ABSTRACT

Background and Objectives: Herniotomy/open surgery (OS) has been the time honored treatment for pediatric inguinal hernia (PIH). Laparoscopic surgery (LS) has recently emerged as an alternative in its management. However, controversy is rife on its feasibility and wider adoption. The present need is to know whether a significant difference exists in the surgical outcomes following either technique.

Methods: In a prospective study between January and December 2006, 85 children underwent either LS (51) or OS (34) for PIH. Operation time, intra- and postoperative complications, postoperative pain, postoperative stay, cosmesis, and the size of testis were recorded and compared for differences in outcome. Patients were followed up for an average of 3.5 months.

Results: All in the open group had unilateral (UL) hernias. The laparoscopy group had 6 (11.8%) bilateral (BL) hernias, and 10 (22.2%) contralateral patencies of processus vaginalis (CPPV) were detected intraoperatively and repaired simultaneously. Bilateral repairs were excluded from comparative analysis. LS was slightly quicker than OS to perform [25.31 min vs 30.65 min (P < 0.06)]. The difference in pain perception, between LS and OS, was insignificant. Immediate postoperative recovery was delayed in more children undergoing LS (P = 0.02), but the duration of hospital stay was similar (P = 0.37). Complication rates were similar (P = 0.96). Cosmesis in LS was superior to that in OS.

Conclusions: Well-performed conventional herniotomy yields results similar to those of laparoscopic repair. Cosmesis and the ability to detect and simultaneously repair CPPV are the 2 main advantages of LS over OS. Keeping in mind the low incidence of meta-chronicity in UL hernias, insignificance of cosmesis over the groin, and the constraints of the developing world, conventional open herniotomy can justly be performed for UL hernias, as the standard of care, in centers lacking laparoscopy.

Key Words: Pediatric inguinal hernia, Laparoscopy, Herniotomy.

INTRODUCTION

Laparoscopic surgery (LS) for pediatric inguinal hernia (PIH) is emerging as an alternative to open surgery (OS) with studies both validating and questioning the superiority of LS over OS. Therefore, wider adoption of LS, in the management of PIH, remains controversial, especially so, in developing countries with limited access to tertiary care facilities. The need for comparison of the 2 techniques for addressing PIH propelled us to prospectively evaluate the differences in their short-term outcomes.

METHODS

Study Design

This study was conducted in a tertiary care, teaching hospital from January 2006 to December 2006 with the approval of the hospital ethics committee. Children below 14 years of age, with congenital inguinal hernia (CIH), were enrolled in the study. Children underwent either LS or OS based on the days of presentation to the outpatient department. Both LS and OS were performed by the respective consultants with a resident as an assistant/cameraman. Protocols for pre- and postoperative care were predetermined to ensure uniformity. Except for the operating surgeon, the team of caregivers and the admission ward remained the same.

Preoperative Assessment

Patients were admitted the evening before surgery after they were screened for associated problems, such as undescended testis. Patients were kept fasting for 4 hours.
before surgery. No premedications were administered. Informed consent was obtained from the parents of all the patients.

**Anesthesia**

All operations for CIH were performed with the patient under general anesthesia (GA).

**Surgical Technique**

Laparoscopic surgery was performed using the standard three 5-mm ports with an intra-abdominal pressure of 8 mm Hg. The internal ring was obliterated by Z-suture purse string suture using 3–0 nonabsorbable (silk) on a 17/20-mm swaged needle, introduced directly through the anterior abdominal wall. A similar procedure was performed on the contralateral side, if found to be patent.

Open herniotomy was performed using a skin crease incision. High ligation of the sac was performed using 4/0 absorbable (Monocryl) suture. The distal sac was slit to prevent postoperative hydrocele formation. The wound was closed in layers, using absorbable suture.

**Study Parameters**

**Table 1** shows the parameters assessed. Postoperative pain was assessed using the Children and Infant Postoperative Pain Score for children <3 years and the Children’s Hospital of Eastern Ontario Pain Score for patients over 3 years. Older children were also assessed using the Verbal Response Score. Acetaminophen was used for analgesia (15 mg/kg/dose, 6 hourly) in children requiring pain relief. Patients were discharged once they were hemodynamically stable, with no residual effects from the anesthesia, tolerating oral feeding well and being ambulatory.

Parents of the patients were asked to bring the patients back for review to the outpatient department on specified days. They were assessed for postoperative pain, postoperative complications; cosmesis of the scar; recurrence and change in testicular size, if any, as compared with the preoperative status. Patients were followed up for an average of 3.5 months to evaluate these short-term outcomes.

**Statistical Analysis**

Continuous variables were expressed as mean±standard deviation. The chi-square test and Fisher’s exact test were used for proportions. Statistical significance was calculated using the 2-tailed Student t test and the Mann Whitney U test. Microsoft Excel and Center for Disease Control software Epi6 were used for statistical work.

**RESULTS**

Of the 85 children (M:F 77:7), hernias were clinically right-sided in 52 (61%) patients, left-sided in 27 (32%), and bilateral in 6 (7%). Fifty-one patients underwent LS, of which 35 children received purely unilateral (UL) repairs. The remaining 16 underwent bilateral (BL) repairs and were excluded from the comparative analysis. Thirty-four children underwent OS, all UL.

Results comparing, exclusively, the UL repairs of LS and OS are tabulated in **Table 2**. The mean age of children undergoing OS was significantly lower than those undergoing LS (P<0.01). This difference was due to the number of very young children operated on by the pediatric surgeon owing to referral bias. When these children were excluded, there was no statistical difference between the OS and LS groups as far as age was concerned. LS was slightly quicker than OS to perform (25.31 vs 30.65 min), but the difference was neither statistically nor clinically significant (P=0.06). The difference in pain perception between LS and OS was insignificant.

Immediate postoperative recovery (<3 hr) was delayed in a greater proportion of children undergoing LS (P=0.02), but duration of hospital stay was similar (P=0.37). All patients except 1, in the OS group, were discharged within 10 hours of surgery. Similarly in the LS group, all but 4 were discharged within a similar time. Patients detained overnight were detained either on account of geographic distance (3 of LS group) or parental concerns (1 each in the LS and OS group).

**Table 1.**

| S No | Parameters                     |
|------|--------------------------------|
| 1    | Operation time                 |
| 2    | Size of incision               |
| 3    | Intraoperative complications   |
| 4    | Intraperitoneal pressure*      |
| 5    | Postoperative pain             |
| 6    | Recovery                       |
| 7    | Postoperative complications    |
| 8    | Discharge                      |
| 9    | Recurrence                     |
| 10   | Cosmesis                       |
| 11   | Testicular atrophy             |

*Only for laparoscopic surgery.*
Complication rates were similar ($P=0.96$). Trivial peritoneal bleeding was observed in 2 cases performed laparoscopically due to needle injury. Transient hydroceles (lasting a few days) were observed in 2 cases performed laparoscopically and in 1 performed conventionally. Mild scrotal edema was observed in 2 cases following OS, which resolved spontaneously in a few days. Erythema over the suture line was observed in 2 cases performed conventionally, which resolved with oral antibiotics. Cosmesis in LS was superior to that in OS. Twenty-two percent of children undergoing LS had CPPV, which were repaired during the same sitting.

### Table 2.
Demographic Data and Results Exclusively of Unilateral Repairs

| S No | Parameters       | Open (n = 34) | Lap (n = 35) | P Value |
|------|------------------|---------------|--------------|---------|
| 1    | Age              | 3.14 ± 0.92   | 5.58 ± 3.52  | 0.01    |
| 2    | Sex              |               |              |         |
|      | M                | 32 (94.12%)   | 30 (85.71%)  | 0.449   |
|      | F                | 2 (5.88%)     | 5 (14.29%)   | 0.449   |
|      | Side of hernia   |               |              |         |
|      | Right            | 18 (52.94%)   | 26 (74.29%)  | 0.0652  |
|      | Left             | 16 (47.06%)   | 9 (25.71%)   | 0.0652  |
| 3    | Time in minutes  | 30.65 ± 10.29 | 25.31 ± 13.02| 0.06328 |
| 4    | Pain             |               |              |         |
|      | Nil              | 0             | 2 (5.7%)     |         |
|      | Mild             | 32 (94.12%)   | 30 (85.7%)   | 0.449   |
|      | Moderate         | 2 (5.88%)     | 3 (8.57%)    | 0.986   |
|      | Recovery         |               |              |         |
|      | <3 hrs           | 32 (94.12%)   | 26 (74.3%)   | 0.0245  |
|      | >3 & <6 hrs      | 2 (5.88%)     | 9 (25.71%)   | 0.0245  |
| 6    | Discharge        |               |              |         |
|      | <10 hrs          | 33 (97.06%)   | 31 (88.57%)  | 0.371   |
|      | 24 hrs           | 1 (2.94%)     | 4 (11.43%)   | 0.295   |
| 7    | Complications    |               |              |         |
|      | Hydrocele        | 1 (2.9%)      | 2 (5.7%)     | 0.963   |
|      | Scrotal edema    | 2 (5.8%)      | 0            |         |
|      | Peritoneal bleed | 0             | 2 (5.7%)     |         |
|      | Erythema         | 2 (5.8%)      | 0            |         |
|      | Recurrence       | 0             | 0            |         |
| 8    | Cosmesis         |               |              |         |
|      | Excellent        | 0             | 35 (100%)    |         |
|      | Good             | 34 (100%)     | 0            |         |

### DISCUSSION
Inguinal hernia is a common problem in children, and herniotomy is its standard treatment against which all alternative modalities of treatment are evaluated. It is credited with being easy to perform, having a high success rate and low rate of complications.

Despite that, in tune with the explosion of minimally invasive surgery in all fields of surgery, laparoscopy is gaining popularity in pediatric hernia surgery as well. However, opinion is divided on its wider adoption as the procedure of choice.
Numerous minimally invasive techniques for addressing PIH have evolved in recent years.6–9 The most practiced and established one being the standard 3-port technique involving intracorporeal suturing of the internal ring.6,7 It is generally felt that a need exists to investigate whether there is any significant advantage of laparoscopy over open surgery in the management of PIH.2,3

**Contralateral Patency**

As in our study, a significant number of children (>20%) presenting with UL hernias have CPPV.6–9 The options for detection of CPPV are many, namely routine bilateral explorations,10 use of ultrasonography,11 laparoscopy,12 and the wait and watch policy.13 Although laparoscopy proves advantageous over OS by precise detection and simultaneous repair of CPPV, its management remains a contentious issue. The current consensus amongst surgeons practicing OS favors operating on the symptomatic side alone13 as the rate of metachronous hernia is so low that it only necessitates subsequent surgery in less than a twentieth of patients.13 Therefore, this advantage of LS may not be very significant in clinical practice.

**Operative Time**

In open surgery, time is consumed in gaining access, obtaining adequate exposure, in localizing and in isolating the sac from the cord structures.14 In LS, approaching from within makes the area of interest bloodless, and the magnification renders anatomy splendidly clear, making surgery precise.6–9 But the time-limiting step remains intracorporeal suturing that places considerable demands on the requirement of hand-eye coordination, especially while negotiating the posterior and medial hemi-circumference of the internal ring, over the iliac and inferior epigastric vessels.6,7 With growing experience6,7 and use of refinements, such as hydro-dissection and needle sign,15 operative time does come down. We found LS marginally quicker (5 min), but this difference appears insignificant, both statistically and in practice.

**Postoperative Pain**

The difference in postoperative pain following OS and LS is subject to controversy. Some report less pain while others report greater pain in the immediate postoperative period following LS compared with OS.16 We found pain perception following either procedure to be similar. One reason for this could be that neither the size of the incision nor the amount of muscle cutting/retraction vastly differs in either CIH surgeries.

Parietal pain predominates in OS, in general, which can well be controlled by caudal analgesia. On the other hand, pain perception is multimodal and multifactorial in LS.17 In addition to parietal pain caused by port placement, capnoperitoneum causes visceral pain due to stretching (peritoneal and diaphragmatic) and acidosis.17 Neither the use of smaller ports nor the use of caudal analgesia would completely obliterate pain following laparoscopy.17 Therefore, the decrease in the size of the incision does not necessarily translate into a proportionate decrease in pain. Hence, the difference in postoperative pain between LS and OS is not significant enough to rate either surgery superior.

**Recovery and Discharge**

Recovery from the effects of anesthesia was delayed in a greater proportion of patients undergoing LS. This may be due to deeper anesthesia and muscle relaxation needed for intubations in LS, in addition to the effects of capnoperitoneum described above.17 OS can well be performed with the patient under a face mask, especially when caudal analgesia is administered simultaneously. Even when a patient is intubated, the degree of anesthesia and relaxation needed is less.

There was no significant difference in duration of hospital stay, as in both groups the majority was discharged within 10 hours of surgery. Hence, both procedures are essentially outpatient.

**Postoperative Complications**

Complication rates of both procedures were similar and minor in nature (Table 2). In LS, trivial ooze from peritoneal vessels, which ceased spontaneously, occurred while the surgeon was negotiating the needle around the internal ring. It is the magnification in LS that renders them conspicuous, which would otherwise go unnoticed in OS.

We observed transient hydroceles more commonly in LS, perhaps due to thicker than peritoneum bites leading to lymphatic embarrassment.18 Wound erythema was minimal in OS, and none at all occurred in LS.

**Recurrence and Testicular Damage**

Although LS has been blamed for higher recurrences,3 we did not observe any recurrence in our patients during our limited follow-up. No metachronous hernia occurred in patients treated unilaterally by OS.
Cosmesis

Five-millimeter incisions in LS were, indeed, cosmetically more appealing compared with 2-cm incisions in OS. However, this significance gets lost because the scar in OS, by virtue of its position, gets concealed by clothing.

Situation in Developing Countries

The medical facilities and monetary affluence are unevenly distributed in rural and urban areas in developing countries. Hence, the need is to find the apt treatment that is both scientifically/ethically correct while being cost effective. Laparoscopic PIH surgery is, no doubt, novel, safe, elegant and in some situations advantageous too. But the cost of setting up and running it may make it an unviable option in rural settings, where the majority of the developing world resides.

Well-performed conventional herniotomy does yield equally good results and, therefore, needs to continue as the standard of care.

CONCLUSIONS

Well-performed conventional herniotomy yields results similar to those of laparoscopic repair. Cosmesis and the ability to detect and simultaneously repair CPPV are the 2 main advantages of LS over OS. Keeping in view the low incidence of meta-chronicity in UL hernias, relative insignificance of cosmesis over the groin, and the constraints of the developing world, conventional open herniotomy can justly be performed for unilateral hernias, as the standard of care.

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