Laparoscopic inguinal hernia repair in children: The early learning curve of the trainer and trainees

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ABSTRACT

Aims: To report our experience with laparoscopic inguinal hernia repair in children.

Materials and Methods: A total of 45 children, who underwent laparoscopic inguinal hernia repair between November 2003 and June 2005 were included in the study. Data were obtained by retrospective review of the case notes.

Results: A total of 63 laparoscopic inguinal hernia repairs (18 right, 9 left and 18 bilateral) were performed on 45 children (29 boys and 16 girls). Age of the children ranged from 4 weeks to 4 years. The operative time ranged from 30 to 70 minutes for unilateral repair and 38 to 95 minutes for bilateral repair (median for unilateral was 48 minutes and for bilateral 55 minutes). This time decreased with surgeon experience, though not reflecting directly due to the fact that the training registrars performed part of the procedures in the last 23 patients. There were no intraoperative complications. The follow up period ranged from 3 to 15 months. One child developed umbilical port site infection, which was treated with appropriate antibiotics.

Conclusions: Laparoscopic inguinal hernia repair in children is safe, with minimal complications. With experience operative time decreases.

KEY WORDS: Inguinal hernia repair, laparoscopic, learning curve

INTRODUCTION

Laparoscopic repair of inguinal hernia in children is now performed routinely in a number of centers. The experience reported so far has been encouraging in terms of early results.[1,2] However, laparoscopic surgery is often perceived as more time consuming. We would like to report our experience in the first 45 patients who had laparoscopic inguinal hernia repair done at the Norfolk & Norwich Hospital.

MATERIALS AND METHODS

This was a retrospective study. The study period was 19 months, between November 2003 and June 2005. Patient details were retrieved from the computerized operating theatre records and patients notes. All consecutive laparoscopic inguinal hernia repairs operated during this period by the senior author (TT) were included. All children who were less than one year of age with unilateral or bilateral inguinal herniae, and children with bilateral inguinal herniae were offered laparoscopic repair. We have adopted the laparoscopic approach for the infant age group because of the opportunity to repair the contra-lateral internal orifice if found to be patent and suggestive of a sub-clinical hernia. The recorded parameters were sex, gestational age, age at the time of the operation, birth weight, weight at the time of the operation, operative time, length of postoperative hospital stay and complications. These were then analyzed. The follow up period ranged from 6 to 26 months.

All the procedures were done under general anaesthesia with endotracheal intubation [Figure 1]. A 30° 5 or 3 mm telescope was inserted through the umbilical port created by Hassan's technique. A pneumoperitoneum was then created with CO₂ gas to 8 mm Hg. Two 3 mm stab
incisions were made in the lower abdomen in the mid-clavicular line, and the working instruments were introduced directly. Both internal inguinal orifices were inspected and a purse string suture was placed around the open orifice using a 4-0 polypropylene suture. To do this the needle was introduced directly through the abdominal wall lateral to the internal inguinal orifice. The purse string commenced from the lateral side of the hernial orifice on the right side and the medial side of the orifice on the left (surgeon being right-handed). Care was taken to avoid damage to the vas and vessels by passing between these structures and the peritoneum. This was facilitated by grasping and lifting the peritoneum away from the vas and vessels [Figure 2]. When the purse string was completed the internal orifice was drawn closed [Figure 3].

All the children were followed up in the clinic 3 months after the operation. Parents were advised to contact the Department of Paediatric Surgery, if there were any concerns in the immediate postoperative period.

RESULTS

About 63 inguinal hernia repairs were performed laparoscopically in 45 patients during the 19 months study period. 16 of these children were girls. The ages of these children ranged from 4 weeks to 4 years. About 37 of these children were aged <1 year, 8 were more than 1 year. The median age was 4 months. Right inguinal hernia was found in 18 children, left inguinal hernia in nine children and bilateral inguinal herniae in 18 children.

Operating time was defined as the time taken between skin preparation with anti-septic solution and the time of completion of the skin closure. This was correlated with sex, age, weight of the child at the time of the operation and with our learning experience to assess whether these factors affected the duration of surgery. The median operating time for both unilateral and bilateral repair in girls was less than boys [Table 1]. The median duration of surgery was lower in children aged over 1 year [Table 2], and in those weighing more than 6 kg [Table 3].

The trend in the operating time was assessed as experience was gained with the surgical technique [Chart 1]. The total number of patients was divided into four groups according to the serial order (each of the groups had similar demographics). The median operating time for the initial 11 patients for unilateral and bilateral repairs was 53 and 54 minutes, respectively. This duration slightly dropped for the next 11 patients to
and in the case of Surgical technique

Table 1: Operating time correlation with sex

<table>
<thead>
<tr>
<th>Operating time in minutes (median and range)</th>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n=29)</td>
<td>51 (30-65)</td>
<td>60 (38-95)</td>
</tr>
<tr>
<td>Female (n=16)</td>
<td>47 (34-70)</td>
<td>51 (40-66)</td>
</tr>
</tbody>
</table>

Table 2: Operating time correlation with age

<table>
<thead>
<tr>
<th>Operating time in minutes (median and range)</th>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year (n=37)</td>
<td>51 (32-70)</td>
<td>60 (46-95)</td>
</tr>
<tr>
<td>&gt;1 year (n=8)</td>
<td>36 (30-41)</td>
<td>48 (40-66)</td>
</tr>
</tbody>
</table>

Table 3: Operating time correlation with weight

<table>
<thead>
<tr>
<th>Operating time in minutes (median and range)</th>
<th>Unilateral</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6 kg (n=21)</td>
<td>57 (32-62)</td>
<td>58 (47-82)</td>
</tr>
<tr>
<td>&gt;6 kg (n=24)</td>
<td>44 (30-62)</td>
<td>57 (38-95)</td>
</tr>
</tbody>
</table>

Chart 1: Surgical technique

45 minutes for unilateral and 51 minutes for bilateral repair. The senior author operated throughout all the first 22 patients. However, for the next 23 patients the senior author performed the procedure in conjunction with a training registrar who undertook a significant proportion of the surgery. Hence, an increase in operating time was seen. Once again there was an improvement noted for the subsequent fourth group of 12 patients as training registrars gained experience.

Children of 6 months or older were able to be discharged home the same day as the operation. As per the surgeon’s practice all children <6 months old were observed overnight in the hospital and discharged home the following morning. We did not encounter any intraoperative complications. One child developed postoperative umbilical port wound infection. This child presented on the fourth postoperative day and was treated with an appropriate antibiotic. Follow up rate at 3 months was 100% and at that time there was no recurrence of inguinal hernia or testicular atrophy in any of the children. One child was noted to have a retractile testis and is currently being observed.

DISCUSSION

Inguinal hernia repair is one of the most commonly performed operations in children. It is traditionally done via an open groin exploration. This has a high success rate and a low complication rate. However, there are some issues, including the debate about managing the contralateral groin in children who present with a unilateral inguinal hernia, and in the case of recurrence, repeated surgery of the cord entails the risk of damaging the spermatic vessels or vas deferens.

There is also a need to embrace recent advancements, and laparoscopic surgery for inguinal hernia is increasingly becoming a part of surgical practice. Reported advantages include excellent visual exposure, minimal dissection and thus, fewer traumas to the inguinal canal and spermatic cord. Recurrence rates are comparable to open inguinal hernia repair and there is improved cosmesis. Laparoscopy can also accurately diagnose a contralateral patent processus vaginalis in children who undergo unilateral inguinal hernia repair.

For these reasons, the laparoscopic approach was adopted in November 2003 by the senior author. Laparoscopic approach was offered only to infants initially, since this did not alter the practice of general anaesthesia with endotracheal intubation in children less than a year old. This was in contrast to older children who were anaesthetized with GA and a laryngeal mask. Later, children with bilateral inguinal hernia were included irrespective of their age, since closure of an additional inguinal orifice added very little time to the entire procedure.

In our series, the median operating time for unilateral inguinal hernia repair was 49 minutes (range 30-70 minutes), and for bilateral repair was 55 minutes (range 38-95 minutes). Considering 37 of 45 children were aged less than 1 year, the operating time was certainly comparable to open inguinal hernia repair. A series published by Burge in 2003, studied the operating and anaesthetic time required for inguinal hernia repair in the neonate reports median operating time for unilateral inguinal hernia repair to be 45 minutes (range 20-170) and bilateral repair to be 64 minutes (range 35-120).

Operating time was understandably longer for smaller and younger babies. This was longer in male children presumably because of additional time spent taking care not to include vas and vessels in the purse string closure of the internal inguinal orifice. Although it is not possible to quantify, the surgeon did become more comfortable with the procedure as experience was gained. There was some reduction in the operating time, however, this is not significant. After the initial 22 patients the consultant...
surgeon allowed the training registrars to carry out part of the procedure and this was reflected by an increase in surgical duration. Currently a simulator in the skills laboratory is being used by our trainees and surgeons to practice inserting the purse string laparoscopically. We are confident that the operating time will reduce significantly with more experience.

There were no intra-operative complications, and no patient required conversion to an open procedure. However, on two occasions a dilated sigmoid colon obscured good vision, but this was vastly improved following a gentle digital rectal decompression.

Postoperatively one child developed umbilical port wound infection, which was treated with appropriate antibiotics. Culture grew *Staphylococcus aureus*, which was sensitive to flucloxacillin. There has been no presentation with recurrent inguinal hernia following laparoscopic repair at the early follow-up. A longer follow-up will be conducted to verify the low recurrence rate. Though the hernial sac was not transected, none of the patients has developed a postoperative hydrocoele.

The senior author has introduced the laparoscopic technique of hernia repair to trainees. This serves as an encouragement and motivation for the trainees to master the fine intra-corporeal suturing technique. Close supervision is essential for this undertaking to avoid unnecessary complications including trocar injury and prolonged anaesthesia.

**CONCLUSION**

Our series support the findings of other studies, that laparoscopic inguinal hernia repair is feasible and safe in children including neonates. Operating time is comparable with open exploration and shortens as one gains experience with the procedure. Complications are minimal though long-term follow-up will be needed to determine the validity of these results.

**REFERENCES**


**Source of Support:** Nil, **Conflict of Interest:** None declared.

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