Pediatr Surg Int (2014) 30:621–624
DOI 10.1007/s00383-014-3507-9

ORIGINAL ARTICLE

Incarcerated inguinal hernia management in children: 'a comparison of the open and laparoscopic approach'

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Accepted: 16 April 2014 / Published online: 8 May 2014

Abstract
Purpose To compare the outcomes of management of incarcerated inguinal hernia by open versus laparoscopic approach.
Methods This is a retrospective analysis of incarcerated inguinal hernina in a paediatric surgery centre involving four consultants. Manual reduction was attempted in all and failure was managed by emergency surgery.
Results The laparoscopy group had 27 patients. Four patients failed manual reduction and underwent emergency laparoscopic surgery. Three of them had small bowel strangulation which was reduced laparoscopically. The strangulated bowel was dusky in colour initially but changed to normal colour subsequently under vision. The fourth patient required appendectomy for strangulated appendix. One patient had concomitant repair of umbilical hernia and one patient had laparoscopic pyloromyotomy at the same time. One patient had testicular atrophy, one had hydrocoele and one had recurrence of hernia on the asymptomatic side. The open surgery group had 45 patients. Eleven patients had failed manual reduction requiring emergency surgery, of these two required resection and anastomosis of small intestine. One patient in this group had concomitant repair of undescended testis. There was no recurrence in this group, one had testicular atrophy and seven had metachronous hernia.
Conclusions Both open herniotomy and laparoscopic repair offer safe surgery with comparable outcomes for incarcerated inguinal hernia in children. Laparoscopic approach and hernioscopy at the time of open approach appear to show the advantage of repairing the contralateral patent processus vaginalis at the same time and avoiding metachronous inguinal hernia.

Keywords Incarcerated inguinal hernia · Herniotomy · Hernioscopy · Laparoscopy hernia repair

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Introduction

Incarcerated inguinal hernia (IIH) is one of the commonest paediatric surgical emergency requiring urgent interventions. The conventional management is to attempt gentle manual reduction and if successful followed by semi-urgent surgery. If hernia is irreducible emergency surgery is required. Laparoscopy is now well established in the management of inguinal hernias [1] and is also being used increasingly in the management of incarcerated hernias [2, 3]. This study was carried out to compare the outcomes of management of IIH by open and laparoscopic approach.

Materials and methods

This is a retrospective review of all children admitted with IIH under the care of four Consultant Paediatric Surgeons in our department from 2002 to 2011.

Three surgeons carried out open herniotomy (OH) through the groin incision with high ligation and division of the hernia sac using vicryl 3/0 suture. One of the three also performed hernioscopy to assess the contralateral deep

Table 1 Patient details

Parameters	Open herniotomy ($n = 45$)	Laparoscopic repair ($n = 27$)
Gender (M:F)	8:1	8:1
Weight (kg)	2.47–15.9 (mean = 11.69)	2.08–22.3 (mean = 8.01)
Prematurity	17 (37 %)	9 (33 %)
Presenting side (right)	28 (62.2 %)	22 (81.5 %)
Presenting side (left)	12 (26.7 %)	3 (11.1 %)
Bilateral	5 (11.1 %)	2 (7.4 %)

inguinal ring. The hernioscopy was performed by insufflating the peritoneal cavity though the hernia sac and then inspecting the contralateral deep ring with 70°, 4 mm telescope. The fourth surgeon performed all inguinal hernia repairs laparoscopically [4]. Contralateral patent processus vaginalis (PPV) demonstrated at the time of the hernioscopy or laparoscopy was repaired at the same time.

The laparoscopic approach was carried out using three trocars, one 5 mm transumbilical camera port and two 3 mm lateral instrument ports. Reduction with gentle external taxis under direct vision of laparoscopy was carried out in all those who failed earlier attempt on admission. The hernia orifice was closed with purse-string polypropylene 4/0 suture on a round body needle in patients under 3 years and 3/0 suture if the child was older than 3 years.

Surgery for acutely IIH or even in the early post reduction period is challenging and the consultant was the primary operating surgeon in a significant number of cases in both groups (58 % OH, 81 % LR).

Patients were followed up for 4 weeks to 2 years in the open surgery group and 4 weeks to 3 years in the laparoscopic surgery group and the status of the repaired side, contralateral side and position of the testis were noted. In addition incidence of testicular atrophy, recurrence and metachronous hernia were noted in the follow up. Records of any further management under different surgeons, such as unplanned admissions with problems related to previous surgery or new inguino-scrotal complaints were reviewed and relevant data were collected.

The statistical test applied is the test of proportions; p value of <0.5 was regarded as statistically significant.

Results

Seventy-two consecutive children with IIH were included in the study. Forty-five patients had OH and 27 had laparoscopic repair. The demographic details of patients are shown in Table 1.

Table 2 Outcomes

Parameters	Open herniotomy ($n = 45$)	Laparoscopic repair ($n = 27$)
Failed manual reduction	11 (24.0 %)	4 (15.0 %)
Consultant as operating surgeon	26 (57.8 %)	22 (81.5 %)
Bowel resection	2 (4.4 %)	0
Conversion	–	0
Duration of surgery (min) mean (range)	48.0 (22.0–117.0)	68.3 (45.0–112.0)
Hospital stays (days) mean (range)	1.2 (0–4.0)	1.4 (0–3.0)
Metachronous hernia	7 (15.6 %)	0 (p value = 0.0155)
Recurrence	0	1(3.7 %)
Testicular atrophy	1 (2.2 %)	1 (3.7 %)
Wound infection	0	1 (3.7 %)

Among 11 (24 %) patients with failed reduction on admission who had emergency OH, two had ischemic bowel requiring resection and anastomosis of short segment of ileum. None of the four patients (15 %), who had emergency laparoscopic surgery, needed bowel resection as the reduced, dusky segment improved after the bowel was reduced back in the peritoneal cavity. However, the appendix in one patient was found severely involved in the incarceration and appendectomy was performed together with the laparoscopic hernia repair (Table 2).

Thirteen out of 45 patients in the OH group had hernioscopy performed, out of these 13 children 5 (38.5 %) had contralateral PPV and repair was performed at the same time. In the LR group, 11 (40.7 %) patients had contralateral PPV demonstrated and repair was performed at the same sitting. One patient had repair of the umbilical hernia while the camera port closure. One of the patients in the LH group was admitted with pyloric stenosis and had incarceration of the inguinal hernia before surgery, both the conditions were dealt with together laparoscopically. One patient in the open group had concomitant orchidopexy.

Duration of surgery in both groups was similar and no conversion was needed in any of the laparoscopic repairs.

All patients including the ones with history of prematurity recovered well after the general anaesthetic. There was no increase in morbidity among those who had added concomitant procedures and hospital stay was similar in the two groups.

In the follow-up period, seven children (15.6 %) in the OH group developed metachronous hernia and had subsequent surgery. Two of the metachronous hernias were in children who had hernioscopy done at the time of primary surgery, rest 5 metachronous hernias were in the children who had OH without hernioscopy. None in the LR group

had metachronous hernia. The difference in incidence of metachronous hernia between the two groups is statistically significant ($p = 0.0155$) (Table 2).

Outcomes such as testicular atrophy, recurrence and wound infection did not show any significant differences between the 2 groups.

Discussion

Laparoscopy is changing our understanding of the inguinal hernia with respect to the diagnosis of contralateral PPV, treatment of recurrences and the incidence of direct and femoral hernias [5–7].

It is still the standard approach to gently reduce the IIH and operate semi-electively. Failed or suspicious incomplete reduction [8] will require emergency exploration. In open approach, the bowel which is already tightly compressed at the internal inguinal orifice is handled very cautiously to avoid pressure or traction on the mesentery compromising further the blood supply.

In the laparoscopic exploration, further attempt of reduction under direct vision is carried out and if successful, the bowel while lying freely in the peritoneal cavity without any tension on the messentry can be examined easily for any ischemia. It has been reported that the pneumo-peritoneum during laparoscopy widens the inguinal rings facilitating reduction of severely incarcerated hernias [3].

The average operating time is comparable between the two groups but we have not differentiated between cases with and without concomitant procedures carried out as the numbers were small. The laparoscopic purse-string suturing of peritoneum around internal ring avoids the tedious dissection of the hernia sac from an oedematous cord [13], which is necessary in open approach and this might result in shorter surgery time [3]. The advantage of avoiding tedious dissection of the oedematous tissue in laparoscopic approach is also emphasised in the recent paper by Esposito et al. [13].

Both open and laparoscopic approaches did not show any significant difference in recurrence (0 vs. 4.5 %, $p > 0.5$). This is similar to other reported series [2]. The only recurrence occurred in a laparoscopic repair of asymptomatic PPV and this could be attributed to the use of simple interrupted sutures for contralateral PPV in the early part of the study. Subsequently, the purse-string suture repair has been used as in the incarcerated hernias and no further recurrence has occurred.

One child had testicular atrophy in each group and there was a clear history of delayed presentation and difficult reduction. The child in the open hernia group who had the testicular loss also had bowel gangrene requiring resection and anastomosis. We had two patients in the OH group requiring bowel resection. It is possible that traction and constriction pressure on bowel mesentery while it is being examined out of the groin wound may contribute to it.

Surgery for acutely IIH or even in the early post reduction period is challenging and the consultant was the primary operating surgeon in a significant number of cases in both groups (58 % OH, 81 % LR).This emphasis on the fact that they are challenging surgeries irrespective of the laparoscopic or open approach.

Metachronous inguinal hernia (MIH) (15.6 %) remained a noticeable feature among patients in the OH group. The preferential use of hernioscopy by one surgeon in his open approach could not diagnose the PPV in two of the seven metachronous hernias. Though there are papers suggesting that the detection rate of contralateral patent deep inguinal ring appears to be higher for direct visualisation via umbilical 30° laparoscope versus 70° scope via the hernia sac, long-term prospective data collection is needed to compare them [12]. We have seen as reported by others, the advantage of avoiding MIH (0 %) in the LR group as all the contralateral PPVs were repaired at the same time negating the risks of incarceration and further hospitalisation and surgery [2, 9–11].

In this study, the overall incidence of contralateral PPV shown in both groups ranges from 26.0 % (OH 12/45) to 40.7 % (LR 11/27) and is similar to other reported series [2, 9–11]. As there is still on-going debate about the risks of asymptomatic PPV in a child, at this moment, parents should be counselled appropriately regarding possible metachronous inguinal hernia in their child especially following OH.

Conclusions

Both OH and laparoscopic repair offer safe surgery with comparable outcomes for IIH in children. Laparoscopic approach and hernioscopy at the time of open approach appear to show the advantage of repairing the contralateral PPV at the same time and avoiding metachronous inguinal hernia.

References

1. Parelkar SV, Oak S et al (2010) Laparoscopic inguinal hernia repair in the paediatric age group–-experience with 437 children. J Pediatr Surg 45(4):789–792
2. Nah SA et al (2011) Surgical repair of incarcerated Inguinal hernia in children: laparoscopic or open? Eur J Pediatr Surg 21:8–11

3. Schier F et al (2006) Laparoscopic repair of incarcerated inguinal hernia in children. J Pediatr Surg 41:567–569
4. Cho A, Devany A, Tsang T (2013) Long-term outcomes of laparoscopic intracorporeal inguinal hernia ligation in infants under 1 year of age. J Laparoendosc Adv Surg Tech A 23(4):387–391
5. Schier F (2000) Laparoscopic surgery of inguinal hernias in children–-initial experience. J Pediatr Surg 35:1331–1335
6. Espostio C, Montupet P (1998) Laparoscopic treat of recurrent of recurrent inguinal hernia in children. Pediatr Surg Int 14:182–184
7. Schier F (2000) Direct inguinal hernias in children, the laparoscopic aspect. Pediatr Surg Int 16:562–564
8. Stylianos S, Jacir NN, Harris BH (1993) Incarceration of inguinal hernia in infants prior to elective repair. J Pediatr Surg 28:582–583
9. Miltenburg DM et al (1998) Laparoscopic evaluation of the pediatric inguinal hernia–-a meta-analysis. J Pediatr Surg 33(6):874–879
10. Lau ST, Lee YH, Caty MG (2007) Current management of hernias and hydroceles. Semin Pediatr Surg 16(1):50–57
11. Ron O, Eaton S, Pierro A (2007) Systematic review of the risk of developing a metachronous contralateral inguinal hernia in children. Br J Surg 94(7):804–811
12. Niyogi A et al (2010) A comparative study examining open inguinal herniotomy with and without hernioscopy to laparoscopic inguinal hernia repair in a pediatric population. Pediatr Surg Int 26:387–392
13. Esposito C et al (2013) Laparoscopic repair of incarcerated inguinal hernia. A safe and effective procedure to adopt in children. Hernia 17:235–239