Journal of Minimal Access Surgery

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REVIEW ARTICLE

Year : 2020 | **Volume** : 16 | **Issue** : 1 | **Page** : 1--4

Outcomes of laparoscopic incarcerated inguinal hernia repair in children

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Abstract

Aim: Laparoscopic inguinal hernia repair (LIHR) is gaining widespread acceptance, but its role in the management of incarcerated cases is not well outlined. This review analyses the outcomes of laparoscopic repair of incarcerated inguinal hernia in children. **Patients and Methods:** Literature was searched on PubMed® using terms 'laparoscopic', 'incarcerated', 'inguinal', 'hernia' and 'children'. Age, sex, side, sac content, operative technique, follow-up period, complication and recurrence rate were analysed. **Results:** Fifteen articles with 689 paediatric incarcerated inguinal hernias were identified between 1998 and 2018. Median age of patients was 22.4 months (2 weeks–16 years; M:F = 2.2:1). Side was mentioned in *n* = 576: *n* = 398 (69.1%) right and *n* = 178 (30.9%) left. In *n* = 355 (51.5%) manual reduction and delayed surgery (MRDS), in *n* = 34 (4.9%) manual reduction in general anaesthesia (MRGA) followed by emergency LHR and in *n* = 300 (43.5%) intraoperative reduction (IOR) was necessary. Incarcerated contents were documented in *n* = 68: intestine *n* = 36 (52.9%), ovary *n* = 14 (20.6%), omentum *n* = 11 (16.2%), appendix *n* = 5 (7.4%) and Meckel's diverticulum *n* = 2 (2.9%). Among the *n* = 18 girls in IOR group, *n* = 14 (77.8%) had ovaries incarcerated. For LHR, the hook method was used in 376 (54.6%) and purse-string suture in 313 (45.4%), with two conversions in IOR group. Mean followup was 15 months (3–80 months), with one (0.15%) testicular atrophy, and 4 (0.58%) recurrences in MRDS and 1 (0.15%) in IOR. All five cases were closed with pursestring technique. Total recurrence rate was 0.73%; significantly higher (*P* = 0.014) with pursestring (*n* = 5, 1.6%) than with the hook (none). **Conclusion:** Hook and purse-string methods are equally popular in LHR for paediatric incarcerated hernias, with 50% hernia reductions possible at the time of surgery. Recurrence rate is low and comparable with non-incarcerated hernias; however, it is significantly higher in purse-string method than hook technique.

How to cite this article:
Balogh B, Hajnal D, Kovács T, Saxena AK. Outcomes of laparoscopic incarcerated inguinal hernia repair in children.J Min Access Surg 2020;16:1-4

How to cite this URL:
Balogh B, Hajnal D, Kovács T, Saxena AK. Outcomes of laparoscopic incarcerated inguinal hernia repair in children. J Min Access Surg [serial online] 2020 [cited 2020 Jun 3];16:1-4
Available from: http://www.journalofmas.com/text.asp?2020/16/1/1/273713

Full Text

Introduction

Indirect inguinal hernia repair is one of the most common surgical procedures in paediatric population. From 1995, laparoscopy was employed to repair the open internal inguinal ring and also to check the contralateral patent processus vaginalis.[1] Laparoscopic hernioplasty thereafter gained popularity; however, its role in incarcerated cases is not well outlined. The incidence of incarcerated inguinal hernia is estimated to be as high as one-sixth of the total population with inguinal hernia.[2] If it is not treated in time, serious complications can develop, such as intestinal obstruction, strangulation and perforation, testicular atrophy or ovarian necrosis. If manual reduction manoeuvres fail, urgent surgical treatment is necessary. Conventional open surgery in these

patients may be difficult due to inflammation and oedema, which in turn may increase the risk of intraoperative injury of the vas deferens or testicular vessels.[3],[4] Laparoscopic inguinal hernia repair (LIHR) gives the advantage of excellent visualisation, ability to evaluate contralateral side, less iatrogenic trauma of incarcerated structures and decreased operative time.[2],[5],[6] Even the pneumoperitoneum helps to widen the internal ring that can aid in the reduction.[7] After the reduction of hernia content, the inguinal ring can be closed in the same session with one of the minimal access technique such as purse-string suture or hook method.

This study performs a literature review to determine the outcomes after LIHR in children with incarcerated inguinal hernias.

Patients and Methods

Literature was searched from 1998 to 2018 on PubMed® using the terms 'laparoscopic', 'incarcerated', 'inguinal', 'hernia' and 'children'. Data were extracted with regard to the age of the child, sex, side of the hernia, sac content, operative technique, follow-up period, complication and recurrence rate and were analysed in this study.

Results

Fifteen articles with 689 incarcerated inguinal hernias were identified that met the inclusion criteria in the English literature. The age distribution at the time of surgery was 2 weeks to 16 years, with median age being 22.4 months. Male-to-female ratio was 2.2:1. The affected side was reported in 576 patients, with 69.1% (n = 398) being right-sided and 30.9% (n = 178) left-sided.

In 355 (51.5%) patients, manual reduction and delayed surgery (MRDS) was performed in 24–48 h. In 34 (4.9%) patients, manual reduction was achievable only in general anaesthesia (MRGA) followed by emergency LIHR. In 300 (43.5%) patients, the hernia content was reducible only intraoperatively (IOR) with laparoscopic instruments and external pressure [Table 1].{Table 1}

During the intraoperative reduction, incarcerated contents were documented in 68 patients: intestine n = 36 (52.9%), ovary n = 14 (20.6%), omentum n = 11 (16.2%), appendix n = 5 (7.4%) and Meckel's diverticulum n = 2 (2.9%). Among the 18 girls in IOR group, 14 (77.8%) had ovarian incarcerated in the sac [Table 2].{Table 2}

The hernia repair was achieved by two different surgical techniques. After the hernia contents are reduced, intracorporeal and extracorporeal techniques can be used for repairing the hernia. Laparoscopic repair of inguinal hernias in paediatric girl patients was first described in 1997 by El-Gohary.[8] During intracorporeal techniques such as purse-string suture, all suturing and knot tying around the inguinal ring is done within the abdominal cavity with laparoscopic instruments, which was first described by Montupet and Esposito in 1999.[9] During extracorporeal hook technique, a stab incision is performed above the inner ring, the needle is introduced medially around the ring in the preperitoneal space, the suture loop left intraabdominally when the needle is withdrawn. With the same technique from the opposite side of the ring, the suture is pulled outside and tied extracorporeally; extracorporeal technique was published first by Prasad et al.[10] Hook method was used in 376 (54.6%) and purse-string suture in 313 (45.4%) patients. Two conversions were found in IOR group; in one patient the reduction required release of the external inguinal ring and in the other patient LIHR was hampered by a friable internal ring. Mean follow-up time was 15 months (3–80 months). During the follow-up, 1 (0.15%) testicular atrophy was reported in the IOR group.[3] Recurrence was found in 4 (0.58%) patients in MRDS group and in one (0.15%) in IOR group.

All five recurrences were found in purse-string technique group. Total recurrence rate was 0.73%. Recurrence was significantly higher (P = 0.014) with Chi-square test in purse-string group (n = 5, 1.6%) than with the hook technique (n = 0).

In the reviewed literature, four male patients required laparoscopic assisted bowel resections: 2 small bowel gangrene, 1 perforated Meckel's diverticulum and 1 deep serosal tear of small bowel. Two partial omentectomies were performed laparoscopically and an oophorectomy in case of necrotic ovary.[11]

One testicular atrophy was mentioned after a late, difficult instrument aided reduction.[3] Umbilical granuloma was mentioned in 19 patients (4,8%).[5],[11] Other minor complications were detected in <1% such as hydrocele (n = 6), port site hernia (n = 6) and trocar infection (n = 3).[3],[5]

Discussion

LIHR is one of the most common minimally access surgery procedures performed in paediatric patients.[12] Incarceration is the severe complication of inguinal hernias, for which emergency treatment is necessary. Manual reduction of the hernia content should be performed with care. After successful reduction, as soon as the patient's general condition improves, the hernia should be closed (MRDS). Hernia can be repaired open or using minimal access techniques, after 24–48 h, during the day shift, when the patient is in good general condition and when the risk of anaesthesia is lower. Laparoscopic closure has the advantage to avoid the difficult dissection of an oedematous sac in the groin even days following reduction of incarceration, and it permits the repair of a contralateral patent processus vaginalis if present.[4]

If general anaesthesia is necessary for successful manual reduction (MRGA), it is recommended to do emergency laparoscopy in the same session, because it allows inspection of the reduced hernia content and serosal or deeper intestinal injury, Meckel's diverticulum or ovarian necrosis.

Reduction of severely incarcerated contents can be done by a combination of retraction using laparoscopic instruments together with external manual pressure – intra-operative reduction (IOR). Further advantage of using the laparoscopic techniques is that carbon dioxide insufflation and intra-abdominal pressure widen the internal inguinal ring, which helps the reduction.[7] Furthermore, under direct vision, the degree of intestinal injury or gonad necrosis can be evaluated, and laparoscopic treatment can be performed.[13] If the incarcerated content is the appendix or the Meckel's diverticulum, both these structures can be resected laparoscopically.[5],[14] Even the repair of the contralateral patent processus vaginalis can be performed with minimally invasive techniques in the same session.[6],[15]

Bowel necrosis due to strangulation or serosal tears resulting from the retraction force of laparoscopic instruments can be treated with intracorporeal suturing,[8] or damaged intestine could be exteriorised through the single-incision LIHR for repair.[16] Omentectomy, oophorectomy or Meckel's diverticulum resection can also be managed with the minimal access approach.[11]

Only one testicular atrophy was documented in a male who underwent a late, difficult instrumental reduction. It can be hypothesised, that the development of testicular atrophy can be attributed more to the duration of incarceration and condition of the testis, rather than the surgical technique employed.

Two conversions were documented: in the first case the releasing of the external inguinal ring was necessary and in the other case, the LIHR was hampered by a friable internal ring.[12]

In girls with irreducible hernia, the content of hernia is most commonly the ovary. Irreducible hernias with ovarian content should be treated by laparoscopy, as soon as possible after they are detected.[16] Incarcerated hernias containing ovary can be corrected laparoscopically with or without cutting the external inguinal ring with a small skin incision.[17]

Recurrence rate of LIHR after incarceration is as low as 0.78%, which is comparable with non-incarcerated hernias.[18] However, recurrence rate in case of incarcerated hernia after open closure can be 15%–20%.[19] Hook and purse-string methods are equally popular in LIHR for paediatric incarcerated hernias; however, recurrence is significantly higher with purse-string suture than hook technique.[3],[6],[19] It can be hypothesised that the recurrence in the purse-string technique can be overcome if the oedema in the area of the internal inguinal ring is recognised and an additional Z-suture is placed to reinforce the purse-string suture. Other factors that could play a role is (a) the type of suture material (thickness and braided vs. monofilament) used for these repairs, (b) the numbers of 'crushes' to the suture material by the instruments, especially in case of monofilament sutures, which could weaken the suture strength with multiple grasps and (c) number of knots tied to hold the suture bearing in mind that unwinding can take place in monofilament sutures with three knots.

LIHR for incarcerated hernias is highly recommended, because of its advantages in reduction of irreducible hernias with pneumoperitoneum. Laparoscopic instruments can help pulling the content of sac during external manual pressure. Even after successful reduction, the content is under direct vision to check if any injury occurred. Inguinal hernia can be easily closed with any LIHR technique, without the danger of injury of vas or vessels encountered in open way. If intestinal injuries or gonadal necrosis or Meckel's diverticulum is visible, it can be treated immediately by laparoscope.[20] Laparoscopic treatment has short post-operative stay and excellent aesthetic outcomes.[21],[22]

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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