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Paediatric Surgery

Laparoscopic Hernia Repair in Children: A Study of Various Techniques and Related Complications

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Original Research Article

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Abstract: Laparoscopic inguinal hernia repair has increasingly been used in paediatrics but the outcome is still not clearly understood. New techniques keep on coming for the repair of patent process vaginalis with new outcomes. This study is designed to assess the feasibility, advantages and disadvantages of laparoscopic hernia repair in children of age <18 yrs, to study different techniques of laparoscopic hernia repair, technical steps to achieve an appropriate repair, the recurrence rates and complications of the procedure in our setup. Prospective and retrospective study of laparoscopic inguinal hernia repair performed in dept of paediatric surgery, NSCB Medical College, Jabalpur, M.P. during July 2009 to July 2012 was done. A total of 79 cases with extracorporeal endosuturing technique, intracorporeal and with SILS technique. Author has also introduced nonsuture technique (tackers) for hernia repair. Various outcomes were studied such as contralateral patency, operative duration, hospital stay, recurrence rate, complications and postoperative results. In this study 79 children underwent inguinal hernia repair laparoscopically of which 53(67.1%) were male and 26(32.9%) females; 73(92.4%) unilateral and 6(7.6%) bilateral. In 31(39.24%) intracorporeal and 34(43.04%) extracorporeal suturing of hernial sacs was done and in rest 14 cases(17.12%) we used tackers to repair the internal ring. 11 cases(13.92%) were done by single incision laparoscopic surgery(SILS). Sac excision was done in 53 cases (67.1%) and ligation of sac without excision in rest 26(32.9%) cases. Contralateral patent processusvaginalis was found in 17.72% (14) cases intraoperatively in our study of which 8 cases(57.14%) were without manifest hernia contralaterally and all these cases were repaired intraoperatively. Mean Operating duration was 28min and 28.09min for unilateral and for bilateral cases. All patients were discharged in 1 day with no significant intraoperative or postoperative complications. Recurrence was seen in only 2(2.53%) case which was due complete resorption of absorbable suture in cases were sac was not excised in complete hernia. Hydrocoele was found in 2(2.53%) cases.
Keywords: inguinal hernia, Hydrocoele, laparoscopic surgery, vaginalis.

INTRODUCTION

Pediatric inguinal hernias (PIH) are due to the persistent processusvaginalis. Conventional inguinal hernia repair in children involves ligation of the hernial sac at the internal inguinal ring. Laparoscopic surgery has been applied in children, and the repair is based on the same principle [1].

Herniotomy is the standard treatment for paediatric hernia [2] against which all alternative modalities of treatment is evaluated. It is credited with being easy to perform, having a high success rate and low rate of complications [2]. 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 [3].

Dr. Ralph Ger is credited with performing the first laparoscopic inguinal herniorrhaphy in the late 1970s using a prototype-stapling device to close the hernia defect from inside the abdominal cavity [4]. Therapeutic use of Laparoscopy in pediatric inguinal hernia was first reported by El-Gohary in 1997 when he performed laparoscopic repair in girls by successfully everting the sac into the peritoneal cavity and then using an endoloop. The first successful laparoscopic repair in boys was reported in 1999 by Montupet[5].

Perhaps the most useful role for the laparoscope is in evaluation of the opposite side during a conventional open herniorrhaphy. In children with inguinal hernias, contralateral exploration of the asymptomatic groin was practiced based on data that

show a high prevalence of a patent process vaginalis on the contralateral side [6-9].

Another major advantage of laparoscopic herniotomy is that the cord structures remain untouched thus reducing chances of testicular atrophy. There is better delineation of anatomy of the region by laparoscopy and less distortion of anatomy postoperatively thus better suited for even recurrent hernias. Recurrence in hernia is more common in initial part of learning curve and reduces to near zero level with experience of surgeon.

With the introduction newer techniques like SILS (single incision laparoscopic surgery) cosmetic results are improving and the use of non-suture techniques like tacker add to the advantage of decreased operative duration without increasing the burden of complications.

AIM

This study is designed to assess the feasibility, advantages and disadvantages of laparoscopic hernia repair in children of age <18 yrs, to study different techniques of laparoscopic hernia repair, technical steps to achieve an appropriate repair, the recurrence rates and complications of the procedure in our setup.

MATERIALS AND METHODS

- Duration: July 2009 to July 2012
- Type of study: Retrospective and prospective study

Inclusion criteria

- All patients of inguinal hernia of age <18 years

Exclusion criteria

Patients with hydrocele, Preterm neonate, Low Birth Weight baby and patients medically unfit for surgery for whom hernia repair is done using monitored local anaesthesia and sedation technique and patients >18 yrs of age.

Technique

All operations will be performed under general anesthesia (GA).The patients placed in a supine position. An Umbilical 5 mm port is inserted with open technique and CO2 pneumoperitoneum is established. The intraabdominal pressure is set at 6-10mm of mercury. A 5-mm scope is then placed at the umbilicus. Findings are noted. Two lateral trocarless working ports of 3/5mm-mm are made through the right and left pararectal region by stab technique to maintain a triangular orientation.

Sac excision was done for hernia more than a bubonocele. In cases with small defects, laparoscopic ring closure was done with 3-0/4–0 Polyglactin 910/ nylon/prolene, introduced directly through the anterior abdominal wall. In extracorporeal knotting technique suture is retrieved with a port closure needle and tied outside followed by placement of knot subcutaneously. An extra medial suture was taken including lateral umbilical ligament to reinforce the repair. A similar procedure was performed on the contra lateral side, if found to be patent. Liquids can be started after 4 hours and solids after 8 hours and patients are discharged after 24 hours.

For severity of hernia, hernioscopy was done. To rule out testicular atrophy testicular colourdoppler was performed at 6 month. Details of cases were noted and documented videographically or electronically and evaluation of results was performed.

RESULTS

In the present study we have studied 79 cases of laparoscopic hernia repair in children done between July 2009 to July 2012 studied retrospective and prospectively.

The mean age of cases included in study was 6.36 years (0.9yrs-14yrs). There were 53(67.1%) males and 26(32.9%) females.

Unilateral hernia was more common 73 cases (92.4%) than contralateral manifest hernia which was found only in 6 cases (7.6%). Contralateral patent processusvaginalis was found in 8 cases (57.14%) without manifest hernia that were repaired intraoperatively.

In our study, techniques used were intracorporeal or extracorporeal suturing or non suture technique using tackers with conventional 3 ports or SILS technique. We performed 31(39.24%) intracorporeal and 34(43.04%) extracorporeal suturing of hernial sacs and in rest 14 cases(17.12%) we used tackers to repair the internal ring. 11 cases(13.92%) were done by single incision laparoscopic surgery(SILS).

Decision regarding sac excision was taken by the surgeon intraoperatively based on size of deep ring and hernia sacs and excision policy was limited to hernia more than bubonocele. Thus in this study, sac excision was done in 53 cases (67.1%) and ligation of sac without excision in rest 26(32.9%) cases. Iliopubic tract repair was done in 4 cases in cases with huge internal ring with dilated deep ring which was confirmed on hernioscopy.

Mean operative duration for the study was 29.22 min. For extracorporeal suturing mean opearative duration was 29.44min, for intracorporeal suturing 29.74min and for non suture technique was 27.5min. SILS required an average of 36.18 min which is slightly longer than conventional 3 port technique having a mean operative duration of 28.1 min. Mean hospital stay was 1.2 days.

Though to know the success rate of the procedures one require a long follow up. After a maximum followup period of 2.5 years, overall recurrence rate in the present study was 2(2.53%). Both of the recurrences were in the initial part of the learning curve. Recurrence rate was 1.27% (single case) with intracorporeal and 1.27% (single case) with extracorporeal suturing. SILS had 0% recurrence rate. Hernia repair with non suturing technique doesn't increase complication rates and had 0% recurrence rate.

Table-1: showing results of the study

Technique	N(79)	Mean Age(6.36yrs)	Recurrence [2(2.53%)]	Hydrocele [2(2.53%)]
SE/ EC	20(25.39%)	6.25	1(1.27%)	0
WSE/ EC	14(17.12%)	5.35	0	1(1.27%)
SE/ IC	19(24.06%)	6.16	0	1(1.27%)
WSE/ IC	12(15.19%)	7.25	1(1.27%)	0
SE/Tackers	14(17.12%)	7	0	0

All cases were performed successfully laparoscopically and there were no conversion to open herniotomy. There were no intraoperative complications and no testicular atrophy on follow up testicular Doppler in 32 cases after 6 months. Cosmesis was good in each case and no wound complications encountered. SILS provided remarkable patient satisfaction as compared to conventional three port laparoscopy (As explained by parents as a wonder that a surgical procedure could be performed with a hidden scar which was not obvious in three port laparoscopy).

In both the recurrences encountered in our study diagnostic laparoscopy was performed and medial recurrence was present in both of them and the sutures were found to be completely absorbed. In both the cases sac was not excised previously and both was complete hernia. Open herniotomy was performed in both the cases then.

Among both the hydrocoeles which occurred postoperatively, diluted injection sterol was injected and one case responded to it. In the other case open herniotomy was done later. In both the cases small opening in deep ring remained which was sufficient to cause hydrocele but not hernia and were successfully managed.

DISCUSSION

According to IPEG guidelines for inguinal hernia and hydrocoele, level I evidence comparing open and laparoscopic herniotomy is limited. Small randomised control trials points both and against laparoscopic hernia repair.

Levels of evidence-

- q Type I -Evidence obtained from at least one properly designed randomized, controlled study
- q Type II-1 -Evidence obtained from well-designed cohort or case-controlled trials without randomization
- q Type II-2 -Evidence obtained from well-designed cohort or case-controlled analytic studies, preferably from more than one center or research group
- q Type II-3-Evidence obtained from multiple time series with or without intervention
- q Type III -Opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees

Thus our study will add to the limited literature on laparoscopic hernia repair and will provide at least a level III evidence.

Hernia surgery is the most commonly performed surgery in children. In whom the standard surgical treatment for inguinal hernia has been high ligation of hernia sac for years. In this open technique, internal ring is reached after a lot of dissection and handling of cord structures, thus there is potential risk of damage to cord structures leading to testicular atrophy, hematoma, wound infection, iatrogenic cryptorchidism, and recurrence. In laparoscopic hernia repair, the cord structure and nerves remain untouched and anterior abdominal wall is intact. Thus minimizing the chances of injury to cord structure and nerves thereby fewer wound related complications, inguinodynia and lesser probability of testicular ischemia. Chances of testicular atrophy in hernia repair range from 0.5% in fresh case to 5% in recurrent hernia repair. Thus laparoscopic hernia repair is a better choice for recurrent hernia repair as it avoids dissection of sac from cord structures which are deeply adhered in recurrent cases. Moreover with laparoscopy it is possible to repair the contralateral side of if patent processusvaginalis is found on that side avoiding unnecessary dissection on other side inguinal region in open herniotomy as was practised in high risk cases for CPPV and reducing the exposure of the patient to another surgery. Another advantage with laparoscopic exploration is that if some other pathology is found associated with hernia in abdominal cavity such appendicitis, Meckel's diverticulum, patent urachus, etc they can be dealt with in same sitting.

In our study, we performed 73 unilateral hernia cases (92.4%) and 6 cases (7.6%) of bilateral hernia. Contralateral patent processusvaginalis was

found in 17.72% (14) cases intraoperatively in our study of which 8 cases (57.14%) were without manifest hernia contralaterally and all these cases were repaired intraoperatively.

SarangaBharathi*et al*. [10] in a prospective study between January and December 2006 performed 85 cases either LS (51) or OS (34) for PIH. 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 processusvaginalis (CPPV) were detected intraoperatively and repaired simultaneously.

In the open herniotomy, trauma due to traverse of the suture and tissue reaction of the suture material may also cause peritoneal adhesion and fibrosis .The tensile strength of any suture may diminish eventually, thus peritoneal adhesion and fibrosis are the leading factor for complete obliteration of the hernia defect in the long run after either open herniotomy or laparoscopic surgery. Since partial omission of the defect circumference is the reported factor contributing to recurrence in laparoscopic hernia surgery, completely enclosing the hernia defect without gaps is crucial to decrease recurrence rate. Thus with the experience of surgeon and practice of suturing the recurrence rates come down to near zero level. In our study, we had only two recurrences, which were in initial period of study. There are no recurrences in last 50 cases. Moreover we can say that recurrence rates are not found to have any association with excision of sac as it depends only on obliteration of deep ring by whichever method adopted. We had 1 recurrence when sac was excised and another without sac excision. Still in large hernia sacs, or complete hernia, sac excision was done followed by suturing. Both of the recurrences in our study were in cases of complete hernia. Thus we suggest that for complete hernia, open herniotomy is still the procedure of choice especially in early phase of the learning curve.

Hydrocoele incidence is also unrelated to sac excision. In our study one case had hydrocoele with excision and one without sac excision. This also depends on complete occlusion of deep ring which requires experience as both of these complications were in early phase of learning curve.

We encountered no intraoperative or wound complications and no testicular atrophy. Schier*et al*. in his study on consecutive personal series of a total of 911 indirect inguinal hernia sacs closed, had 4.1% hernia recurrences, 0.7% hydroceles and 0.2% testicular atrophies [11].

Dutta S in his study had four out of 275 hernias (1.5%) recurred (mean age 4.5 years; 3 male, 1 female). There were four superficial wound infections, two umbilical granulomas, two hydroceles, and six self-resolving hematomas. There were no spermatic cord injuries, testicular atrophy, or symptoms of ilioinguinal nerve injuries [12].

Use of non-suture techniques, like tackers is being introduced by the surgeon for laparoscopic inguinal hernia repair in children. As the main aim of such a hernia repair is deep ring occlusion, it can be done with any of techniques of suturing like extracorporeal knotting or intracorporeal knotting. Similarly it can also be occluded using non suture technique like tackers. We have used tackers in 14 cases and with the follow up of the patients, no significant increase in rate of complication was encountered. Rather the operative duration was significantly decreased. Thus non suture technique can become a technique of choice for inguinal hernia repair in children in near future.

The suturing techniques were further reinforced by the addition of a medial suture involving lateral umbilical ligament in every technique including intracorporeal, extracorporeal or tackers. This assisted in complete occlusion of the ring and thus reducing complications further and can be adopted selectively for large hernias.

Moreover laparoscopic hernia repair in children does have a learning curve which needs to be overcome with experience. The suturing at abdominal wall and internal ring pose challenges for a beginner due to difficult ergonomics. Operating time is more during initial cases of experience and gradually reduces with time. It also depends on suturing technique adopted by surgeon. Intracorporeal knotting requires more time to expertise than extracorporeal knotting and tackers can be applied within minutes. Thus similar trends were found in operative duration which was related to technique used with comparable results with every technique in other aspects. In the beginning of learning curve one should adopt extracorporeal technique. There were no conversions to open in the cases of laparoscopic hernia repair performed in our institute.

Single incision laparoscopic surgery (SILS) in hernia, has lead to better cosmetic results, which are more demanding these days. This surgery gives only one scar at umbilicus. Though SILS require longer operative duration due to decreased fulcrum to handle instruments, but it is a promising surgery in near future with better prospectives with surgeon’s experience. The operating surgeon believes that if there is cosmetic advantage in laparoscopic hernia repair then it is there in SILS Herniotomy.

Hospital stay for both open and laparoscopic herniotomy remains comparable even though laparoscopies is performed under general anaesthesia

and open in caudal analgesia or local anaesthesia or face mask.

As anticipated to have more postoperative pain in laparoscopic hernia repair due to visceral peritoneal stretching by capnoperitoneum and parietal peritoneum handling, no significant increase in postoperative pain was observed. Patient seldom required any extra analgesic.

Though laparoscopic hernia repair is technically challenging and has faced criticism from inception for breaching the peritoneum, still it is gaining acceptance worldwide. There is a strong need to do large randomized controlled trials and metaanalysis comparing open and laparoscopic Herniotomy in children with incorporation of many high volume centres and a longer followup to collect more of level I evidence.

CONCLUSIONS

1. Literature on laparoscopic inguinal hernia repair is limited so our study will add to the level II evidence.
2. Laparoscopic hernia repair (LHR) in children should be offered, as it is safe, reproducible, and technically easy for experienced laparoscopic surgeons.
3. It give an advantage of identifying contralateral patency, allows minimal dissection and avoids vasal injury, provides better cosmesis in comparison to open Herniotomy.
4. Large / complete hernia is prone for recurrence and hydrocoele by laparoscopic approach thus can be selected for open Herniotomy over LHR in the early part of learning curve in authors' view.
5. There is no significant difference in results with or without sac excision and with the technique of suturing used.
6. There is definitive role of non-suture technique like tackers in near future depending on its feasibility.
7. SILS has an excellent cosmetic outcome and extreme parent satisfaction over open and conventional laparoscopic techniques.
8. Laparoscopic herniotomy in children does have a learning curve which can be overcome with experience.
9. Complications like recurrence are more common in initial part of learning and decreases with surgeon's experience.
10. Recurrence can be avoided by use of added procedure for larger rings like iliopubic ligament repair, and lateral umbilical ligament repair to strengthen the LHR.
11. There is a strong need to do large randomized controlled trials and meta-analysis comparing open and laparoscopic Herniotomy in children with incorporation of many high volume centres and a longer follow-up to collect more of level I evidence.

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