *et al.* [10], and Boone *et al.* [2] (average hospital stay 8.8, 5.8, 4.4 days, respectively) but was longer than that in Barbaros *et al.*'s [8] study (average mean is 3 days).

In our study, there were no reported complications or mortalities during the perioperative period. Fan *et al.* [11] reported a complications rate of 7.7% in their study, whereas Boone *et al.* [2] reported 25% incidence of morbidities with no mortalities in both studies. Han *et al.* [11] documented that there was incidence of 6.8% morbidities in their study with no mortalities. Barbaros *et al.* [8] reported 2 cases of developing complications (out of 19) with no mortalities.

In our study, only three cases required more than the usual NSAIDs in their pain control, which coincides with the study done by Barbaros *et al.* [8] who documented that pain control is better in SPLS-SP than the multiport technique.

Conclusion

SILS-SP with finger fracture technique for splenic extraction with preservation of its tissues integrity is a feasible and safe procedure and can be done with the traditional instruments with the average and accepted rate of morbidities and mortalities.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Chamberlain RS, Sakpal SV. A comprehensive review of single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) techniques for cholecystectomy. J Gastrointest Surg 2009; 13:1733–1740.

2 Boone BA, Wagner P, Ganchuk E, Evans L, Evans S, Zeh HJ. Single-incision laparoscopic splenectomy: preliminary experience in consecutive patients and comparison to standard laparoscopic splenectomy. Surg Endosc 2013; 27:587–592.

3 Binsaleh S, Alomar M, Madbouly K. Pfannenstiel incision for intact specimen extraction in laparoscopic transperitoneal radical nephrectomy: a longitudinal prospective outcome study. Clinics (Sao Paulo) 2015; 70:475–480.

4 Sharma A, Dahiya P, Khullar R, Soni V, Baijal M, Chowbey PK. Single-incision laparoscopic surgery (SILS) in biliary and pancreatic diseases. Indian J Surg 2012; 74:13–21.

5 Yoshiki N. Single-incision laparoscopic myomectomy: a review of the literature and available evidence. Gynecol Minim Invasive Ther 2016; 5:54–63.

6 Saber AA, Elgamal MH, El-Ghazaly TH, Dewoolkar AV, Akl A. Simple technique for single incision transumbilical laparoscopic appendectomy. Int J Surg 2010; 8:128–130.

7 Akshay A, Sameer R. Single incision multiport laparoscopic surgery (SILS) with conventional instruments: a single centre experience. IOSR-JDMSOSR 2016; 15:112–115.

8 Barbaros U, Aksakal N, Tukenmez M, Agcaoglu O, Bostan MS, Kilic B. Comparison of single port and three port laparoscopic splenectomy in patients with immune thrombocytopenic purpura: clinical comparative study. J Minim Access Surg 2015; 11:172–176.

9 Wu S, Lai H, Zhao J, Deng X, Wei J, Liang J. Systematic review and meta-analysis of single-incision versus conventional multiport laparoscopic splenectomy. J Minim Access Surg 2018; 14:1–8.

10 Han ES, You YK, Kim DG, Lee JS, Kim EY, Lee SH. Clinical significance of single-port laparoscopic splenectomy: comparison of single-port and multiport laparoscopic procedure. Ann Surg Treat Res 2015; 89:55–60.

11 Fan Y, Wu SD, Kong J, Chao W. Single-incision laparoscopic splenectomy with conventional instruments: preliminary experience in consecutive patients and comparison to standard multiple-incision laparoscopic splenectomy. J Laparoendosc Adv Surg Tech A 2014; 24:799–803.