

Our Experience in Comparing Laparoscopic and Open Herniotomy For Pediatric Inguinal Hernia Repair: Revisiting the Debate

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Abstract

Introduction: Traditionally, open groin exploration has been done for congenital inguinal hernia and hydrocele, but recently, laparoscopic herniotomy has gained popularity and has become a successful alternative to open herniotomy. This study compares Laparoscopic herniotomy [LH] and Open herniotomy [OH] regarding operative time, patency of contralateral internal ring, post-op complications, recurrence rates, and parental satisfaction.

Materials and Methods: A multicentric randomized prospective comparative study was done at two tertiary care centers in North India. A total of 180 patients (newborn to 12 years) with congenital inguinal hernia and congenital

hydrocele was included based on the inclusion criteria, and were randomized using computer-generated numbers to assign to open and laparoscopic herniotomy surgery groups. Various parameters were evaluated during the pre-op, intra-op, and post-op periods.

Results: The study was carried out from Nov 2014 to April 2019. The majority of the patients operated on had a right inguinal hernia in both groups (50% in each group). For bilateral inguinal hernia or hydrocele mean time taken by open technique was 41.16 minutes, and by laparoscopy was 37.75 minutes. In the case of unilateral hernia/hydrocele, it was 20.24 minutes by open technique compared to 24.3 minutes by laparoscopy. But the difference in operative time was statistically not significant.

Keywords

- Hernia
- open herniotomy
- laparoscopic herniotomy
- pediatric hernias
- pediatric surgery

Conclusion: Based on our observation and results, we conclude that both laparoscopic and open techniques are equally effective and comparable in managing inguinal hernia and hydrocele, with advantages and disadvantages. Claims of one procedure being better than the other and counterclaims of one being more complicated than the other are ill-founded, and the efficacy of each procedure must be viewed with an unbiased approach.

Introduction

Congenital inguinal hernia is a common surgical disorder in pediatric patients and requires surgical repair at diagnosis.¹ Traditionally, open groin exploration was done to repair the hernia, with a high success rate and a low complication rate. Open herniotomy involves high ligation of

the process's sac at the internal ring. The Ferguson principle states that the excision of the hernia sac is sufficient; it is still the basis of all pediatric hernia repairs even in the present times. This was applied successfully to the pediatric population by Pott et al.²

In cases of unilateral Inguinal hernia, there used to be a debate regarding managing the contralateral inguinal hernia (if found on exploration during open inguinal hernia repair surgery) in children. In case of a recurrence and repeat surgery, there is a risk of damaging the cord structures, which is also part of the debate.

Recently, laparoscopic herniotomy has gained popularity and has an established role in managing pediatric inguinal hernia. It is fast becoming a successful alternative to open herniotomy.³ Laparoscopic repair of inguinal hernia in children has become popular in the last decade and a half because it is a minimally invasive surgery that also allows the evaluation of contralateral patent processus vaginalis (CPPV).⁴ Several studies on laparoscopic repair in children have been published, and the procedure has gained favor amongst pediatric surgeons.⁵ However, there are also many controversies on the benefits of LH over OH.⁶

The indications of LH are not different from those of OH. The laparoscopic approach provides ample working space and a magnificent view, enhancing the procedure's relative ease. Still, in tiny babies, it presents a challenge to a pediatric surgeon and the anesthetist. Therefore,

inexperienced surgeons remain reluctant to

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perform laparoscopic repair in the early age groups.⁷ Open repair too in small babies needs technical skills because of the common difficulties of the open approach in these patients, including the fragility of the hernia sac and the vulnerability of the spermatic cord.⁸ Subsequently, the recurrence rate and testicular atrophy incidence are higher in neonates or small infants.⁹ In comparison, laparoscopic repair has a straightforward approach to the opening of inguinal hernia, and repair can be performed with minimal manipulation of the spermatic cord.

Initially, the laparoscopic procedure was used to examine the contralateral internal ring, but subsequently, laparoscopic inguinal hernia repair was started and showed promising results.¹⁰ Reported advantages of laparoscopic hernia repair include; excellent visual exposure, minimal dissection, comparable recurrence rates, and cosmetic results compared with open herniotomy.¹¹ However, controversy remains regarding parameters like increased operative time, cost, complications, indications, contra-indications, and most importantly, parental satisfaction. Whether laparoscopic herniotomy is superior to open herniotomy continues to be debated.

Materials and Methods

This multicentric randomized prospective comparative study was done at two tertiary care centers in north India. Patients presenting to this hospital during the study period were selected based on pre-defined inclusion criteria. A total of 180 patients (newborn babies to 12 years, both male and female) were included in the study, of which 96 were included in the control group [OH] and 84 in the study group [LH]. Written & informed parental consent was obtained. The patients were assigned to LH and OH groups by simple randomization method using computer-generated numbers. However, the parents/caregivers of three patients later decided to undergo OH due to personal preference.

The history of onset, precipitating factors, and the clinical course of the disorder was recorded for all the patients, including the present status of the patient and previous treatment received, if any. The study period was from Nov 2014 to April 2019. All patients were operated upon by two pediatric surgeons with more than ten years of experience.

Inclusion Criteria: -

1. Unilateral or bilateral inguinal hernia.

2. Clinically communicating congenital hydrocele (age > two years)
3. Recurrent hernia

Exclusion Criteria: -

1. Preterm baby (only open herniotomy was done)
2. Hernia associated with undescended testis.
3. Patient unfit for laparoscopic surgery (multiple previous surgeries, bladder exstrophy, mucopolysaccharidosis)

Both the procedures were done under general anesthesia and in the supine position. All patients were given only one dose of pre-operative intravenous antibiotics (3rd generation cephalosporin).

Open Herniotomy: The lowermost skin crease incision was made transversely in the inguinal region, and the fascias of Camper, Scarpa, and external oblique were opened in layers, followed by separation of cremasteric muscle fibers and identification of the cord. The hernial sac was separated, and the contents were reduced. The sac was then transfixed with absorbable suture (polyglactin) at the deep ring and divided. The incision was closed in layers, and the skin was closed with sub-

Laparoscopic Herniotomy: Through an intra-umbilical incision, a Veress needle was inserted & pneumoperitoneum (maintained at 8-9 mmHg pressure) was established. Three 5-mm ports were placed at the intra-umbilical incision and the right and left sides of the umbilical port at the mid-clavicular line. Through the umbilical port (camera port), an inspection of the bilateral internal inguinal ring and assessment of its patency was done. Any contents, bowel or omentum, were reduced into the abdominal cavity. Patent processus vaginalis, or the peritoneal sac, were pulled into the abdominal cavity, and the peritoneum was incised all around the internal ring, safeguarding the vas deferens. The peritoneal defect was closed using non-absorbable silk 3-0 purse-string suture. The same procedure was done on the opposite side if contra-lateral patent processus vaginalis was present. The skin was closed with the sub-cuticular sutures for cosmesis.

During the post-op period, the patients were monitored for pain severity with the

application of the Visual Analogue Scale (VAS) for children > 05 yrs, while Children and Infants Postoperative Pain Scale [CHIPPS] for children < 05 yrs. Any urinary retention, emesis, time of resumption of oral feeds, and reambulation (for age > 18 months) were also recorded. Once patients started accepting orally, they were discharged with oral analgesics on an SOS basis only.

The follow-up was OPD based, where patients were reviewed after one week of discharge for any wound infection and after that, followed up at 3 & 6 months (telephonically or on an OPD basis as needed) and finally were again evaluated at 12 & 24 months for any recurrence of the hernia.

Since parents are the primary source of subjective but fair inputs and opinions about their experience with the procedure and overall hospital stay, we asked the parents/caregivers of the operated children to reply to a simple, user-friendly questionnaire during the six-month follow-up visit. The same is listed in **Table 1**.

Table 1: Questionnaire-based input from parents.

Question	Scoring	Remarks	Mean score OP group	Mean score LP group
Are you satisfied with the surgical team's preoperative counseling and consent form?	1-5	Excellent- 5 Good- 4 Satisfactory- 2-3 Bad- 0-1	4.5	4.4
How well controlled was the post-op pain for your child?	1-5	Excellent- 5 Good- 4 Satisfactory- 2-3 Bad- 0-1	4.0	4.2
Would you prefer to undergo the same surgical procedure (given an opportunity to undergo a repeat surgery), or would you choose an alternative type of procedure?	0-2	Yes, same-2 Maybe/I don't know/Doctor's advice – 1 No, I would prefer the other procedure – 0	1.8	1.8
How was your overall experience concerning pre-op, the operative procedure offered, post-op recovery, and surgical scar?	1-5	Excellent- 5 Good- 4 Satisfactory- 2-3 Bad- 0-1	4.4	4.5

This was to assess and compare the degree of satisfaction with the two different types of surgical procedures/treatments offered in the two groups. The identity of the parent/patient was kept hidden as the questionnaire only had OH or LH written on it. This resulted in removing any apprehension in the parents' minds about any backlash to their negative inputs (if any), and candid feedback was received.

Statistical Analysis: The data for two procedures were analyzed. All the measurable data were checked for their

normality using the Kolmogorov–Smirnov test for each procedure separately and for the overall data. For normally distributed measurable data over the two procedures, their means were compared using Student's t-test (unpaired); whereas for skewed (non-normally distributed) or ordinal data, their distributions over the two procedures were compared using Mann Whitney test. The data is presented with descriptive statistics with Mean±SD or Median and inter-quartile range as their minimum and maximum values were depicted.

For categorical/classified data, their association with the two procedures was analyzed using the Chi-Square test. The data are presented as frequencies, percentages, rates, etc. The descriptive statistics like mean \pm SD, median, and inter-quartile range for the overall data are presented with their minimum and maximum values. All tests are two-sided, and $p < 0.05$ is the significance level.

Results

We had a total of 180 patients, including patients with both hernia and hydrocele. Out of these, 50% of the subjects had a right-sided inguinal hernia, 16.3% had a left-sided inguinal hernia, and 12% had a bilateral inguinal hernia. The rest of the study population comprised right-sided hydrocele (8.3%), left-sided hydrocele (8.3%), and bilateral hydrocele (5%).

In bilateral cases, both sides were operated in the same sitting in all cases.

The age distribution of the study population is illustrated in **Figure 1**, where the most common group ranged from 3-6 years of age. The majority of the patients were male (86.67%), both in the laparoscopic (82.14% of total patients in the group) and open herniotomy (90.6% of total patients in the group) groups. Females accounted for 13.33% of the study participants, which indicates the low incidence of inguinal hernia in females in the general population. For bilateral inguinal hernia/hydrocele, mean time taken by open technique was 41.16 minutes, and by laparoscopy was 37.75 minutes. In the case of unilateral hernia/hydrocele, it was 20.24 minutes by open technique compared to 24.3 minutes by laparoscopy. But the difference was found to be statistically not significant. This is indicated in **Table 2**.

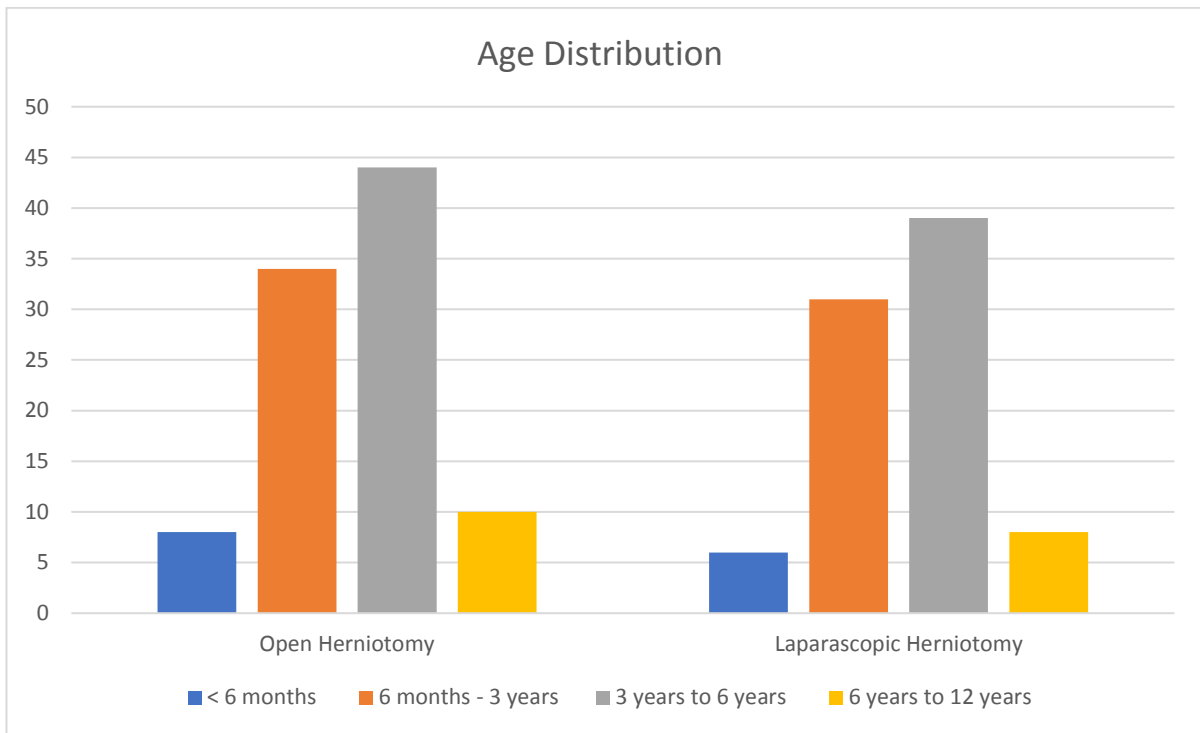


Figure 1: Age Distribution

Table 2: Comparison of Mean Operative Time (in minutes) between the study subjects

Operation Time	Group A (Open Herniotomy)	Group B (Laparoscopic Herniotomy)	p-value
Unilateral Inguinal Hernia/Hydrocele	20.24	24.3	0.152
Bilateral Inguinal Hernia/Hydrocele	41.16	37.75	

We used the scale proposed in the study by Tsze et al¹² to evaluate pain in our patients using Faces Pain Scale (revised) and then classifying the findings as no pain (0 and 2), mild pain (4), moderate pain (6) and severe pain (8 and 10). The study found that 65.62% of patients in the OH group and 50% of patients in the LH group had mild post-op pain, while 34.3% of patients in the OH group and 50 % of patients in the LH group experienced moderate pain. In both groups, no patient-reported severe post-op pain. Association of pain with the type of herniotomy was statistically not significant.

All patients in the LH group had shorter hospital stays than in the OH group. This is consistent with the previous studies on the subject. This difference was not statistically significant. During follow-up, 02 patients (6.25%) in the OH group developed contralateral hernias within six months, but none of the cases in the LH group were detected with the contralateral hernia. These 02 cases were subjected to open herniotomy subsequently.

Parents/caregivers in both the groups expressed 'good to excellent' level of satisfaction with the surgical procedure their child was offered, which was assessed by the questionnaire at discharge. The

mean score from the questionnaire was 14.7 (range 10-17) in the OH group and 14.9 (Range 10-16) in the LH group. The same is listed in table 1. It was noted that the LP group had slightly higher satisfaction with the postoperative analgesia. Overall, there was no statistically significant difference in the satisfaction levels of parents/caregivers among the two groups.

Discussion

Inguinal Hernia is a common surgical disorder in children. Its management by open herniotomy has long been considered the gold standard because of its ease of performance, high success rate, and low rate of complications. However, with the advancement in minimally invasive surgery, laparoscopy has gained popularity as an alternative option for children.¹³ Laparoscopic procedures, compared to open hernia repair in pediatric patients, have comparable recurrence rates with better cosmetic results. Incision of peritoneum over the internal inguinal ring

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rate of complications. However, with the advancement in minimally invasive surgery, laparoscopy has gained popularity as an alternative option for children.¹³ Laparoscopic procedures, compared to open hernia repair in pediatric patients, have comparable recurrence rates with better cosmetic results. Incision of peritoneum over the internal inguinal ring and then taking purse-string suture on incised edges of peritoneum over the internal inguinal ring is the basic principle of laparoscopic pediatric inguinal hernia repair.

In our study, the patients presenting with unilateral inguinal hernia (33.33%) and hydrocele (25%) were found to have contralateral patent processus vaginalis. Similar results were shown in other studies.¹⁴ The options for detection of contralateral patent processus vaginalis are many, namely routine bilateral explorations,¹⁵ use of ultrasonography¹⁶, laparoscopy,¹⁷ and the wait and watch policy.¹⁸

In a unilateral hernia, the chances of having a patent sac on the opposite side are as high as 50%.¹⁹ Initially, pediatric surgeons routinely performed bilateral exploration in the unilateral hernia. Still, only 7% of such patients developed a contralateral hernia,

implying that all patent sacs need not necessarily become clinical hernia.²⁰ So, as per current consensus, surgeons practicing open hernia repair favor operating on the symptomatic side alone as the rate of metachronous hernia is so low that it only necessitates subsequent surgery in ~5% of patients. Laparoscopic repair enables examination and suturing of the contralateral sac without additional incision. Studies have shown that, during laparoscopic herniotomy, routine prophylactic suturing of the contralateral sac reduces the metachronous hernia from 7% to 0.3%.²¹ However, the routine bilateral intervention also increases the operation time, and simultaneous repair of all contralateral patent processus vaginalis may lead to overtreatment.²²

The operating time for laparoscopic hernia repair in children largely depends on the experience of the operating surgeon and coordination amongst a trained surgical team. As per literature, it ranges from 20 to 74 minutes.²³ In our study, the median duration of surgery for bilateral hernia/hydrocele was 37.75 minutes by laparoscopy. In the case of unilateral hernia/hydrocele, it was 24.3 minutes by laparoscopy. But this difference was found to be statistically not significant. In females

mean operative time was ~3 minutes less than the male patients, given that the dissection required was minimal in female patients.

The limiting step in laparoscopic hernia repair is documented as the intracorporeal suturing of the internal inguinal ring.²⁴ In laparoscopic surgery, approaching the hernial defect from within the abdomen with magnification renders anatomy remarkably clear, thus making surgery meticulous and bloodless.²⁵ While in open herniotomy, most of the time is consumed in obtaining adequate exposure for identifying and isolating the sac from the cord structures. Our study observed that with growing experience, operative time decreases in both groups. Chan and Tam found that laparoscopic surgery is marginally quicker (5 min),²⁶ but this difference appears insignificant, both statistically and in practice. In our study, laparoscopic hernia repair for unilateral lesions took marginally longer mean operating time than open herniotomy, but the difference was statistically insignificant. Similar results were shown in other studies done by Chan et al, Bharathi et al and Koivusalo et al, but were statistically insignificant.²⁷⁻²⁹

The difference in postoperative pain following OH and LH is subject to controversy. Some report less pain, while others report greater pain in the immediate postoperative period following LH than OH.³⁰ In our study, mild pain was seen in 50% of patients with LH and 66% of patients with OH, while in a study done by Bharathi et al, mild pain was reported in 94.12% of patients in the LH group and 85.7% in the OH group.³¹ Similar results were observed by Wills et al.³² Hence, the difference in postoperative pain between LH and OH groups is not significant enough to declare either surgery superior.

As per our hospital protocol, all cases were admitted an evening before the day of surgery and discharged 24-36 hours after surgery. Patients were discharged on fulfilling the criteria of acceptance of oral feeds, the passage of urine and stool, relative pain-free status, and ambulation (in patients with age >18 months). As per our study, patients with unilateral inguinal hernia/hydrocele in the LH group had a shorter hospital stays than the OH group. The hospital stay difference was statistically insignificant. These results are also confirmed in a meta-analysis study conducted by Yang C et al which affirmed

that there is no significant difference in the duration of hospital stay between the two procedures.³³

Previous studies have reported the recurrence rate of pediatric inguinal hernia repair as 1-2.5%. Such high recurrence rates are more common in patients operated on by relatively less experienced surgeons.³⁴ High hernia sac ligation is needed for its correction in the case of pediatric inguinal hernia.³⁵ Multifold factors may be responsible for recurrence in an open repair like inguinal canal floor injury due to operative trauma, failure of internal ring closure in girls, or post-operative wound infection and hematoma.³⁶ In our study, no recurrence was found in either group, which shows that both types of repair are safe methods to prevent or avoid hernia recurrence when performed meticulously. Similar results were shown in studies done by Sharifuzzaman et al.³⁷

From a cosmesis point of view, especially in females, in open herniotomy, skin crease incision in the groin gets hidden by undergarments. Still, two working port scars in the midclavicular line are visible in laparoscopic herniotomy, especially in Indian clothing. But parental satisfaction

for both groups has been at part concerning cosmesis and outcome.

Conclusion

Based on the results, we conclude that both Laparoscopic and Open techniques are equally effective and comparable in managing inguinal hernia and hydrocele, with advantages and disadvantages in each modality. Claims of one procedure being better than another and counterclaims of one being more complicated than the other are ill-founded. The efficacy of each procedure must be viewed with an unbiased approach. We feel both are equally effective in experienced hands. Also, complications are approximately the same in both procedures. It is also emphasized and proposed that during training, a general surgery resident must be exposed to both types of procedures, such that young practicing surgeons may select their cases to perform either type of procedure for a satisfying outcome.

We conclude that both procedures have merits and demerits, but neither is superior in all aspects. It is also recommended that further trials, especially multicentric and randomized, be conducted to give more strength to the evidence in our trial.

Ethical Consideration

This study was approved by the ethical committee of Command Hospital Chandigarh, India with code number 2013/IEC/surg/03.

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Conflict of interests

There is no conflict of interest

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