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Original Research Article

Splenectomy indications and outcomes among children: a retrospective study from a tertiary care center in Saudi Arabia

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ABSTRACT

Background: Splenectomy is a surgical procedure frequently performed on children and adolescents for several hematological indications. It is recognized as a safe and feasible procedure. However, post-splenectomy complications are recognized well in some cases. Experienced surgeons play a vital role in managing intra-operative and postoperative complications. Evaluate indications, outcomes and complications of splenectomy among children and to find out the indications for open splenectomy in the era of minimally invasive surgery in a tertiary care center.
Methods: A retrospective study was conducted among 71 children (0-14) years old who underwent a splenectomy at King Faisal Specialist hospital and Research Center (KFSHRC) in Riyadh, Saudi Arabia, from 2010-2019. The study is based on electronic medical records. Data analysis was carried out using the Excel analysis tool.
Results: In total, 71 pediatric participants were included in this study. 60 (84.5 %) of them underwent laparoscopic splenectomy (LS) and 11 (15%) open splenectomy (OS). For LS (35 males, 25 females), while in OS (Seven males, four females). The median age was seven years among the LS group and six among the OS group. The average hours of surgery were 2:13 Hours (LS) while 2:23 Hours (OS). The median hospital stay among LS was four and a half days and the OS group was six days. The most common immediate postoperative complication was fever.
Conclusions: Laparoscopic Splenectomy has become the standard of care. LS has advantages over OS, like earlier recovery and shorter hospital stay.

Keywords: Blood transfusion, Hematological disorders, Laparoscopic, Spleen, Splenectomy

INTRODUCTION

The spleen is an immunological organ with a highly organized lymphoid compartment that combines the innate and adaptive immune system. This structure enables it to eliminate older erythrocytes from the bloodstream, which leads to the effective removal of microorganisms and cellular debris. For that, the spleen is considered the most vital organ for immunity.[1] Splenectomy is a surgical procedure that partially or entirely removes the spleen. In the pediatric age group, the most common indication of splenectomy is congenital hematological disease, which is common in this age group in addition to malignancy and trauma.[2] Traditionally, splenectomy was performed using an open approach. However, the laparoscopic approach has been increasingly adopted following the initial description in 1993 due to better patient-related outcomes.[3] This minimally invasive technique offers the advantages of a shorter hospital stay, less postoperative pain and procedure-related complications, minor abdominal scars and faster recovery, in addition to hematological benefits.[2] post-splenectomy complications include immediate postoperative and long-term complications. Overwhelming post-splenectomy infection (OPSI) is considered one of the most serious complications. Most

are caused by encapsulated organisms such as streptococcus pneumonia, Neisseria meningitis and Haemophilus influenza type b (Hib). However, this can be prevented by antibiotics and vaccinations.[4]

In the current study, we aim to investigate the indications, outcomes and complications of splenectomy among children and to find out the indications for open splenectomy in the era of minimally invasive surgery.

METHODS

Study design, setting and populations

The study was designed as a retrospective chart review of pediatric patients who underwent a splenectomy at King Faisal Specialist hospital and Research Center (KFSHRC) in Riyadh, Saudi Arabia for the period 2010–2019.

Data collection

Data was collected from patients' health medical records. Demographic data, surgical approach, operative time, hospital stay, preoperative and postoperative blood transfusions, intraoperative, postoperative and late complications were collected. Splenectomy was performed for a variety of hematological and non-hematological etiologies. Trauma patients were excluded. The decision was taken for splenectomy based on a multidisciplinary team, including pediatric hematologists, general pediatrics and pediatric surgeons. All (71 children) had a complete blood workup and abdominal ultrasound before surgery. A frequent blood transfusion is defined as more or equal to 250 ml/kg /year.5; based on that, the blood transfusion is classified into three levels: frequent, less frequent and none.

Three parameters (white blood cell, red blood cell and platelet counts) were used to assess the efficacy of splenectomy. Blood transfusion is considered a distinct factor in evaluating the effectiveness of splenectomy. Authors have been utilizing laparoscopy as a standard approach. Laparotomy is reserved for patients with comorbidities that prevent using the pneumoperitoneum, malignancy or a challengingly large spleen. The operative time was calculated after the exclusion of all combined cases.

Short-term complications were defined as those that occurred within 48 hours after surgery. All late complications and outcomes were assessed. The duration of the hospital stay is considered between admission and discharge or having a full oral diet without any symptoms related to surgery.

Inclusion criteria

The study included pediatric patients aged from 1-14 years old who underwent laparoscopic and open splenectomy at king Faisal specialist hospital and research center from 2010 -2019.

Exclusion criteria

The study excluded all trauma patient underwent splenectomy and patients with incomplete medical records.

Statistical analysis

Data analysis was carried out using the Excel analysis tool. Frequencies and percentages were used to present categorical variables. A T-test was used to compare continuous variables and a chi-squared or Fisher's exact test was used for proportions. A p value of 0.05 or lower was considered statistically significant.

RESULTS

There were 71 children with splenic diseases who underwent splenectomy. They were divided into two groups: 60 (84.5%) (35 male and 25 female) who had laparoscopic splenectomy versus 11 (15%) (seven male and four female) who had an open splenectomy, with no statistical significance (p=0.7). The mean age at the procedure was 6.78 (1-14) years in the laparoscopic group vs. 5.54 (2-9) in the open one with no statistical significance (p=0.17) as illustrated in (Table 1).

The medical diagnosis for both groups is illustrated in (Table 2). Thalassemia and sickle cell anemia were the top indications for surgery. The mean platelets, RBCs and WBCs count were extremely significant before and after splenectomy, as illustrated in (Table 3). In terms of blood transfusion, there are significant differences in blood transfusion before and after splenectomy as shown in (Table 4).

Regarding short-term complications, as shown in (Table 5). Fever and respiratory symptoms were the most common symptoms encountered (8.4% each). One patient in the laparoscopic group had low hemoglobin post-surgery related to Vaso occlusive crises. One patient with leukemia and a splenic fungal infection developed a collection post-open splenectomy, which was successfully treated conservatively.

The long-term complications are summarized in (Table 6). The Vaso occlusive crises were among the most long-term complications that happened at 11.3 %, followed by thrombocytosis at 4.2 %. One patient in the laparoscopic group has thrombocytopenia. One patient with lymphoma developed metastases and one with pancreatoblastoma had a recurrence; both were in the open group. Follow-up was considered from the time of the procedure until the last clinic visit, ranging from 2 to 11 years. In terms of operative time, after excluding Seven combined cases in the laparoscopic group (cholecystectomy, fundoplication, Heller esophagomyotomy, inguinal hernia, circumcision,

Perm catheter insertion and bone marrow aspiration and biopsy), there were no statistically significant differences between the two groups (p=0.48) as shown in (Table 7).

The hospital stay was longer in the open group, even though it did not reach significance statistically (p=0.21) as illustrated in (Table 7).

Table 1: Patient demographics and operative characteristics (n=71).

Variable	N (%)	P value
Sex		
Male	42 (59.2)	
Female	29 (40.8)	
Type of splenectomy		
Laparoscopic	60 (84.5)	0.70
Open	11 (15.5)	
Mean age at procedure (in years)		
Laparoscopic	6.78	0.17
Open	5.54	

Table 2: The medical diagnosis for the open and laparoscopic groups (n=71).

Diagnosis	Lap N (%)	Open N (%)
Thalassemia/thalassemia sickle	17 (28.)	4 (36.36)
Sickle cell	8 (13.3)	-
Idiopathic Thrombocytopenia purpura	6 (10)	-
Congenital dyserythropoietic anemia	5 (8.3)	1 (9.09)
Spherocytosis	3 (5)	1 (9.09)
Wandering spleen	3 (5)	-
Pyruvate kinase deficiency	2 (3.3)	-
Hereditary elliptocytosis	2 (3.3)	-
Autoimmune Lymphoproliferative disease	2 (3.3)	-
Juvenile myelomonocytic leukemia	2 (3.3)	-
Sideroblastic anemia	1 (1.6)	-
Xerocytosis	1 (1.6)	-
Hydatid cyst	1 (1.6)	-
Hemophagocytic syndrome	1 (1.6)	1 (9.09)
Lymphoma	1 (1.6)	1 (9.09)
Langerhans cell histiocytosis	1 (1.6)	-
Myelodysplastic syndromes /AML	1 (1.6)	-
Splenic abscesses	1 (1.6)	1 (9.09)
Myelofibrosis	-	1 (9.09)
Pancreatoblastoma	-	1 (9.09)
Pancytopenia, lymphadenopathy and splenomegaly	1 (1.6)	-
Malignant osteopetrosis	1 (1.6)	-

Table 3: The mean platelets, RBCs and WBCs count pre and post splenectomy.

	Before	After	P value
Platelet	181.7464789	373.2112676	<0.001
RBC	3.587605634	3.980140845	<0.001
WBC	8.645633803	13.48535211	<0.001

Table 4: Blood transfusion requirement before and after splenectomy.

Blood transfusion	Before splenectomy	After splenectomy	P value
No transfusion	16	19	0.00001
Less transfusion (< 250 ml/kg/year)	4	45	
Frequent transfusion (>=250 ml/kg/year)	51	7	

Table 5: Short-term complications post splenectomy (n=14).

Short term complication	Number (N)	%
Fever	6	8.40
Respiratory symptoms	6	8.40
Drop of HB*	1	1.40
Collection	1	1.40

*Hemoglobin.

Table 6: Long-term complications post splenectomy (n=14).

Long term complication	Number (N)	%
Vaso-occlusive crisis	8	11.3
Thrombocytosis	3	4.2
Thrombocytopenia	1	1.4
Tumor recurrence	1	1.4
Tumor metastasis	1	1.4

Table 7: Operative time and length of hospital stay among open and laparoscopic groups.

	Lap	Open	P value
Operative time (in hours)	2.13	2.23	0.48
LOH* (in days)	5.93	8.54	0.21

*length of hospitalization.

DISCUSSION

Splenectomy is frequently performed in children and adolescents for different hematological indications. In the present study, most of the sample underwent laparoscopic splenectomy, which indicates that LS is considered the most common approach and has been utilized as a standard approach. The evaluation conveyed that a major indication for splenectomy among children was hematological diseases, came in the top hemolytic diseases like thalassemia and thalassemia sickle, followed by sickle cell anemia and other indications like idiopathic thrombocytopenic purpura and hereditary spherocytosis. A previous study conducted on children with hematological diseases showed that the most frequent indications were sickle cell disease, sickle-beta thalassemia and beta-thalassemia, respectively.[6] We believe this might be related to the widespread nature of these hematological diseases among the Saudi population, which frequently presents with splenomegaly and ultimately needs splenectomy as a part of the definitive treatment.[7]

The laparoscopic approach has become the standard of care and has advantages over open splenectomy, like earlier recovery and a shorter hospital stay. However, open splenectomy still has indications and is reserved for challenging cases like huge splenomegaly and malignancy. As in this study, 11 out of 71 children underwent an open approach; for four of them, the decision was to be open from the beginning because of the huge spleen. However, seven patients were converted to open surgery. The reasons for conversion were adhesion of the spleen to nearby structures in two patients, tumors involving part of the pancreas in two patients and difficult spleen extraction due to its huge size in three patients.

Regarding the lab parameters used in our study to assess the beneficial effect of splenectomy, the mean of platelets, RBCs and WBCs increased after the splenectomy and was extremely significant. This significant difference was observed in previous comparative studies, which support the beneficial effect of splenectomy among patients with hematological disorders and showed considerable improvement of lab parameters post-splenectomy.[6,8]

According to Lisa Pecorari splenectomy reduces the transfusion requirement to half that of the pre-splenectomy stage and the interval between blood transfusions doubles after splenectomy.[3,6,9] In the current study, the frequency of blood transfusion decreased significantly post-splenectomy compared to pre-splenectomy. These results proved the beneficial effect of splenectomy in managing hematological conditions.

There is a similar study done by Ikramullah Khan Akhtar et al, showed that the frequency of blood transfusion decreased after splenectomy from more than 250 mg/kg/year to about 125 ml/kg/year post-splenectomy as well as that the interval of blood transfusion was one month while pre-operative was less than two weeks.[10] Another analytic study done in 2019 to evaluate the outcome of splenectomy among thalassemia patients showed a decreased frequency of blood transfusion from 4691.4 cc per year to 3764.2 cc per year, which was a significant difference.[11] Regarding complications, no

intraoperative complications were observed among the two groups. For postoperative complications, there was no significant difference between the two groups. A previous study done by Utria et al, showed no significant difference in overall complications between OS and LS. However, OS had a higher risk of preoperative transfusion. LS was associated with a shorter median hospital length of stay compared to the open group, which was significantly different. Both groups had similar mean operative times.[12]

This study showed that hospital stay and operative time were shorter in the laparoscopic group; however, they were not significantly different. Previous comparative studies showed that the operative time was longer in the laparoscopic group compared to the open group. One of the studies showed no significant difference between the two groups.[13] While the other showed a significant difference.[8] This difference may be due to the general pre-procedure preparation for minimally invasive procedures.

Ten previous comparative analytic studies showed that the median length of hospital stay ranged from 1.4 days to 4 days.[10,13-21] Six reports from them showed a significant difference between the laparoscopic and open groups, which was shorter in the laparoscopic one.[10,13,16,18-20] Four studies concluded that there were no significant differences between the two approaches. We thought these differences were due to the nature of minimally invasive procedures compared to other MIS that have shorter hospitalization stays and will reduce overall hospital costs.[22]

Retrospective nature of this study one of limitations that should be considered. Retrospective design may have resulted in incomplete or poorly recorded data as they are limited by their reliance on exciting data. Finally, as a single center study the results and findings might not be the same in other places and practical settings.

CONCLUSION

In conclusion, splenectomy has a beneficial effect, especially in hematological diseases. As shown in our study, it decreases the frequency of blood transfusions and improves the patient's condition. The laparoscopic approach is considered a standard of care and a feasible procedure as it is associated with a shorter hospital stay and rapid recovery.

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