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Early Experience with Laparoscopic Splenectomy in Benign Splenic Disorders

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Abstract: *Background:* Laparoscopic splenectomy is evolving procedure and is now considered the procedure of choice in elective splenectomy by many centers, but technically demanding especially in large sized ones. *Our aim* was to evaluate the outcome of laparoscopic splenectomy for a variety of benign splenic disorders in our early experience. *Patients and Methods:* This prospective study was carried out on twenty-two patients treated with laparoscopic splenectomy in Tanta University Hospital from January 2014 to January 2016. Patients chart review including patient characteristics, splenic pathology, intraoperative difficulties or complications and postoperative outcome. Follow up ranged from 6 months to 2 years with a mean of 20 months. *Results:* Age of patients ranged from fifteen to fifty-nine years with a mean of 41.7 years. Fourteen cases (63%) with idiopathic thrombocytopenic purpura (ITP), six cases (27.3%) with hypersplenism and two cases (9.1%) with autoimmune hemolytic anemia. Accessory spleens were found in six patients (27.3%) and removed. Mean operative time was 120±15 minutes. Intraoperative bleeding occurred in six cases (27.3%), laparoscopic control attempted and succeeded in four of them, but conversion was inevitable in two cases (9.1%). There were no major postoperative complications or deaths. *Conclusion:* Laparoscopic splenectomy is not only safe minimal invasive procedure, with comparable results of the open splenectomy in management of small and medium sized spleens but also, has the advantages of negligible intraoperative blood loss. Larger series with longer periods of follow up are required to evaluate this promising operation.

Keywords: Laparoscopic Splenectomy, Purpura, Idiopathic Thrombocytopenic, Hypersplenism

1. Introduction

Splenectomy has an important role in the management of certain hematological conditions that fail to respond to conventional medical therapy. Open splenectomy is not usually technically demanding, except for the treatment of a massively enlarged spleen. [1]. However, it requires a wide laparotomy to gain access to the left hypochondriac region. The spleen's rich vascularization and its intimate anatomic relations with intra-abdominal organs, along with the traction and maneuvers necessary for exposure, mean that the procedure is associated with complications in 5% to 60% of patients [2, 3].

The complications are mainly secondary to pancreatic tail injury, bleeding, or are pulmonary in origin. Splenectomy for malignant diseases or enlarged spleen is associated with a morbidity of 40% to 60%. The well-recognized benefits of laparoscopic surgery should also apply to splenectomy, moreover the magnification and the wide operative field can lessen these complications [4].

The first laparoscopic splenectomy (LS) was reported by *Delaitre et al;* I991 [5], and many authors afterwards have described excellent results especially in management of idiopathic thrombocytic purpura (ITP) [6]. In the past decade, LS has rapidly become recognized as the gold standard for the management of nontraumatic splenic disorders, such as ITP, thrombotic thrombocytopenic purpura, and hemolytic anemias [7, 8]. Laparoscopic splenectomy is a challenging procedure given the fragile, highly vascularized nature of the spleen and its proximity to the pancreas, stomach, and colon. Perioperative morbidity may also be influenced by specific features associated with hematologic disease including thrombocytopenia and the immunocompromised state of patients with leukemia or lymphoma [9]. In 1992, Ganger M,

introduced the posterolateral approach for adrenalectomy, and this was subsequently adapted for splenectomy [10]. The laparoscopic approach is hampered in traumatic injuries by inadequate visualization due to ongoing hemorrhage and potential hypotension. Due to the general success of nonoperative management strategies, surgical intervention is more typically performed in patients who are hemodynamically unstable. Under these circumstances, laparoscopic exploration is contraindicated due to the potential for further hemodynamic compromise [1].

2. The Aim of this Study

The Aim of this Study was to evaluate the outcome of laparoscopic splenectomy for a variety of benign splenic disorders in our early experience.

3. Patients and Methods

This prospective study was carried out on eleven patients treated with laparoscopic splenectomy in Tanta University Hospital from January 2014 to January 2016. Evaluation including patient characteristics, indication for surgery, duration of surgery, hospital stay, transfusion requirement, intraoperative difficulties or complications, postoperative outcome and the response of the original condition to surgical intervention. Full explanation of procedures; possible complications and patient consent were assured before inclusion in the research. The study protocol was approved by the Ethics Committee of General Surgery Department, Tanta University Hospitals.

Patients with massive splenomegaly, intractable coagulopathy, or who are unfit for general anesthesia were *excluded* from our study. Each patient was subjected to history taking and thorough clinical examination. Laboratory investigations Included CBC, liver functions, renal functions, blood sugar, prothrombin time & activity and hepatitis B & C markers. Abdominal ultrasound examination was done. Upper GIT endoscopy was done to rule out varices or any gastric pathology. Pneumococcal, H influenza and meningococcal vaccines were given 2 weeks prior to surgery.

3.1. Surgical Technique

After induction of general anesthesia, patients are placed in a right lateral decubitus position. Pneumoperitoneum is established, and trocars are introduced parallel and about 5 cm below the left costal margin. Before starting the dissection of the spleen, a thorough search for accessory spleens is performed and if any to be removed first. We then sequentially dissect the splenic flexure of the colon. The splenic hilum is approached from the lower pole, and dissection is continued upwards. The splenic artery and vein are divided using a linear vascular stapler either before or after division of the short gastric vessels; finally the posterior layer of the lienorenal ligament is dissected using energy device. Placing the completely detached spleen into an extraction sac is the last step. The spleen is extracted piecemeal. Occasionally a muscle splitting transverse incision, or 4 cm pffannestiel incision was preferred in females with large spleens. The incisions are closed after insertion of tube drain in the splenic bed.

Follow up: patients were followed weekly in the first three months, then monthly thereafter.

Figure 1. *Patient position in the right lateral decubitus.*

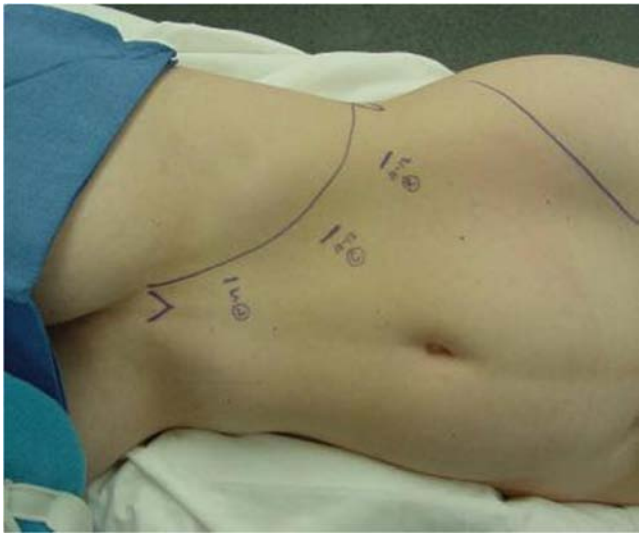

Figure 2a. *Marking the trocar sites.*

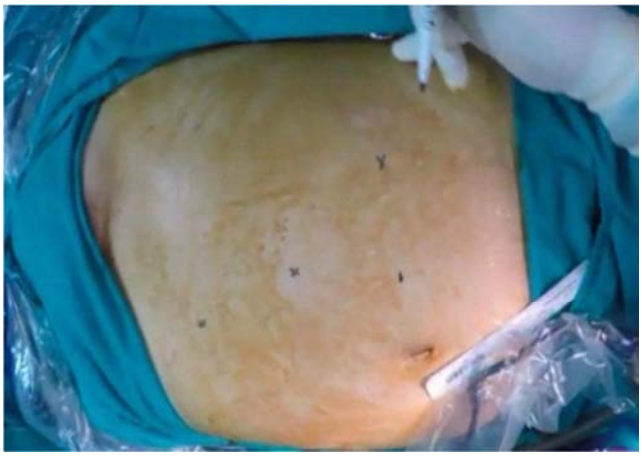

Figure 2b. *Marking the trocar sites.*

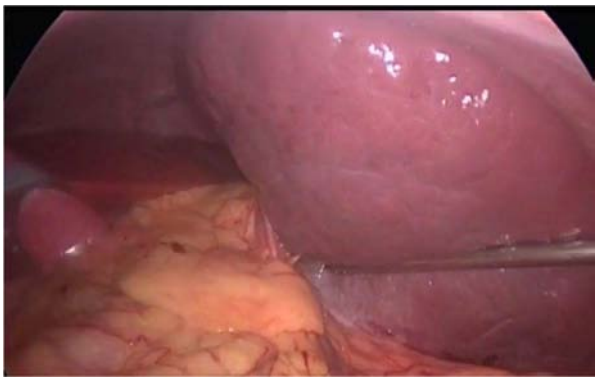

Figure 3. *Elevation of the spleen to expose the lower pole.*

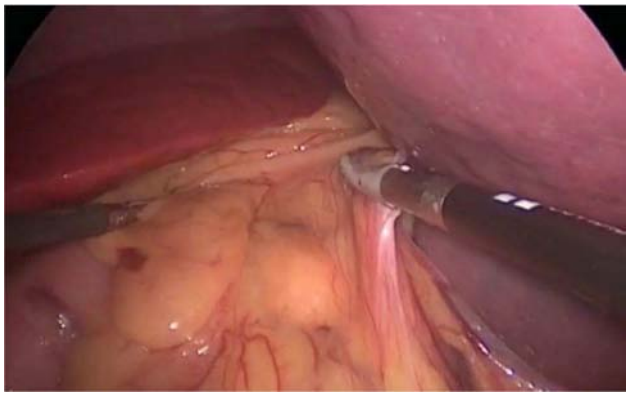

Figure 4. *Starting dissection from the lower pole upwards.*

Figure 5. *Hilar dissection (the dissector creates a tunnel behind the vessels for the application of the vascular stapler).*

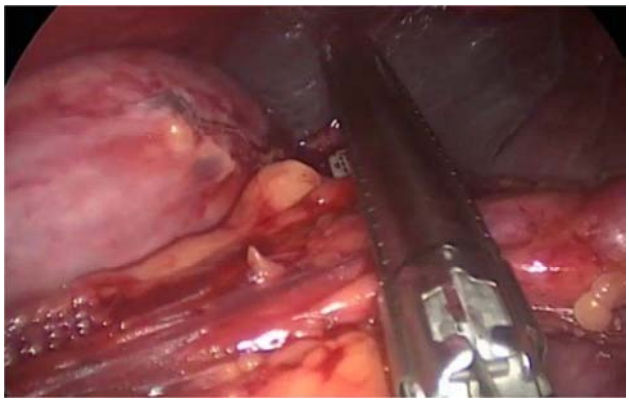

Figure 6. *The vascular stapler (white) is applied to control the hilar vessels.*

Figure 7. *Complete transection of the splenic pedicle.*

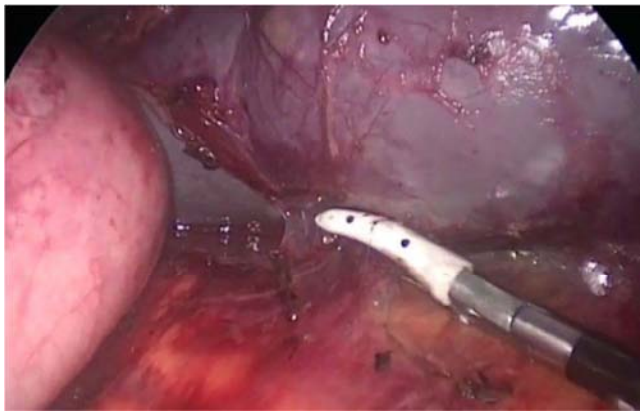

Figure 8. *Dissection of the posterior layer of lienorenal ligament.*

3.2. Statistical Analysis

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation and chisquare test by SPSS v.20.

4. Results

Age of patients ranged from fifteen to fifty-nine years with a mean of 41.7 years. Fourteen cases (63%) were presented with idiopathic thrombocytopenic purpura (ITP), six cases (27.3%) with hypersplenism and only two cases (9.1%) with autoimmune hemolytic anemia. Accessory spleens were found in six patients (27.3%), and removed. Mean operative time was 120 +15 minutes. Intraoperative bleeding occurred in six cases (27.3%), laparoscopic control attempted and succeeded in four of them, but conversion was inevitable in two cases (9.1%). Home-made extraction bag (sterile infusion container) was used in most of cases 16 (72%) out of 22. The hospital stay ranged from 3 to 11 days with a mean of 6 days. There were no major postoperative complications or deaths.

Table 1. *Patient characteristics.*

Number	22(100%)
Age	41.7(15-59)
Sex:	
Male	6(27.3%)
Female	16 (73%)

Co-morbidity	4 (18.2%) (diabetes 2-hyperension 2)
Previous abdominal surgery	8(36.4%)
Patient weights (Kgs)	75.8 (61-95)
Indication of splenectomy:	
ITP	14 (63%)
Hypersplenism	6 (27.3%)
autoimmune hemolytic anemia	2(9.1%)

Table 2. *Peri-operative results.*

27.3%	6	Accessory Spleens (%)
27.3%	6	(%) Intra-operative bleeding
	280 (150-32)	Splenic Weight (gm)
	120+15	Operative time (min)
9.1%	2	(%)Conversion to open surgery
0%	0	(%)Visceral Injury
	150+30	Blood loss (ml)
Postoperative complications:		
9.1%	2	Bleeding
18.2%	4	Subphrenic collection
27.3%	6	Wound infection
9.1%	2	Partial portal vein thrombosis
Hospital stay (days)	6 (3-11)	

Regarding platelet count, 20 (91%) of our patients presented to us by platelet count less than 150,000 and two (9.1%) patients presented with platelet count between 150-400 ranging from 68 to 254 with mean of 109.45. During the operation they received platelet units with range zero to 12 units and mean 8.54. And by the end of third month postoperative all of them returned to normal values and these values were maintained during the consecutive follow up studies.

Table 3. *Platelet count pre and postoperative.*

preoperative	**Platelet count <150 20(91%)**	**150-400 2(9.1%)**	**>400 0**
First 3days	10(45.5%)	10(45,5%)	0
First week	2(9.1%)	18(82%)	2 (9.1%)
Second week	0(0%)	8(36.4%)	2 (9.1%)
Third week	0(0%)	8(36.4%)	14(63.9)
Fourth week	0(0%)	16(73%)	6(27.3%)
Three months	0(0%)	22(100%)	0(0%)
Sixth months	0(0%)	22(100%)	0(0%)
Chi-square	X2	88.	
	P value	0.001	

The two cases (9.1%) of autoimmune hemolytic anemia gave history of repeated blood transfusion (6 monthly), and were presented with low hemoglobin level of 8 and 10gm.

Follow up data after 1year revealed hemoglobin level of 12 and 13gm respectively without transfusion.

5. Discussion

Laparoscopic Splenectomy has become the modality of choice for the elective treatment of many splenic diseases, particularly for ITP patients who are refractory to medical treatment [7].

In cases of massive splenomegaly, most surgeons are reluctant to perform LS. Because placement of the spleen into an intracorporeal bag is quite challenging and creation of an enlarged incision or hand-assisted incision is necessary for removal of the spleen, the advantages of laparoscopic surgery are obviated [4].

Our study comprises 22 patients with mild to moderate enlarged spleens treated with LS in Tanta University Hospital during the period from January 2014 to January 2016.

The limited number of cases in this study may be attributed to the fact that the requirements needed are very coasty, and also many patients are still resisting this new approach.

Age of patients ranged from fifteen to fifty-nine years with a mean of 41.7 years. Fourteen cases (63%) were presented with idiopathic thrombocytopenic purpura (ITP), six cases (27.3%) with hypersplenism and two cases (9.1%) with autoimmune hemolytic anemia. Accessory spleens were found in six patients (27.3%), and removed. Intraoperative bleeding occurred in six cases (27.3%), laparoscopic control attempted and succeeded in four of them, using Hemo-clips or vessel sealing devices.

The mean operative time was 120 ± 15 minutes, which is considered good in our early experience may be attributed to the choice of small sized spleens in most of our cases and the use of energy devices in dissection, this results are superior to Yikun Qu et al; 2014 who reported 160 m in LS versus 98 m in open splenectomy group [11], but agree with Wang Y et al. 2010 who published a retrospective study on LS for two groups, the first was 96 patients with hypersplenism secondary to liver cirrhosis and the second comprised 110 patients with hematological and other disorders, the mean operative time was 2.8 vs 2.1 h respectively [12]. While Brunt LM, Langer, 1996 mean time was 170 minutes in LS [13].

Conversion to open surgery occurred in two cases (9.1%) out of six intraoperative bleeding, in which massive bleeding suddenly developed during hilar dissection obscuring the camera and necessitating rapid conversion to control bleeding. While in the other four cases, bleeding encountered during division of the short gastric vessels and controlled by LigaSure or hemoclips without the need of blood transfusion.

Alfons P et al; 2005 reported conversion rate of 7.4% of cases due to bleeding and technical difficulties in large spleens with limited working space [6], while in Wang Y et al.2010 conversion from laparoscopic to open surgery was necessary for 5 patients (2.4%) because of hemorrhage [12].

Yikun Qu et al; 2014 reported 12.5% conversion rate most of them due to uncontrolled hemorrhage and stated that bleeding is the most critical complication during LS, which can be avoided with the use of advanced instruments and a skillful technique. There are several vessel sealing energy devices that can be used to reduce the rate of bleeding to a certain extent including the LigaSure, the harmonic shears and the electrocoagulation [11].

Intraoperative blood loss was 150±30 ml in our study, which correlates with the estimated blood loss in Yikun Qu et

al; 2014 of 100±40ml in the laparoscopic group and 376±60ml in the open splenectomy group, while in Alfons P et al. 2005 series was less than 250 mL in 93 patients, between 250 and 500 mL in 21 patients, and greater than 500mL in 17 patients. Thirteen patients (10%) in Alfons P et al. series required transfusions in the perioperative period [6, 11].

We believe that the tamponade effect of the pneumoperitoneum, the magnification and the good visualization in laparoscopy, provide an excellent opportunity to control bleeding in LS, and is considered advantageous than open splenectomy, except in case of massive bleeding obscuring the field.

As regard the method of splenic retrieval from the abdomen (excluding the converted cases), we used a home-made extraction bag (sterile infusion container) was used in most of cases to reduce the cost in 14 out of 20, this method was ineffective in some patients with moderately large spleen, but fortunately this occurred in six female patients (27.3%) previously experienced caesarean section with scar on which 4 to 6cm incision was made to extract the spleen after manipulating the operative table raising the head up pushing the spleen to the pelvis, to be removed completely avoiding fragmentation with subsequent splenosis. Chia-Hung Su et al. 2013 had introduced a cost-effective. Homemade retrieval bag made from a commercial sterile infusion container and concluded that it is not only cheap but also easy to use [14]. While Mohan Ramalingam et al. 2013 had a case report of transvaginal splenic extraction combined with hysterectomy as NOTES technique with no complications [15]. The hospital stay ranged from 3 to 11 days with a mean of 6 days. There were no major postoperative complications or deaths. These results are comparable to many published series [11, 12].

The problem of splenosis was aroused by Yikun Qu et al; 2014 who recommended Follow-up to be continued for the duration of these patients' lifetimes because splenosis from a tiny, invisible fragment caused by piece meal retrieval may require a long period of time [11]. In addition, if splenosis occurs, a long period of time may also be required to change from just splenosis to hypersplenism. Therefore, patients should undergo long-term evaluation of hemoglobin levels, white blood cell counts, and platelet counts [12].

Hyperslenism was the aetiology of splenectomy of 6 cases (27.3%), with cirrhotic liver and moderate spleens, this agree with many studies which consider laparoscopic splenectomy and azygoportal disconnection with the new technique may become the gold standard for removal of massively enlarged spleens with use of an electromechanical morcellator. This technique will extend the advantages of laparoscopic surgery to a number of patients that are likely to benefit the most, namely cirrhotic patients with bleeding portal hypertension and hypersplenism [12, 16, 17].

Our study has been performed in anterolateral approach which has the advantage of better visualization of the splenic hilum, this correlates with the concept of Gajbhiye AS et al.2015 who preferred this approach to the posterolateral one as it elongates the splenic pedicle [18].

The postoperative complications in our study were minors and treated all conservatively without long term morbidity and there was no mortality, this means that LS is a safe procedure with comparable results to the open surgery with the advantages of minimally invasive technique.

The hospital stay of our patients ranged from 3-11 days with a mean of 6 days which is comparable to the Canadian (Montreal) group (5.5 days (range 2-32)) and the series of Delaitre et al. 2000 who reported a mean hospital stay of 6.4 days [19].

20 of our patients presented to us by platelet count less than 150,000 all of them returned to normal values at three months postoperatively and these values were maintained during the consecutive follow up studies, this agree with Yikun Qu et al; 2014 who noticed increase of the post-operative platelet count significantly in both groups (LS &open splenectomy) in comparison with that before the operation [11].

The two cases (9.1%) of autoimmune hemolytic anemia treated with LS with no relapse during the follow-up period, this correlates with the results of Valentima Get al. 2016 who stated that LS is considered a good therapeutic option with complete remission rate of 81% at 35.6 months [20].

5. Conclusion

Laparoscopic splenectomy is not only safe minimal invasive procedure, with comparable results to the open splenectomy in management of small and medium sized spleens in benign disorders but also, has the advantages of negligible intraoperative blood loss. Larger series of randomized controlled trials with longer periods of follow up are required to evaluate this promising operation.

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