Laparoscopic Splenectomy in Children with Sickle Cell Disease

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Background: Many children with Sickle Cell Disease (SCD) might experience severe sickle cell crises due to splenic complications. These include hypersplenism, acute splenic sequestration, splenic abscess and massive splenic infarction. Splenectomy is indicated to decrease the rate of recurrence of complications and the associated morbidity and mortality. The laparoscopic approach has proved to be associated with a better outcome. Many laparoscopic techniques were implemented for the removal of the spleen, especially when it is enlarged and fragile.

Objective: To evaluate laparoscopic assisted splenectomy technique and outcome in 51 children with SCD.

Design: A Retrospective Review.

Setting: Department of Pediatric Surgery, Salmaniya Medical Complex, Bahrain.

Method: Fifty-one children who had laparoscopic assisted splenectomy with a small inguinal incision from January 2002 to December 2014 were reviewed.

Result: Fifty-one children had laparoscopic assisted splenectomy for either hypersplenism 42 (82.4%) or acute splenic sequestration 9 (17.6%); 32 (63%) males and 19 (37%) females. The age range was 6 to 14 years, a mean age of 9.8. Only one (1.9%) case required conversion to open procedure due to excessive bleeding. Only 7 (13.7%) were admitted in the ICU following the procedure. The mean length of hospital stay was four days; the measured decrease in the HBS was 38%, preoperative fever was seen in 16 (31%), and there was no mortality.

Conclusion: Laparoscopic splenectomy with a left inguinal incision is a safe and effective approach in children with SCD.


Sickle Cell Disease (SCD) is a common genetic hematological disorder. The spleen is one of the early organs to be affected by SCD. Early in life, splenomegaly occurs, and with repeated vaso-occlusion and infarctions, auto splenectomy would follow; although splenomegaly could persist in some patients. Acute splenic sequestration, hypersplenism, splenic abscess and massive splenic infarction are serious SCD complications. Treatment could be either conservative with repeat transfusions or surgical. Splenectomy is indicated due to the high risk of recurrence and increased morbidity and mortality of some of the above-mentioned complications.

The laparoscopic approach has been compared to open approach in multiple studies in children with SCD as well as other hematologic disorders, and has proven to be superior to the open approach. It has the advantages of decreased pain, shorter hospital stay, fewer complications, faster return to normal activities and better cosmetic outcome. Several techniques were practiced for laparoscopic splenectomy in children, some of which had been tried in SCD children because they require a rigorous management from their caregivers. The aim of this study is to evaluate laparoscopic splenectomy technique and outcome in 51 children with SCD.

METHOD

Fifty-one patients who had laparoscopic splenectomy for SCD from January 2002 to December 2014 were reviewed. The age, sex, weight, indication for splenectomy, Sickle Hemoglobin percentage (HBS%) on admission and preoperatively, operative time, intraoperative complications, splenic weight, ICU admission, the length of hospital stay and conversion to open approach were documented. The inclusion criteria were patients with SCD below the age of 15, splenic complication, hypersplenism or acute sequestration. The following patients were excluded: adults or patients with other hematological disorders and patients needing concomitant cholecystectomy.

The diagnosis of SCD was based on Hemoglobin (HB) electrophoresis. Indications for splenectomy were either acute splenic sequestration or hypersplenism. Acute splenic sequestration crisis was defined as acute enlargement of the...
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Table 1: Patients’ Characteristics

<table>
<thead>
<tr>
<th>Age</th>
<th>Mean ± SD</th>
<th>9.8 ±1.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>6-14</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>Mean ± SD</td>
<td>32.4 ± 6.9</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>21-50</td>
</tr>
<tr>
<td>Gender</td>
<td>Males</td>
<td>63%</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>37%</td>
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Table 2: Measured Outcomes

| Operative Time (minutes) | Mean ± SD  | 131.7 ± 30.6 |
|                         | Range      | 75-190      |
| Splenic Weight (grams)  | Mean ± SD  | 218.8 ± 133.7 |
|                         | Range      | 50-470      |
| Length of Hospital Stay (days) | Mean | 4 |
|                          | Range      | 2-7         |
| Need for ICU Admission  | Percentage of Patients | 13.7% |
| HBS% on Admission       | Mean ± SD  | 63.9 ± 5.2  |
|                         | Range      | 50-70       |
| HBS% Preoperative       | Mean ± SD  | 39.6 ± 5.1  |
|                         | Range      | 30-55       |
| Mean Decrease in HBS Preoperative | Percentage | 38% |
| Intraoperative Complications - Bleeding | 1 case only - percentage | 1.96% |

The efficacy of splenectomy in children with SCD is evaluated by measuring the HBS percentage preoperative and postoperative. There was a decrease in HBS% in all patients, a mean decrease of 38% (P-value < 0.01). Nevertheless, there was no statistically significant difference between both genders in HBS% decrease on admission and preoperatively (P-value 0.9).

Other than pneumonia, there was no reported postoperative complication or mortality. No patient required postoperative blood transfusion or was readmitted after discharge. The follow-up revealed improved hematological and symptomatic profile.

DISCUSSION

Laparoscopic splenectomy in children was first described in 1993 by Tulmen et al. Since then, it became increasingly used as a safe and effective procedure, and now is considered superior over open surgery. Multiple advantages have been...
linked to the laparoscopic approach; these include decreased pain, shorter hospital stay, better cosmetic outcome and faster return to normal activities. The laparoscopic approach also has the advantage of available image magnification to allow clear visualization and full exploration of the abdominal cavity. The disadvantages of laparoscopic approach are longer operating time and higher costs.

Several techniques were implemented for the laparoscopic removal of the spleen in children. They vary in the patient's position, surgeon's approach, method of vessels devascularization and method of splenic extraction. The positions that were described for laparoscopic splenectomy include the supine position, the semi-lateral and the lateral. The approaches were anterior and lateral.

Different devices were tried for vessel devascularization; these include clips, sutures, ties, staplers, ultrasonic coagulation, monopolar and bipolar coagulation, Ethicon Endo-Surgery and ligature diathermy. Splenic extraction could be performed using either an endo-bag, an electrochemical morcellator with the endo-bag or by doing a Pfannenstiel or an inguinal incision. Although the endo-bag preserves the advantage of laparoscopic procedure as being minimally invasive, it could be difficult to manipulate and position the spleen correctly during extraction. The electrochemical morcellator technique was described 17 years ago as a technique that allows the removal of a massively enlarged spleen via laparoscopy.

Pfannenstiel or inguinal incision were also described for splenic extraction although it may sacrifice the mini-invasiveness advantage of laparoscopy.

Hand assistance during laparoscopy as a method to decrease pulmonary complications was also described by Lee et al especially for enlarged spleens. Nevertheless, this method was performed on adults, none of which had SCD.

Another technique described in the literature for splenectomy is the SIPES (single-incision pediatric endo-surgery). Three laparoscopic fascial incisions are performed, one of which is upsized for the endoscopic stapler and retrieval bag.

One alternative to both open and laparoscopic procedures, which preserves the mini-invasiveness of laparoscopy is described by Esposito et al in 2008 as a mini-laparotomy incision in the subcostal region. However, this approach does not have the cosmetic advantage of laparoscopy or lower groin incision, especially if the spleen is enlarged. In SCD children, it becomes more challenging when it comes to enlarged and fragile spleens.

Compared to other studies, our mean operative time is similar; however, our length of hospital stay is significantly higher. This is attributed to the fact that SCD patients are at higher risk of complications than other patients.

Reported complications for both open and laparoscopic splenectomy include intraoperative and postoperative bleeding, incision infection, pancreatic leak, rupture of the diaphragm, subphrenic hematoma, rupture of the colon, portal or splenic vein thrombosis, splenic hematoma, postoperative fever, acute chest syndrome and pulmonary complications, particularly in SCD children. In our study, only one case of intraoperative bleeding was converted to laparotomy (a conversion rate of 2%), and postoperative pneumonia in 31% of patients.

CONCLUSION

There is no standard procedure for laparoscopic splenectomy in children or particularly in children with SCD. Laparoscopic approach with a mini-inguinal incision is considered safe and effective for the removal of spleen in SCD children. Prospective blinded randomized controlled trial is recommended to compare the effectiveness of each laparoscopic approach for children with SCD.

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REFERENCES


