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ORIGINAL ARTICLE

Safety and Feasibility of Laparoscopic Splenectomy in Patients with Blunt Splenic Injury.

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ABSTRACT

Background: With the rise of laparoscopic surgery, there have been reports of blunt trauma situations where a laparoscopic approach was used, particularly for partial splenectomies. However, the evidence has not yet met acceptable criteria. This study aimed to evaluate the safety, feasibility, and outcome of laparoscopic splenectomy in patients with blunt splenic injury.

Patients and methods: This clinical trial study was carried out in Zagazig University hospital including 30 patients with splenic injuries caused by blunt abdominal trauma who were admitted to the Emergency Department of Zagazig University hospitals during the period from March 2020 to September 2020 to evaluate the feasibility and outcome of laparoscopic splenectomy in patients with blunt splenic injury. The diagnosis of splenic injury caused by blunt splenic trauma was confirmed on basis of Radiological investigations and Laboratory investigations.

Results: in this study, Only 2 cases 6.7% converted to open. Overall complication founded in 4 cases with 13.3%.

Conclusion: Laparoscopic Splenectomy was safe and technically feasible when applied carefully to patients with blunt abdominal trauma, decreasing the hospitalization time and postoperative ICU stay.

Keywords: laparoscopic Splenectomy, open splenectomy, Splenic Injury.

INTRODUCTION

Laparoscopy adoption in the trauma setting has been slow. Exploratory laparotomy has been the standard of care, with laparoscopy reserved only for selected cases in which a diagnosis of abdominal penetration is questionable. In 1995, the first therapeutic laparoscopic procedure in a trauma patient was reported, which involved the repair of a diaphragmatic injury [1].

In the past decade, there has been an increased use of both diagnostic and therapeutic laparoscopic techniques in the trauma setting. There have been reports of repairs of injuries to the stomach, intestine, liver, spleen, and diaphragm. The imminent goal in trauma patients often includes the most expeditious way to diagnose and treat life-threatening conditions; many believe this can be best achieved through laparotomy with a full exploration of the abdomen. Yet, often, trauma patients are stable enough to avoid laparotomy in favor of the laparoscopic approach [2].

Splenic injuries can be lethal not only at the moment of the trauma, but also if a subcapsular hematoma or pseudoaneurysm ruptures afterwards. Finally, due to the spleen's loss of immune function, overwhelming post-splenectomy infections are a late cause of problems [3].

Blunt abdominal trauma is a common cause of splenic rupture. The classic explorative laparotomy and splenectomy have given way to interventional, nonoperative therapy in the management of splenic injuries. Angioembolization of the splenic artery has been proposed as a non-operative treatment option for splenic injury. Lower grades of injury did, in fact, have a better success rate with this method. Nonoperative therapy, on the other hand, fail to manage the rupture in up to 40% of patients[4]. The current study aimed to evaluate the safety, feasibility, and outcome of laparoscopic splenectomy in patients with blunt splenic injury.

METHODS

This study was approved by the local institutional review board of the Faculty of Medicine, Zagazig

University. Informed written consent was obtained from patients included in the study. A total of 30 patients with splenic injury caused by blunt abdominal trauma were admitted to the Emergency Unit of the General Surgery Department of Zagazig University hospitals during the period from March 2020 to September 2020. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria: Medical fitness for general anesthesia and laparoscopic splenectomy. Haemodynamically stable patients. Grade I, II, III & IV splenic injury.

Exclusion criteria: Hemodynamically unstable patients. Patients underwent previous upper abdominal surgeries. Patients with penetrating trauma. Patients with any associated other organ injuries. Successful nonoperative splenic injury management, Grade V& VI splenic injury. Patient unfit for laparoscopic surgery.

The diagnosis of splenic injury caused by blunt splenic trauma was confirmed on basis of proper history taking and examination, Radiological investigations (Primarily in the form of FAST scan for free fluid, CT scan with contrast), and laboratory investigations (CBC, Blood group, Random blood sugar, Urea and electrolytes, Liver function) were done.

Operative procedure

The procedure was performed under general anesthesia with endotracheal intubation. One gm ceftriaxone was given IV at the induction of anesthesia and was repeated every 12 hours postoperatively for 3 days. The procedure was performed while the patient in a lateral position. The abdomen is prepared and draped. The table was angulated, giving lateral flexion of the patient. The surgeon stood on the patient's right side, while the cameraman stood on the surgeon's right side and the assistant stood on the patient's left side. The patient was in a reverse Trendelenburg position of 15 degrees. While gravity retreated the stomach, transverse colon, and omentum inferiorly, putting the splenic hilum under stress, the spleen was able to hang by its attachments, acting as natural counter-traction.

The veress needle was used to create carbon dioxide pneumoperitoneum, which was kept at a pressure of 13 to 15 mmHg. On the mid-clavicular line, a ten mm camera port was installed. Another 10 mm port was implanted above the patient's anterior superior iliac spine at the anterior axillary line. In the left subxiphoid region, a five-mm trocar was placed. Another 5 mm trocar was inserted between the mid and post axillary lines below the twelfth rib. If the space between the umbilicus and the left costal margin was greater than the breadth of the hand after the pneumoperitoneum was created, the camera trocar was shifted up toward the left costal margin as a rule of thumb. The surgeon's second and third trocars are put in a triangulated method around the telescope at a 90° angle. The gastrosplenic ligament, splenocolic ligament, larger omentum, and phrenosplenic ligament were all examined after the stomach was retracted to the right. The mesentery, mesocolon, and pelvis were examined in the area of the internal rings in both sexes and the adnexa in women.

The dissection was carried out in five steps: division of the short gastric vessels, division of the splenocolic ligament, clipping and division of the inferior polar vessels, hilar control, and division of the splenic phrenic attachments. After retracting the gastric fundus, the gastrosplenic vessels were divided with four or five harmonic scalpel applications, while the spleen was retracted with a liver retractor. The spleen was still suspended from the diaphragm as the dissection progressed toward the splenorenal ligament. (**Figure 1)**. Clips and harmonic shears were used to divide the inferior polar branches. The colour of the spleen changes from brown to bluish due to segmental devascularization (**Figure 2)**.

The splenic hilar groove was exposed by gentle retraction of the freed inferior pole of the spleen, and the vascular distribution of the hilum was assessed. The splenic pedicle, which is formed by the splenic artery and vein, enters the splenic hilum as a compact bundle. The pedicle was transected en bloc using intracorporeal suture made of vicryl 0 and large polymer clips on both the artery and vein. (**Figure 3).** After the hilum was controlled, the harmonic scalpel was used to divide the remaining splenic attachment at the superior pole of the spleen and the ligamentous phrenic attachments, completing the splenic mobilisation. The spleen is removed and placed in a rip-stop nylon sack. (**Figure 4).** The extraction is done through trocar site after widening the trocar site and fragment the specimen using Babcock forceps. A tube drain in the splenic bed was left. Closure of the port sites.

Post-operative care

intravenous Analgesics were given when indicated (e.g., paracetamol infusion and Pethidine if needed). parenteral fluids were given in the form of ringer solution and glucose solutions according to body weight until oral feeding can be started. Post-operative vaccination: pneumococcal vaccine, the Haemophilus influenzae type B vaccine, and the meningococcal vaccine were administrated within 2 weeks postoperatively. IV Antibiotics were given

in the form of 1gm ceftriaxone every 24 hours for three days.

Oral feeding was started in the form of clear fluids just the patient had audible intestinal sounds. The tube drain was removed when it drained less than 50 ml of serous fluid per day. Patients were discharged when tolerating oral feeding, had recovery of GIT motility with no clinical or radiological evidence of complication.

Post-operative follow-up

Clinical evaluation of all patients and any complications, minor or major, were registered every week for one month, then monthly for six months in the outpatient clinic. Conversion to open surgery, wound complications e.g. wound infection, wound dehiscence, and Porte site hernia, postoperative laboratory investigations e.g., CBC and length of hospital stay were recorded.

Statistical analysis

The collected data were analysed by computer using the Statistical Package for Social Services version 24 (SPSS), and the results were displayed in tables. When the significant probability was less than 0.05 (P 0.05), the results were considered statistically significant. P-value 0.05 was deemed statistically insignificant (NS).

RESULTS

The commonest cause of blunt abdominal trauma among patients in this study was road traffic accidents, seventeen patients (56.7%). Fall from a height and direct abdominal trauma represented 36.6% and 6.7% of the causes of abdominal trauma among patients in this study. CT was done to all patients. grade I splenic injury was the commonest 56.7% followed by grade II 23.3% and then grade III 16.7% and finally grade IV 3.3% **(Table 1)**.

The candidate patients for this study should be hemodynamically stable. The systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse were 108.83±14.24, 72.50±9.16, and 97.40±12.09 respectively. The mean operative time was 145.66±29.55 minutes with a minimum of 100 and a maximum of 220 minutes. The mean intraoperative blood loss was 253.33±81.63 ml with a minimum of 100 and a maximum of 550 ml. Only 2 cases 6.7% converted to open due to uncontrolled bleeding **(Table 2)**.

Overall complication founded in 4 cases with 13.3% (3 patients with wound infections and one patient with atelectasis). The duration of hospital stay was 8.03±1.62 with a minimum of 6 and a maximum of 14 days **(Table 3)**.

Table 1: The causes of spleen injury and CT grade of splenic injury among studied group

		N	%
Causes of injury	**Fall from a height**	**11**	**36.6**
	Direct	**2**	**6.7**
	Traffic accident	**17**	**56.7**
CT Grade	**I**	**17**	**56.7**
	II	**7**	**23.3**
	III	**5**	**16.7**
	IV	**1**	**3.3**

Table 2: Shows preoperative systolic, diastolic blood pressure and puls with operative data and hospital stay

SBP	**Mean± SD**	**108.83±14.24**	
DBP	**Mean± SD**	**72.50±9.16**	
Pulse	**Mean± SD**	**97.40±12.09**	
Operative time	**Mean± SD**	**145.66±29.55**	
Intraoperative blood loss	**Mean± SD**	**253.33±81.63**	
Conversion to open	**Not**	**28**	**93.3%**
	Converted	**2**	**6.7%**
Hospital stay	**Mean± SD**	**8.03±1.62**	

Table 3: Shows postoperative complications among the studied patients

		N	%
Complication	**Non-complicated**	**26**	**86.7**
	Complicated	**4**	**13.3**
	wound infections	**3**	**10**
	Actelactasis	**1**	**3.3**
	Total	**30**	**100.0**

Fig. (1): Division of the posterior layer of the lienorenal ligament allowing complete splenic mobilization.

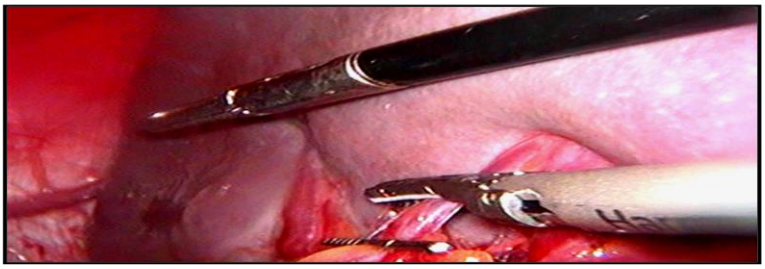

Fig. (2): Division of a branch of the splenic artery.

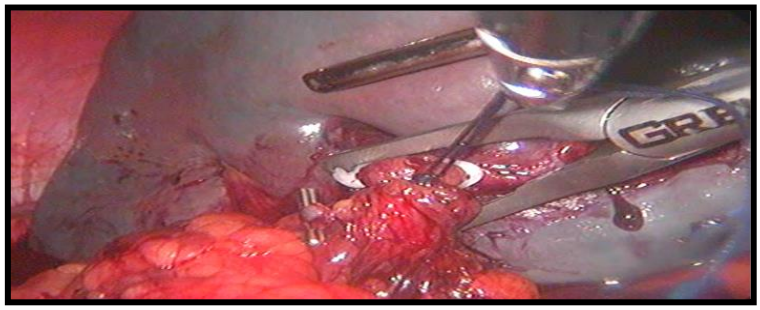

Fig. (3): Intracorperal suture using vicryl 0 and large polymer clip of splenic artery.

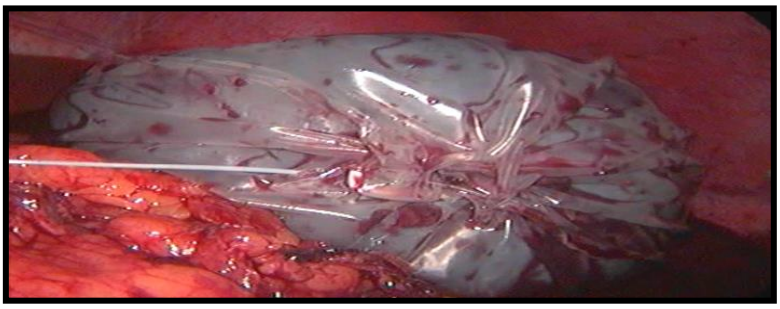

Fig. (4): Placement of the spleen in the retrieval bag

DISCUSSION

The current study showed that the operative time was distributed as 145.66±29.55 with a minimum of 100 minutes and a maximum of 220 minutes, which is close to the results of **Targarona et al.** [5] who found that the operative time, 153 ± 59 (60-240) min. Also, **Abdelshafy et al.** [6] reported that the operative time was 123.28±21.61 min. while **Li et al.** [7] found that operation time in the laparoscopic splenectomy group was 110.5±18.7 minutes.

In contrast, **Wysocki et al.** [8] found that the median operative time in the entire group was 100 min (70–130 min). **Ohta et al.** [9] reported that Operation time was 201.7 ± 75.5 min.

The current study showed that the bleeding amount was distributed as 253.33±81.63 with a minimum of 100 and a maximum of 550 CC. which in agreement with the study of **Nafady et al.** [10] who reported that the blood loss was 252.50 ± 113.695 with minim.

Also, **Huang et al.** [11] found that blood loss was 520.18± 65.5 ml. (180- 540). **Wysocki et al.** [8] found that the median blood loss was ≥ 500 mL (120–580 mL).

In this study, only 2 cases 6.7% were converted to open**, Wysocki et al.** [8] found that the Conversion was necessary in 14 cases (2.99%)

Nafady et al. [10] reported that two cases (6.3%) were converted to open splenectomy due to bleeding from splenic artery trunk or vein at

splenic hilum with failure of control of bleeding vessel due to large splenic artery size (one case was 6.2mm and the other was 7 mm) and big spleen 20 cm.

Huang et al. [11] reported that none of the surgeries in the laparoscopy group was converted to an open approach.

Targarona et al. [5] reported that 9 (7.4%) patients were converted to open splenectomy; The reasons for the conversion to open surgery were as follows: diffuse oozing (n=2), large splenic size (n=6), and adhesions (n=1)

Complications were encountered in 4 (13.3%) cases (3 patients with wound infections and one patient with atelectasis)

Shamim et al. [12] reported that the major complications were reported in 12 patients (12/113, 10.6%) of the Laparoscopic group (surgical site infections, sepsis, venous thromboembolism, myocardial infarction, pneumonia, cerebrovascular accident, reintubation, acute renal failure, acute respiratory distress syndrome)

Huang et al. [11]**,** reported that the wound infection was reported in one patient (1/11, 9.1%) in the Laparoscopic group.

CONCLUSION

Laparoscopic Splenectomy was safe and technically feasible when applied carefully to patients with blunt abdominal trauma, decreasing the hospitalization time and postoperative ICU stay. It also offered profound therapeutic potential and cost-effectiveness.

RECOMMENDATIONS

Further studies on large number of cases and longer duration follow up are required to validate the results of this study.

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