

Laparoscopic splenectomy versus open splenectomy for immune thrombocytopenic purpura

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Abstract- Background: Idiopathic thrombocytopenic purpura (ITP) is an acquired disorder in which there is immune-mediated destruction of platelets. ITP is characterized by mucocutaneous bleeding and a low, often very low platelet count with an otherwise normal peripheral blood cells and smear. Patients usually present either with ecchymoses and petechiae or with thrombocytopenia incidentally found on a routine complete blood count (CBC). Mucocutaneous bleeding, such as oral mucosal, gastrointestinal, or heavy menstrual bleeding may be present. Rarely, life threatening including central nervous system bleeding can occur.

Splenectomy was initially described as a therapeutic measure for idiopathic thrombocytopenic purpura (ITP) by Kaznelson in 1916.¹ This procedure remained the only effective treatment for ITP until 1951, when Harrington and colleagues² discovered the role of plasma immunoglobulin in the induction of thrombocytopenia in ITP. Dameshek et al.³ coined the term hypersplenism and demonstrated a rise in platelet counts with the administration of steroids. Since then, medical management has been the primary treatment for ITP. Today, splenectomy is indicated in (1) refractory symptomatic thrombocytopenia after 4 to 6 weeks of medical therapy, (2) when toxic doses of steroids are required to achieve remission, and (3) for relapse of thrombocytopenia after an initial response to steroid therapy.

Methods

- 54 patients underwent splenectomy for ITP in our hospital were included in the study.
- This is a prospective and retrospective study.

-Study period:

Retrospective study from January 2003- March 2012.

Prospective study from April 2012- July 2014.

- Institutional ethical committee clearance was obtained.

Findings

- From our study it is observed that laparoscopic splenectomy for ITP offers following advantages over open splenectomy:
 1. Lesser intraoperative blood loss.
 2. Lesser intraoperative and postoperative platelet and blood transfusion.
 3. Lesser pain and duration of intravenous analgesia
 4. Lesser duration of nil by mouth and early resumption to general normal diet.
 5. Early drain removal

Interpretation

Laparoscopic approach may be considered as a better choice of approach for splenectomy in patients with ITP in view of less intraoperative blood loss, less post operative pain, lesser time to resume to normal diet and better cosmetic value.

Funding

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I. INTRODUCTION

Idiopathic thrombocytopenic purpura (ITP) is an acquired disorder in which there is immune-mediated destruction of platelets. ITP is characterized by mucocutaneous bleeding and a low, often very low platelet count with an otherwise normal peripheral blood cells and smear. Patients usually present either with ecchymoses and petechiae or with thrombocytopenia incidentally found on a routine complete blood count (CBC). Mucocutaneous bleeding, such as oral mucosal, gastrointestinal, or heavy menstrual bleeding may be present. Rarely, life threatening including central nervous system bleeding can occur. Splenectomy was initially described as a therapeutic measure for idiopathic thrombocytopenic purpura (ITP) by Kaznelson in 1916.¹ This procedure remained the only effective treatment for ITP until 1951, when Harrington and colleagues² discovered the role of plasma immunoglobulin in the induction of thrombocytopenia in ITP. Dameshek et al.³ coined the term hypersplenism and demonstrated a rise in platelet counts with the administration of steroids. Since then, medical management has been the primary treatment for ITP. Today, splenectomy is indicated in (1) refractory symptomatic thrombocytopenia after 4 to 6 weeks of medical therapy, (2) when toxic doses of steroids are required to achieve remission, and (3) for relapse of thrombocytopenia after an initial response to steroid therapy.

Until recently, splenectomy had been performed exclusively as an open surgical procedure. In 1991, Delaitre and Maignien⁴⁻¹⁰ reported the first successful laparoscopic splenectomy (LS). Since then, multiple studies have suggested that LS is effective, feasible, safe, and provides clinical and economic benefits such as shorter hospital stay, less postoperative pain, and fewer complications over open splenectomy (OS). Because laparoscopic splenectomy is associated with less abdominal trauma, operative platelet consumption and therefore need for platelet transfusion may be reduced during laparoscopy compared with open surgery.

II. MATERIALS AND METHODS

- 54 patients underwent splenectomy for ITP in our hospital were included in the study.
- This is a prospective and retrospective study.

-Study period:

Retrospective study from January 2003- March 2012.

Prospective study from April 2012- July 2014.

- Institutional ethical committee clearance was obtained.

• **Inclusion criteria:**

1. All patients who underwent splenectomy for ITP in Kasturba Hospital, Manipal from January 2004 to July 2014.
2. Age >18years.

• **Exclusion criteria**

1. Laparoscopy converted to open splenectomy
 2. Age < 18years.
 3. Patients undergoing any other surgery concomitantly with laparoscopic/open splenectomy.
 4. Patients with co-existing myeloproliferative diseases.
- All patients were referred from medicine department for splenectomy. Medical therapy with steroids and other immunomodulatory agents constituted the initial treatment option. However, when the disease was refractory to medical therapy or the toxicity of the medication was unacceptable, splenectomy was offered.
 - Type of procedure (laparoscopic/open splenectomy) was based on the preference of the operating surgeon. All successful laparoscopic splenectomies for ITP, were done by a single surgeon. Open splenectomies were by random surgeons in the department of General surgery.
 - Nature of procedure and complications associated with the procedure has been explained to the patient. Outcome of splenectomy for ITP has been explained.
 - All patients received immunization against pneumococcus and H. influenza at least 2 weeks before surgery.
 - Patients with severe anaemia and very low platelet counts were optimized before surgery either with IVIG and or blood and platelet transfusion, so the platelet count reached at least 10,000/ μ L.
 - All clinical and laboratory data were collected from the medical records of the patients.
 - Patients were shaved from nipples to mid thigh in night before surgery. Ryles tube was placed in all patients and urinary catheter was placed as per surgeon's choice on the day of surgery under anaesthesia.

- Antibiotic was given at the time of induction of anaesthesia and were continued for 3-5 days depending on the surgeon's choice.
- Intraoperative/postoperative platelet and blood transfusions were given depending on the individual patient's blood loss intraoperatively.
- Postoperative pain was evaluated by using Visual analogue scale (VAS) in the immediate postoperative period usually in the postoperative ICU (0 hours), after 12 hours and 24 hours.
- Nature of parenteral analgesic was of surgeon's choice usually opioid congeners/NSAIDs at the standard dose required. Duration of analgesics was depending on the pain experienced by the patient. Oral analgesics were given as and when required after stopping parenteral analgesics.
- Duration of nil by mouth is calculated from the time patient reaches post operative ICU to the time when patient tolerates liquids usually water. This time is usually 6 hrs for laparoscopic splenectomy group and 24 hrs for open splenectomy group. In case of intolerance to liquids at 6 hrs/ 24 hrs in the respective groups the time at which patient tolerates liquids was taken in to account. Similarly tolerance to general normal diet is calculated.
- Platelet counts were repeated on the following day and subsequently daily till it stabilized.
- Patients were categorized into responders, complete responders and refractory based on the classification described by International Working Group (Vicenza Consensus Conference) in 2009 (mentioned above).
- Patients were discharged once platelet count stabilized in case of responders incase of persistent low platelet counts post surgery which required treatment they were considered refractory and started on immunosuppressants and are evaluated for accessory spleens by sulphur colloid scans/denatured red blood cell scintigraphy.
- Antiplatelets and anticoagulants were started if platelet counts are >10,00,000/ μ L.
- Patients were followed up regularly and frequency depending on the platelet count.
- Most of the patients had to be kept in the ward due to mounting platelet count.
- Abdominal drain was put in all patients and criteria for drain removal was drain out put less then 20ml for 24 hrs.
- Final analysis was made.

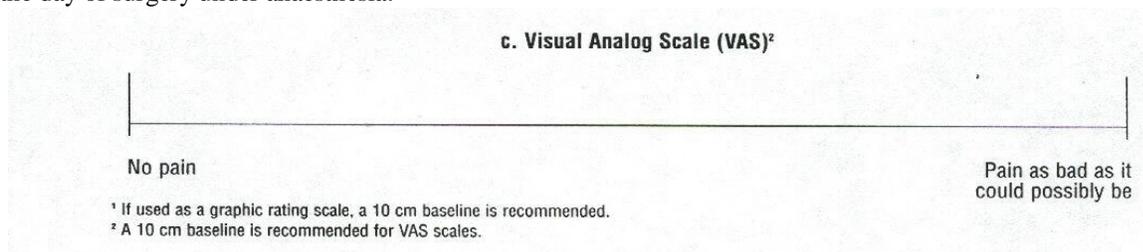
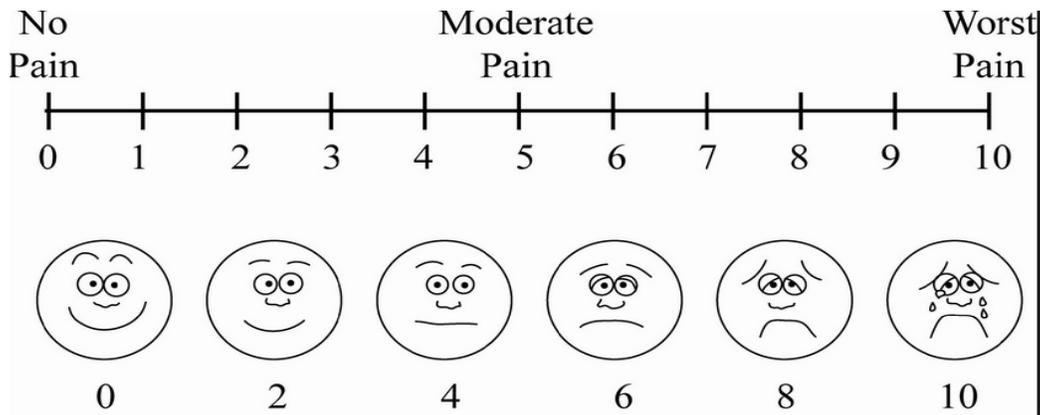


Figure 1: Visual analogue scale



III. OBSERVATIONS AND ANALYSIS

Total 54 patients underwent splenectomy for ITP in the given time period. Laparoscopic splenectomy was attempted in 32 patients and in 4 patients procedure had to be converted in to open splenectomy due to varied reasons. Hence, those 4 patients were excluded in the analysis.

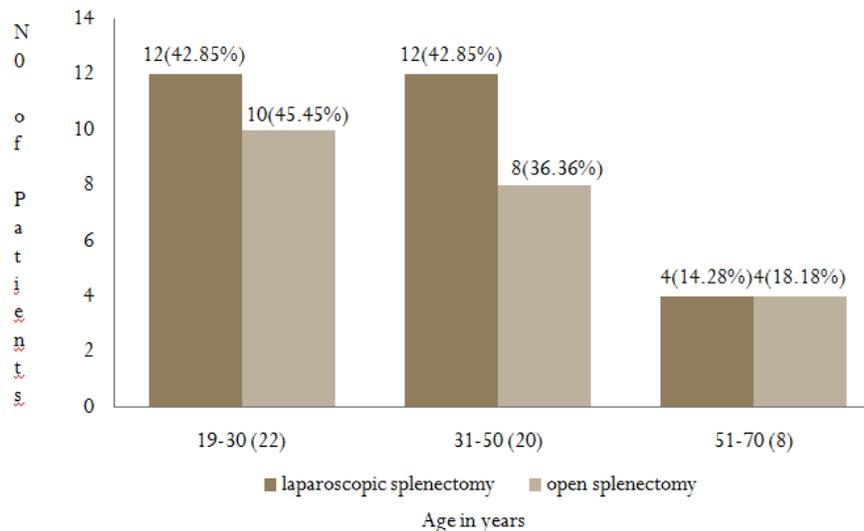
- **Laparoscopic splenectomy group:**

- 28 patients underwent laparoscopic splenectomy and were followed up within a range of 1-60 months.

- **Open splenectomy group:**

- 22 patients underwent open splenectomy and were followed up within a range of 2-40 months.

Patient's parameters:



- **Age distribution**

- In this study, the range of age in laparoscopic splenectomy group is 19-57 years with mean age of 34.36 years (SD =1.16). Range of age in open splenectomy group is 19-66 years with mean age of

36.77 years (SD = 1.39). p value is 0.507 which is statistically not significant.

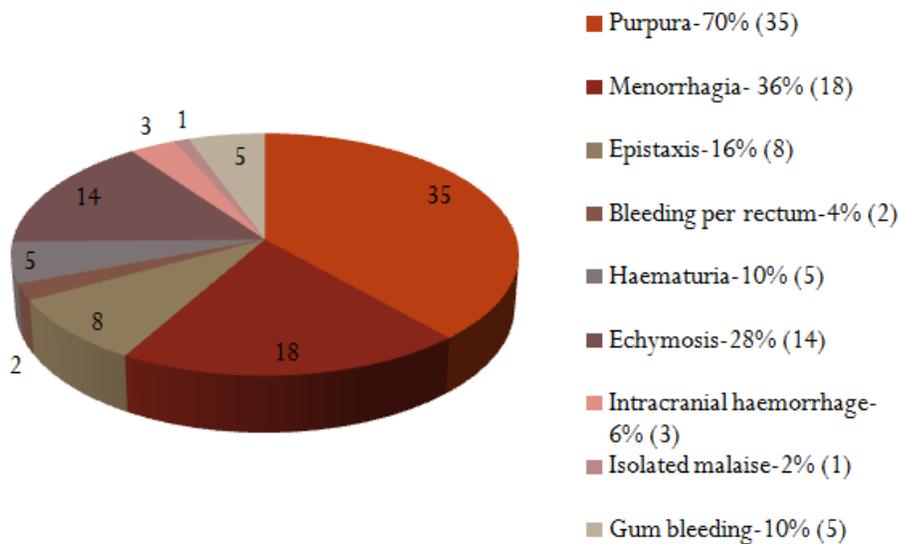
- Maximum number of patients are within 19-30 years.

- **Sex distribution**

Study group	Males	females	Ratio
Laparoscopic splenectomy (28)	5	23	1:4.6
Open splenectomy (22)	8	14	1:1.75
Total (50)	13	37	1:2.85

- In this study, 5/28 patients were males and 23/28 patients were females in the laparoscopy group with a ratio of 1:4.6. In open splenectomy group 8/22 patients

were males and 14/22 patients were females with a ratio of 1:1.75.



○ **Chief complaints**

- Majority of the patients in the study had purpura 35 (70%) followed by menorrhagia in 18 (36%) patients, epistaxis in 8 (16%) patients, bleeding per rectum in 2 (4%) patients, haematuria in 5 (10%) patients,

ecchymosis in 14 (28%) patients and 5 (10%) patients presented with bleeding gums.

- Interestingly 3 (6%) patients presented with intracranial haemorrhage, 1 (2%) presented with isolated generalized weakness without any other complaints.

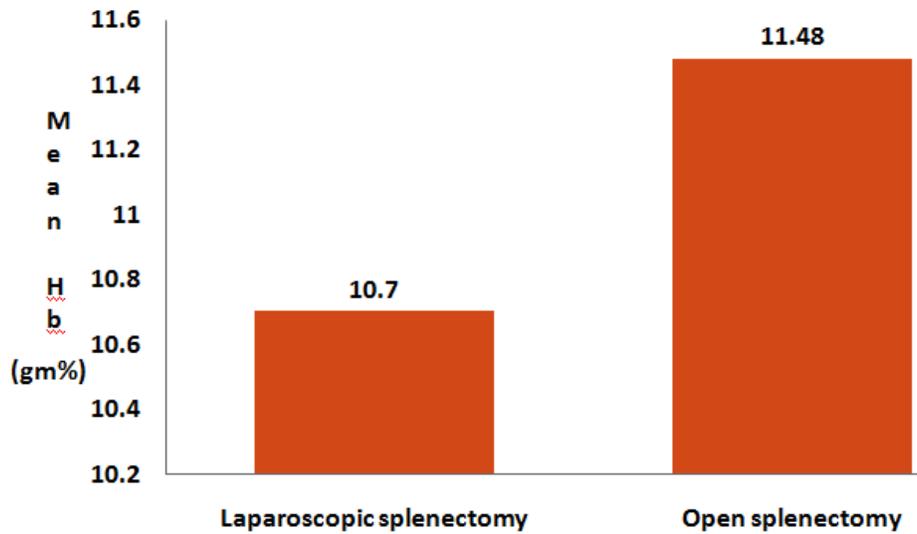
Preoperative platelet count	Laparoscopic splenectomy	Open splenectomy	p value
Mean (per μL)	31178 (SD=29298)	25209 (SD=27118)	0.465
Range (per μL)	2000-100000	3000-116000	-

○ **Preoperative platelet count**

- The mean preoperative platelet count in laparoscopic splenectomy group is 31178 (SD=29298) per μL and is

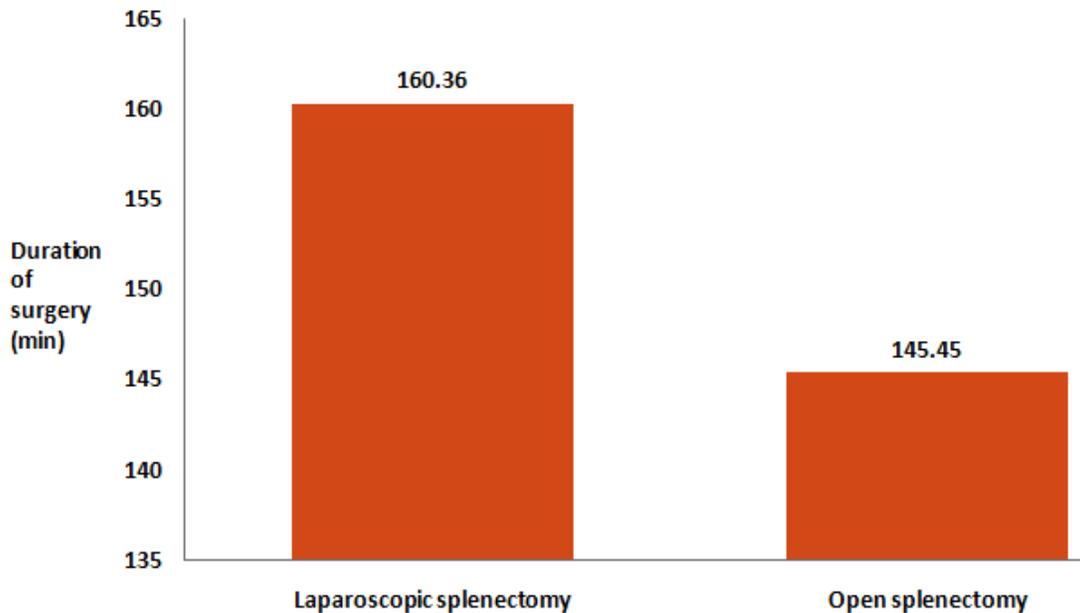
open splenectomy group is 25209(SD=27118) per μL . p value is 0.465 which is statistically not significant.

○ **Preoperative Haemoglobin**



- The mean preoperative haemoglobin in laparoscopy group is 10.7gm% and in open splenectomy group is 11.48gm%. p value is 0.207 which is statistically not significant.

o **Duration of surgery**



- Mean duration of surgery in the laparoscopic splenectomy group is 160.36 (SD=50.95) and in open splenectomy group is 145.45 (SD=41.60). p value is 0.99 and is statistically not significant.
- The mean duration of surgery in the prospective group ie., 15 patients in laparoscopic splenectomy group and 7 patients in open splenectomy group is 125.4 min(SD=30.4) and 110.6 min (SD=27.5) respectively. P value is 0.97 and is statistically not significant.

- Intraoperative blood loss**

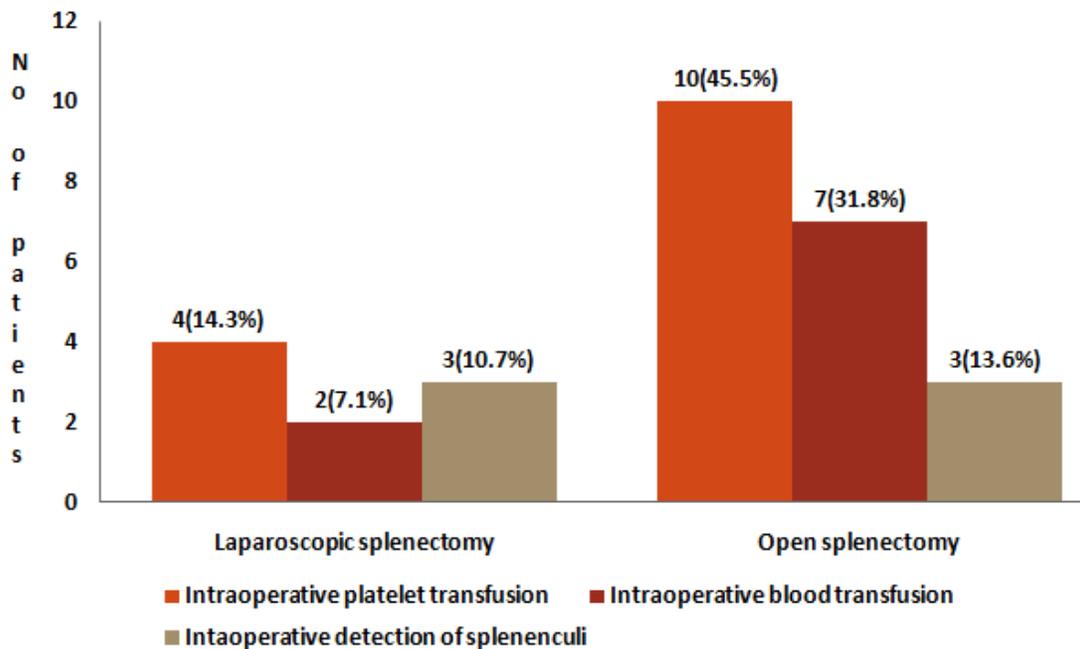
Intra operative blood loss (ml)	Laparoscopy splenectomy	Open splenectomy	p value
Mean	130.6(SD=379.5)	450 (SD=287.2)	0.001
Range	15-1500	100-1000	

Intraoperative blood loss was quantified in 15 patients in laparoscopic group 7 patients in open splenectomy group (prospective group of patients). The mean blood loss in laparoscopic splenectomy group is 130.6ml (SD=379.5) and 450ml (SD=287.2) in open splenectomy group. p value is 0.001 and is statistically significant.

• Intraoperative platelet/blood transfusion and intraoperative detection of splenenculi

	Laparoscopic splenectomy	Open splenectomy	p value
Intraoperative platelet transfusion	4 (14.3%)	10 (45.5%)	0.015
Intraoperative blood transfusion	2 (7.1%)	7 (31.8%)	0.032
Intraoperative detection splenenculi	3 (10.7%)	3 (13.6%)	1

○ **Intraoperative platelet/blood transfusion and intraoperative detection of splenenculi**

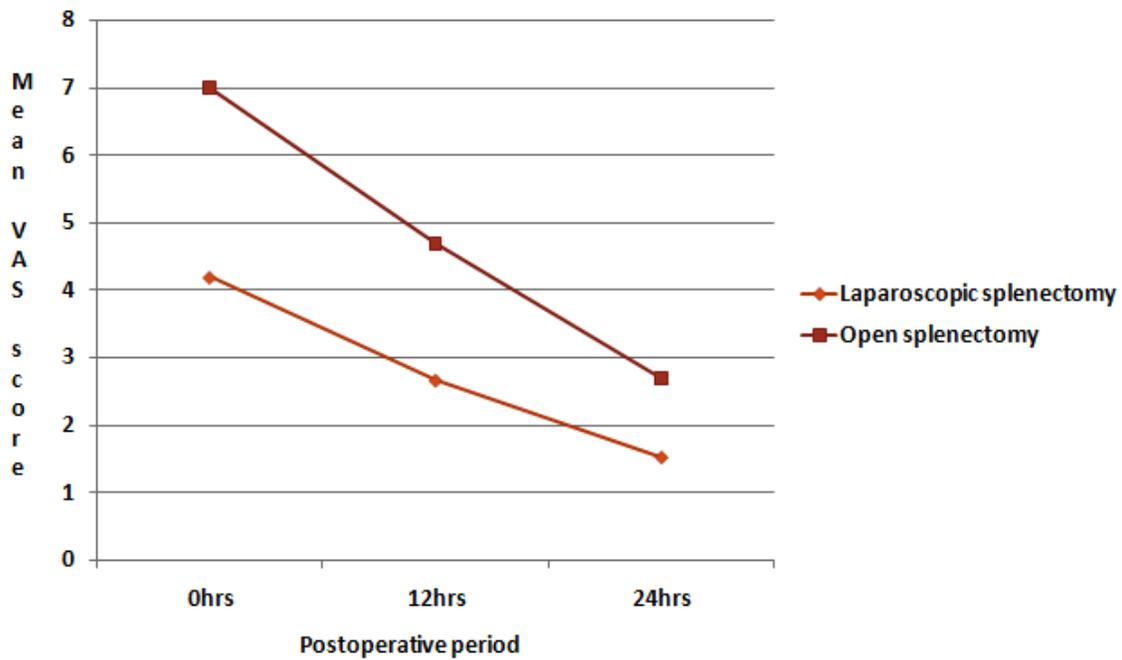


- Intraoperatively 4 (14.3%) patients in the laparoscopy group and 10 (45.5%) in the open splenectomy group required platelet transfusion. p value is 0.015 which is statistically significant.
- Intraoperatively 2 (7.1%) patients in the laparoscopy group and 7 (31.8%) in the open splenectomy group

required blood (packed red blood cells) transfusion. p value is 0.032 which is statistically significant.

- Intraoperatively 3 (10.7%) patients in the laparoscopy group and 3 (13.6%) in the open splenectomy splenenculi were detected. p value is 1 which is statistically not significant.

Postoperative pain



- VAS score could be calculated in 15 patients who underwent laparoscopic splenectomy and in 7 patients who underwent open splenectomy at 0hrs, 12hrs and 24 hrs post surgery.
- At 0hours post surgery mean VAS score was 4.20 (SD=0.77) in 15 patients under laparoscopic splenectomy group and 7.01 (SD=0.90) in 7 patients who underwent open splenectomy group. p value is 0.001 which is statistically significant.
- At 12hours post surgery mean VAS score was 2.67 (SD=0.81) in 15 patients under laparoscopic

- splenectomy group and 4.71 (SD=0.75) in 7 patients who underwent open splenectomy group. p value is 0.001 which is statistically significant.
- At 24hours post surgery mean VAS score was 1.53 (SD=0.51) in 15 patients under laparoscopic splenectomy group and 2.71 (SD=0.75) in 7 patients who underwent open splenectomy group. p value is 0.005 which is statistically significant.
- **Duration of parenteral analgesia**

Duration of parenteral analgesia	Laparoscopic splenectomy	Open splenectomy	p value
Mean (days)	1.32 (SD=0.66)	3.63 (SD=0.72)	0.001
Range (days)	1-3	2-6	-

- The mean duration of parenteral analgesia use in laparoscopic splenectomy group is 1.32 (SD=0.66) and
- **Duration of nil by mouth**

in open splenectomy group is 3.63 (SD=0.72). p value is 0.001 which is statistically significant.

	Laparoscopic splenectomy	Open splenectomy	p value
Mean duration of nil by mouth (hours)	7.50 (SD=4.79)	22.91 (SD=7.32)	<u>0.001</u>
Range of duration of nil by mouth (hours)	(6-24)	(12-48)	-

- The mean duration of nil by mouth in the laparoscopic splenectomy group is 7.50 (SD=4.79) hours and in open

splenectomy group is 22.91 (SD=7.32) hours. p value is 0.001 which is statistically significant.

Postoperative platelet/blood transfusion

	Laparoscopic splenectomy	Open splenectomy	p value
Post operative platelet transfusion	1 (3.6%)	5 (22.7%)	<u>0.039</u>
Post operative blood transfusion	0 (0%)	5 (22.7%)	<u>0.008</u>

- In laparoscopic splenectomy group 1 (3.6%) patient required postoperative platelet transfusion and in open splenectomy group 5 (22.7%) patients required the same. p value is 0.039 which is not statistically significant.

- In laparoscopic splenectomy group none required postoperative blood transfusion and in open splenectomy group 5 (22.7%) patients required the same. p value is 0.012, which is statistically significant.
- o **Complications**

Complication	Laparoscopic splenectomy	Open splenectomy	p value
Surgical site infection	1 (3.6%)	4 (18.2%)	0.15
Wound gaping	1 (3.6%)	3 (13.6%)	0.31
Postoperative pneumonia	1 (3.6%)	1 (4.5%)	1
Postoperative pleural effusion	1 (3.6%)	2 (9.1%)	0.57
Postoperative haemorrhage	0 (0%)	1 (4.5%)	0.44
Left subphrenic collection	1 (3.6%)	2 (9.1%)	0.57
Pancreatic injury	0 (0%)	0 (0%)	-
Portal vein thrombosis	1 (3.6%)	0 (0%)	0.44
Death	0 (0%)	0 (0%)	-
Total	6	13	0.078

- In this study surgical site infection was noted in 1 (3.6%) patient in the laparoscopy group and 4 (18.2%) patients in open splenectomy group.

- 1 (3.6%) patient in laparoscopy group and 3 (13.6%) patients in open splenectomy group developed wound gaping.

- 1 (3.6%) patient in laparoscopic splenectomy group and 1 (4.5%) patient in open splenectomy group developed post operative pneumonia.
- 1 (3.6%) patient in laparoscopic splenectomy group and 2 (9.1%) patients in open splenectomy group developed post operative pleural effusion and left subphrenic collection.
- 1 (4.5%) patient in open splenectomy group developed post operative haemorrhage.
- Among one patient who developed left subphrenic collection in laparoscopic splenectomy group had developed gastrocutaneous fistula due to an iatrogenic gastric injury during pig tail drain insertion. Food particles were noted in the drain and on performing upper gastro-intestinal endoscopy pig tail drain tip was seen inside the stomach.

- 1 (3.6%) patient in laparoscopic splenectomy group had portal vein thrombosis.
- 1 patient in open splenectomy group developed OPSI six months after splenectomy and died in spite of treatment.
- There is no pancreatic injury in either group.

○ **Duration of postoperative hospital stay**

- The mean duration of postoperative hospital stay in laparoscopic splenectomy group is 10.11 (SD=4.84) days and in open splenectomy group it is 12.23 (SD=3.89) days. p value is 0.10 which is statistically not significant.

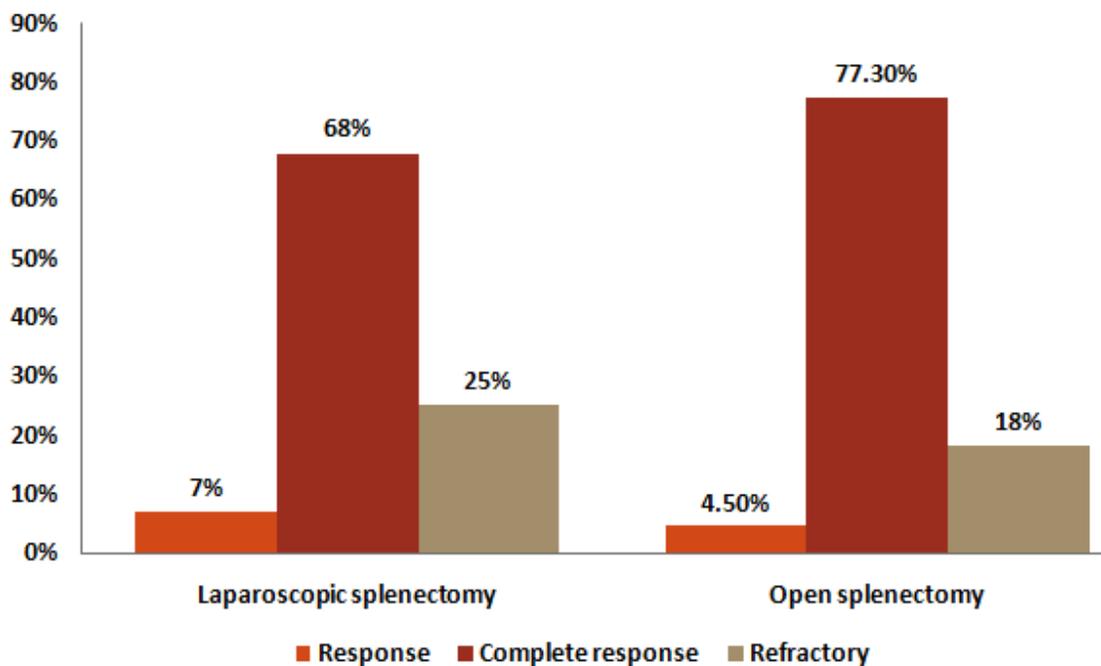
○ **Duration of abdominal drain in situ**

Duration of abdominal drain in situ	Laparoscopic splenectomy	Open splenectomy	p value
Mean (days)	1.75 (SD=0.89)	3.59 (SD=1.01)	<u>0.001</u>
Range (days)	1-4	2-7	-

- In laparoscopic splenectomy group mean duration of abdominal drain in situ was 1.75 (SD=0.89) days and in

open splenectomy group it was 3.59 (SD=1.01) days. p value is 0.001 which is statistically significant.

○ **Outcome of splenectomy**



- Complete response was seen in 19 (67.9%) patients in laparoscopic splenectomy group and in 17 (77.3%) patients of open splenectomy group. p value is 0.537, which is statistically not significant.

- Response was seen in 2 (7.1%) patients in laparoscopic splenectomy group and in 1 (4.5%) patients of open splenectomy group. p value is 0.701 which is statistically not significant.

- Refractory ITP was seen in 7 (25%) patients in laparoscopic splenectomy group and in 4 (18.2%)

patients of open splenectomy group. p value is 0.734 which is statistically not significant.

○ **Duration of follow up**

Duration of follow up	Laparoscopic splenectomy	Open splenectomy	p value
Mean (months)	17.4 (SD=16.52)	19 (SD=12.43)	0.708
Range (months)	1-60	2-40	-

- The mean duration of follow up in laparoscopic splenectomy group was 17.36 (SD=16.52) months and in open splenectomy group was 18.95 (SD=12.43) months. p value is 0.708 which is statistically insignificant.

- The mean duration of follow up in laparoscopic splenectomy group was 17.36 (SD=16.52) months and in open splenectomy group was 18.95 (SD=12.43) months. p value is 0.708 which is statistically insignificant.

• **Normalization of platelet counts**

Platelet count normalized on	Laparoscopic splenectomy	Open splenectomy	Combined
Day 1	11 (39.3%)	6 (27.3%)	17 (34%)
Day 2	8 (28.6%)	5 (22.7%)	13 (26%)
Day 3	4 (14.3%)	5 (22.7%)	9 (18%)
Day 4	1 (3.6%)	1 (4.5%)	2 (4%)
Day 5	0 (0%)	2 (9.1%)	2 (4%)
Day 7	1 (3.6%)	2 (9.1%)	3 (6%)
Never	3 (10.7%)	1 (4.5%)	4 (8%)
Total	28 (100%)	22 (100%)	50 (100%)

- Platelet count was normalized within 2 days of splenectomy in 60% of the patients. Platelet counts

never reached normal level in 8% of patients in the immediate postoperative period.

○ **Thrombocytosis**

Thrombocytosis	Laparoscopic splenectomy	Open splenectomy	Total
Present	9 (32.1%)	4 (18.2%)	13 (26%)
Absent	19 (67.9%)	18 (81.8%)	37 (74%)
Total	28 (100%)	22 (100%)	50 (100%)
Required antiplatelet/ anticoagulant	7 (25%)	3 (13.6%)	10 (20%)

- Thrombocytosis is present in 9 (32.1%) patients in laparoscopic splenectomy group and in 4 (18.2%) patients in open splenectomy group.
- Seven (25%) of the patients required antiplatelet/ anticoagulant in laparoscopic splenectomy group and 3 patients (13.6%) patients required the same in open splenectomy group.
- Accessory spleens were identified in 6 (12%) patients three in either group. The locations being hilum of

spleen and gastrosplenic ligament in one patient, gastrosplenic ligament in one patient, splenic hilum in 3 patients and in splenocolic ligament in one patient.

- Thirty two patients were attempted for laparoscopic splenectomy, 4 patients required conversion to open procedure reasons being intraoperative bleeding in three cases and failed to dissect splenic vessels in one patient.

IV. DISCUSSION

- **Age and sex distribution**

	Sampath S et al		Cordera F et al		Mohamed SY et al		Current study	
Group	LS	OS	LS	OS	LS	OS	LS	OS
Mean age (years)	43	46	52.5	49.9	31	38	34.4	36.8
Sex distribution (M:F)	1:1.5	1:1	1:2.2	1.3:1	1:4.3	1.8	1:4.6	1:1.7

- The mean age of patients undergoing surgery for ITP is less in our study as compared to studies of Sampath S et al and Cordera F et al. However, it is similar when compared to Mohamed SY et al.

- **Presenting complaints**

- The percentage of females is more in our study which is comparable with other studies.

Presenting complaints	Cordera et al	Current study
Purpura	38.37%	70%
Ecchymosis	51.16%	28%
Menorrhagia	NA	36%
Epistaxis	NA	16%
Bleeding per rectum	NA	4%
Haematuria	NA	10%
Intracranial bleed	NA	6%
Gum bleeding	NA	10%
Isolated malaise	NA	2%
Haemorrhage	53.48%	-
Fever	2.32%	-
Thrombosis	5.81%	-

NA- Details not available

- The predominant presenting complaints in the both studies are similar however there is higher incidence petechiae in the current study as compared to Cordera et al.
- Fever and thrombosis were presenting complaints in 2.32% and 5.81% in Cordera et al study which were not present in the current study.
- Preoperative haemoglobin/platelet count**

Preoperative test	Mohamed SY et al			Cordera et al			Sampath S et al			Current study		
	LS	OS	P value	LS	OS	P value	LS	OS	P value	LS	OS	P value
Mean Hb (gm%)	12.3	13.1	-	12.4	13	0.148	-	-	-	10.7	11.48	0.207
Mean platelet count ($\times 10^3/\mu\text{L}$)	48	18	0.28	58.4	65.4	0.130	56	60	0.8.8	31.2	25.2	0.465

- In the current study patients who underwent laparoscopic splenectomy had less mean haemoglobin and less mean platelet count. However, the difference in means is statistically not significant as compared to Cordera et al and Sampath S et al.
- Mean platelet count is higher in laparoscopy group than open group in Mohamed SY et al.
 - Duration of surgery**

Duration of surgery	Mohamed SY et al			Cordera et al			Sampath S et al			Current study		
	LS	OS	P value	LS	OS	P value	LS	OS	P value	LS	OS	P value
Mean (minutes)	175	185	-	167.07	119.21	0.001	156	103	0.001	160.36	145.45	0.708
Range (minutes)	(140-230)	(110-210)	-	-	-	0.130	-	-	-	(60-270)	(60-240)	-

- The mean duration of surgery is more in laparoscopic splenectomy group than open splenectomy group in the current study group as compared to Cordera et al study and Sampath S et al study.
- In Mohamed SY et al study mean duration of surgery in open splenectomy group is higher than laparoscopic splenectomy group.

Intraoperative platelet/blood transfusion and splenunculi detection

	Laparoscopic splenectomy	Open splenectomy	p value
Intraoperative platelet transfusion	4 (14.3%)	10 (45.5%)	<u>0.015</u>
Intraoperative blood transfusion	2 (7.1%)	7 (31.8%)	<u>0.032</u>
Intraoperative detection splenunculi	3 (10.7%)	3 (13.6%)	1

- Intraoperative platelet and blood transfusion requirements are significantly less in the laparoscopic splenectomy group when compared to open splenectomy group as compared to other studies.
- Intraoperative detection of splenunculi is more frequent in open splenectomy group than laparoscopic splenectomy group as compared to Cordera et al. study. However, this doesn't carry any significance.

Duration of nil by mouth, resumption of general oral diet and duration of parenteral analgesia

	Cordera et al			Current study		
	LS	OS	p value	LS	OS	p value
Mean duration of nil by mouth (hours)	-	-	-	7.5	22.91	0.001
Mean duration for resumption of general oral diet (days)	2.33	4.02	0.001	2.1	4.2	0.001
Mean duration of parenteral analgesia	1.24	2.42	0.001	1.32	3.63	0.001

- In the current study patients in laparoscopic splenectomy group had less mean duration of nil by mouth and less mean duration for resumption of general normal diet both of them are statistically significant and the later one is comparable with Cordera et al study.
- In the current study, patients in laparoscopic splenectomy group had significant less mean duration of parenteral analgesia which is comparable with Cordera et al study.
- Post operative complications**

	Cordera et al			Sampath S et al			Current study		
	LS	OS	P value	LS	OS	P value	LS	OS	P value
Surgical site infection (%)	0	4	0.494	1.96	1.85	-	3.6	18.2	0.15
Post operative pneumonia(%)	0	2	1	1.96	3.7	-	3.6	4.5	1
Post operative pleura effusion(%)	-	-	-	-	-	-	3.6	9.1	0.57
Post operative haemorrhage(%)	-	-	-	1.96	1.85	-	0	4.5	0.44
Left subphrenic collection(%)	-	-	-	1.96	3.70	-	3.6	9.1	0.57
Pancreatic injury(%)	-	-	-	1.96	0	-	0	0	-
Thrombosis	2	4	1.000	0	1.85	-	3.6	0	1
Death (%)	0	0	-	0	0	-	0	0	-
Total	-	-	-	-	-	-	7	13	0.12

- In the current study patients in laparoscopic splenectomy group had less number of complications statistically insignificant.

○ **Duration of postoperative stay**

Duration of postoperative stay	Sampath S et al			Cordera et al			Watson DI et al			Current study		
	LS	OS	p value	LS	OS	p value	LS	OS	p value	LS	OS	Pvalue
Mean (days)	3	10	0.001	3.31	5.34	0.001	2.1	13.4	0.001	10.11	12.23	0.1

- The mean duration of postoperative stay is lesser in laparoscopic splenectomy group when compared to open splenectomy group. However, when compared to other studies duration of postoperative stay in either group is higher because of the concern of

thrombocytosis and delay in patients clearing hospital bills.

- **Conversion of laparoscopic splenectomy to open procedure**

	Mohamed SY	Sampath S et al	Cordera et al	Current study
Conversion to open surgery(%)	14	9.8	21.4	12.5

- In the current study 4 cases were converted to open procedure that is 12.5% which is comparable with the Mohamed SY et al study.

- However, a single unit where laparoscopic splenectomy is done regularly there was 0% conversion rate.

Duration of follow up and percentage of patients with refractory ITP

	Watson DI et al			Sampath S et al			Cordera et al			Current study		
	LS	OS	Pvalue	LS	OS	Pvalue	LS	OS	Pvalue	LS	OS	P value
Mean duration of follow up (months)	14	60	-	18	44	-	-	-	-	17.4	19	0.708
Refractory (%)	7.7	17	-	15	28	0.222	9	12	-	25	18.2	0.734
% of patients found to have splenunculi upon investigating refractory ITP	100 (1/1)	100 (2/2)	-	NI*	NI*	-	50 (2/4)	NI#	-	20 (1/5)	100 (2/2)	-

#refractory group not investigated.

*peripheral smears demonstrated aspleniemia, follow-up imaging and consequently re-exploration were not indicated in any cases of complete recurrence.

- There was no statistical difference in the mean duration of follow up between the two groups in the study.
- When compared to open splenectomy group, laparoscopic splenectomy group has more number of refractory ITP however it is not statistically significant.
- Missed splenunculi are more in open splenectomy group.

- ✓ Laparoscopic splenectomy duration of surgery was more when compared to open splenectomy. However, mean duration of surgery decreased significantly in the prospective group of patients probably due to improvement in learning curve.
- ✓ Total numbers of postoperative complications are less in laparoscopic splenectomy group.
- ✓ Duration of post operative hospital stay is more in open splenectomy group.
- ✓ Complete response and response rates are marginally higher in open splenectomy group and refractory rates are marginally higher in laparoscopic splenectomy group.

V. CONCLUSION

- Most common age group who underwent splenectomy for ITP is 19-30 years in either group.
- Females commonly underwent splenectomy for ITP in either group.
- Most often encountered complaint is purpura.
- From our study it is observed that laparoscopic splenectomy for ITP offers following advantages over open splenectomy:
 - ✓ Lesser intraoperative blood loss.
 - ✓ Lesser intraoperative and postoperative platelet and blood transfusion.
 - ✓ Lesser pain and duration of intravenous analgesia
 - ✓ Lesser duration of nil by mouth and early resumption to general normal diet.
 - ✓ Early drain removal
- Though not statistically significant the following observations were made in our study:
 - ✓ Patients in open splenectomy group underwent surgery with less platelet counts.
 - ✓ Patients in laparoscopic splenectomy group underwent surgery with less haemoglobin.

- Missed splenunculi are more in open splenectomy group.
- To conclude laparoscopic approach may be considered as a better choice of approach for splenectomy in patients with ITP in view of less intraoperative blood loss, less post operative pain, lesser time to resume to normal diet and better cosmetic value.

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