Avoiding cord extraction or mobilization during pediatric inguinal hernia repair: a step midway between conventional and minimally invasive approaches

Mohammad G. Khirallah, Hamada Daowood, Abdelfatah Ali and Mhamed Ashour

Background **Pediatric inguinal hernia (PIH) represents one of the most common congenital defects in infants and children worldwide. Several techniques have been adopted for repair. Conventional open excision of the sac is considered the most popular and most accepted among pediatric surgeons. In the past few years laparoscopic PIH repair has started to gain popularity.**

Aim **The aim of this study was to minimize the intervention to be near to minimally invasive but at the same time to be conventional in approach, reducing the stretch and manipulation of the vital cord structures.**

Patients and methods **During the period from April 2013 to May 2015, 200 male infants who presented with PIH were operated upon in our hospital. We excluded patients with complicated inguinal hernias, hernias associated with hydroceles, undescended testis, and female infants.**

Results **Of the 200 male infants with PIH who were operated upon, 107 had hernias on the right side, 74 had on the left side, and 19 were bilateral. The mean age was 4.5 months. The mean body weight was 5 kg. All infants received general anesthesia. The mean length of the incision was 10 mm. Recurrence was found in only three cases. There were no cases of testicular atrophy.**

Conclusion **We found our approach to be safe and easy to perform, and the vital structures in the cord did not have to be manipulated.** ***Ann Pediatr Surg*** **12:86–89 © 2016 Annals of Pediatric Surgery.**

Annals of Pediatric Surgery 2016, **12**:86–89

Keywords: pediatric, inguinal hernia, repair

Department of Pediatric Surgery, Faculty of Medicine, Tanta University Hospitals, Tanta, Egypt

Correspondence to Mohammad G. Khirallah, MD, PhD, Department of Pediatric Surgery, Faculty of Medicine, Tanta University Hospitals, Elgeish Street, Tanta 31111, El Gharbeya, Egypt
Tel: +20 100 354 6853; e-mail: mohamed.khirallah@med.tanta.edu.eg

Received 21 April 2016 **accepted** 22 May 2016

Introduction

Pediatric inguinal hernia (PIH) represents one of the most common congenital defects during neonatal, infancy, and childhood periods [1].

The conventional open approach through inguinal incision is the gold standard for the repair of the defect, as described for decades, because of its lower morbidity and lower rates of recurrence in addition to its simplicity [2,3].

However, it is not free from complications. The most serious complication is injury to the structures of the spermatic cord, such as the vas deferens or testicular vessels, which may result in testicular atrophy [4].

During recent years, minimally invasive access (MIA) using laparoscopy has gained popularity and many studies have proven its feasibility, safety, and efficacy. The most important advantage of MIA is that there is no manipulation of the important cord structures such as vas or testicular vessels [5].

However, laparoscopic repair requires several lines of equipment and training programs with a learning curve to be applicable and safe. Further, this approach is contraindicated in children with major cardiac and chest troubles. That drove us to find a way to minimize the intervention so that it is similar to an MIA but still follows a conventional pattern and to fashion our technique to reduce stretching and manipulation of the vital cord structures.

Patients and methods

During the period from April 2013 to May 2015, 200 male patients with PIH were operated upon with our technique. We had excluded complicated cases, cases with hydrocele, and cases with huge hernia sacs. All patients underwent an ultrasound of the inguinoscrotal region for determining the diameter of the inguinal canal and the size of both testes and an examination of the contralateral region in unilateral cases to detect the presence or absence of contralateral hernia. Routine laboratory investigations such as complete blood count and coagulation profile were carried out. All patients received general anesthesia, either through endotracheal intubation or through a laryngeal mask.

The study had ethical committee approval. An informed consent had been assigned by parents of all cases.

Operative details

We palpated the spermatic cord with its silky glove sign at the pectineal line lateral to the pubic tubercle. We incised the skin at this level, which was slightly caudal to conventional incision. The skin incision was 1 cm in length and the usual layers were incised down to the fascia scarpa, which was held in place by two mosquito forceps (Fig. 1). Then two small retractors were placed so that the spermatic cord now appeared to cross the pectineal line lateral to the pubic tubercle. The cremasteric muscle fibers peeled away from the cord in anterior and caudal direction. The sac was found as the

1687-4137 © 2016 Annals of Pediatric Surgery DOI: 10.1097/01.XPS.0000484541.89793.03

Fig. 1

Incision overlying the cord as it crosses the picteneal line.

Fig. 2

Extraction of the sac.

most anterior structure and was grasped by a nontoothed instrument and bluntly dissected from the cord structures without its extraction or mobilization, which was the main goal of our technique (Fig. 2). The sac was then dissected up to the deep ring where it was transfixed and excised at the proper neck. The vas and vessels were at the base of the incision, untouched or stitched. Thus, our approach was similar to the laparoscopic approach in that aspect and there was no possibility of damage to any of the structures. We had to extend the wound in 10 cases and the incision was closed as usual. All our patients received a single dose of antibiotic. Nonsteroidal analgesics were prescribed when required. All of our infants were discharged on the same operative day. All were followed up by inguinoscrotal ultrasound at 3 and 6 months postoperatively to detect any changes in the testicular size in relation to the preoperative finding. All data were registered and statically analyzed using SPSS (SPSS Inc., Chicago, Illinois, USA).

Results

Two hundred infants with PIH were operated upon using a skin incision overlying the spermatic cord as it crossed the pectineal line. Their ages ranged from 1 week to 14 months, with an average of 4.5 months. Their mean body weight was 5 kg. We operated upon 107 infants with right PIH, 74 with left side hernia, and 19 with bilateral hernias. The mean volume of testis on the affected side in unilateral cases was 704.5 on the right side and

Table 1 Demographic and preoperative data

Cases	Data
Age (mean) (months)	4.8
Weight (mean) (kg)	5
Maturity no of cases	
Mature	178
Immature	28
Side	
Right	107
Left	74
Bilateral	19
Testicular volume (mm^3)	
Right	704.5
Left	723
Bilateral	700

Table 2 Operative data

Variables	Data
Operative time (mean ± SD) (min)	
Unilateral cases	20 ± 2.45
Bilateral cases	32 ± 3.04
Length of incision (mean ± SD) (mm)	10 ± 0.24
Need of extension	
190 cases	No need
10 cases	Extension up to 20 mm
Vascular injury	None
Vas manipulations	None
Need to extract or stretch the cord	None

Table 3 Postoperative data

Variables	Data
Scrotal edema	
170 cases	None
30 cases	Present and resolved within days
Wound infection	None
Recurrence	
179 cases	No recurrence
3 cases	Recurrent few weeks later
Satisfaction of parents	All satisfied

Table 4 Testicular volume preoperatively, 3 months postoperatively, and 6 months postoperatively

	Mean volume			*P* values	
Affected sides	Preoperatively (mm^3)	3 months postoperatively	6 months postoperatively	Preoperatively and 3 months postoperatively	Preoperatively and 6 months postoperatively
Right side	704.5	705.24	715.24	0.288	0.258
Left side	724	725	727	0.278	0.268
Bilateral	700	705	710	0.284	0.235

724 mm^3 on the left side, and the mean volume of testis in bilateral cases was 700 mm^3 (Table 1).

The mean length of incision was 1 cm. Ten cases required extensions of incision up to 2 cm and this occurred during the early period of study. The mean operative time for unilateral cases was 20 min, whereas that for bilateral cases was 32 min. As regards the postoperative period 30 cases had scrotal edema, which improved with time and completely disappeared by the first postoperative follow-up visit. No cases had wound infection. Three cases had recurrence. These cases were operated upon laparoscopically once detected. Follow-up was carried out at the third postoperative month using inguinoscrotal ultrasound. We found no obvious change in testicular size in relation to its size before the operation. On the sixth postoperative month, the mean size of the testis on the affected side was 715.24 mm^3 in the right cases and 727 mm^3 in the left cases, and 710 mm^3 in bilateral cases. This means no cases of testicular atrophy were recorded. Parents were satisfied with the cosmetic appearance of the incision (Tables 2–4).

Discussion

Conventional open repair of PIH is considered a common surgical practice in infants and is considered the standard for repair [6].

However, it sometimes requires extensive hernia sac dissection from other spermatic cord structures including testicular vessels and vas deferens, which may focus light on the impact of these manipulations on the vascularity of the testis and structural changes in the vas while approaching the sac [7,8].

There are multiple studies using Doppler scanning of the testis to detect any impairment of vascularity in adults after inguinal hernia repair. Some authors have reported affection of vascularity in the immediate postoperative period that returned to normal values in the late postoperative period, whereas other authors have stated that there is no change in the early postoperative period [9,10].

This motivated us to modify the conventional technique so that it was a fine balance between the MIA and traditional approach.

In this respect we were in agreement with Ikeda *et al.* [6], who also pursued this minimal approach with satisfactory surgical and cosmetic results.

To achieve this minimal invasive strategy during our work we needed to be closest to the cord. This occurred only when the skin incision was made overlying the thickened cord as it crossed the pectineal line so that we could selectively extract the sac and repair the hernia.

In the traditional conventional approach the incision for inguinal hernia repair was made within the lowest abdominal crease at the inguinal region, which was above our incision by a few centimeters and necessitated adequate dissection to reach the cord and hence the sac [11].

Although our main aim was to avoid stretching or extraction of the cord during repair of the PIH, thus avoiding unnecessary manipulation of vas or vessels, this seemed to be the second goal for Ikeda *et al.* [6], whose main goal was the final cosmetic results.

Palabiyik *et al.* [12] studied the effect of manipulation of the cord structures in the conventional approach on the vascularization of the testis. They performed their study on kids aged 2–14 years using duplex scanning before, immediately after, and 30 days after the operation and found only changes in the early postoperative period, which returned to normal values at the end of the late postoperative period; thus, these changes were transient. They excluded children younger than 2 years because of the inability to assess the vascularity of the testis [12].

We believe that depending on the size of the testis instead of on a duplex study during follow-up with ultrasound scanning allowed us to detect any changes in the size of the testis especially in infants below 2 years of age, a group excluded by Palabiyik *et al.* [12]. During our study no cases had postoperative testicular atrophy.

Oyen [8] showed that the traditional approach may be associated with a very low incidence of vas or testicular vessel injuries but they are far more disastrous.

From the experimental point of view Choi *et al.* [13] showed that the dissection of the cord and high ligation of the sac, which may not directly affect the vas, may affect testicular growth.

As regards MIA, Schier *et al.* [14] were the first to evaluate testicular vascularization in PIH repair in children following the laparoscopic approach and concluded that laparoscopic repair did not impair testicular perfusion and also avoided injury to the vas. As in our study they depended on the testicular size as well as on duplex scanning.

In the same context, Çelebi *et al.* [7] stated that open and laparoscopic hernia repair techniques did not impair the testicular vascularization. But they did not study the vas structural changes.

On revision of their technique Ikeda *et al*. [6] recorded no cases of testicular atrophy during follow-up but they depended mainly on clinical examination and comparison with the contralateral side or, if bilateral, compared testicular size with that of normal children of the same age group. From our point this was more subjective than if they had depended on ultrasound examination, which was more objective, especially when compared with preoperative results [15].

Ceylan *et al.* [16] proved that there was progressive thinning of the smooth muscle layer of the vas deferens and testicular atrophy in their experimental work due to temporary stretching of the cord during the conventional approach to hernia repair.

The estimated values for the injury of the vas deferens during conventional open repair were 0.8–2% [17].

Through our technique we did not record any incidence of vas deferens injury because of selective sac extraction in which the vas and vessels were located at the base of the field away from the dissection.

The final cosmetic results were as satisfactory to the parents in our study as in the study of Ikeda *et al*. [6].

Conclusion

In conclusion, we believed that our technique aided in considerably reducing unnecessary stretching, extraction, and dissection of the cord structures and in avoiding any testicular atrophy or vas injury. Therefore, we believe that it is a step midway between the conventional inguinal open approach and the laparoscopic approach for PIH repair.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

1 Kumar A, Ramakrishnan TS. Single port laparoscopic repair of pediatric inguinal hernias: our experience at a secondary care center. *J Minim Access Surg* 2013; **9**:7–12.
2 Levitt MA, Ferraraccio D, Arbesman MC, Brisseau GF, Caty MG, Glick PL. Variability of inguinal hernia surgical technique: a survey of North American pediatric surgeons. *J Pediatr Surg* 2002; **37**:745–751.
3 Ein SH, Njere I, Ein A. Six thousand three hundred sixty-one pediatric inguinal hernias: a 35-year review. *J Pediatr Surg* 2006; **41**:980–986.
4 Schier F. Laparoscopic inguinal hernia repair a prospective personal series of 542 children. *J Pediatr Surg* 2006; **41**:1081–1084.
5 Bharathi RS, Arora M, Baskaran V. Minimal access surgery of pediatric inguinal hernias: a review. *Surg Endosc* 2008; **22**:1751–1762.
6 Ikeda H, Hatanaka M, Suzuki M, Fujino J, Tahara K, Ishimaru Y. A selective sac extraction method: another minimally invasive procedure for inguinal hernia repair in children: a technical innovation with satisfactory surgical and cosmetic results. *J Pediatr Surg* 2009; **44**:1666–1671.
7 Çelebi S, Yıldız A, Üçgül A, Karadağ ÇA, Sever N, Akın M, Dokucu Aİ. Do open repair and different laparoscopic techniques in pediatric inguinal hernia repairs affect the vascularization of testes? *J Pediatr Surg* 2012; **47**: 1706–1710.
8 Oyen RH. Scrotal ultrasound. *Eur Radiol* 2002; **12**:19–34.
9 Aydede H, Erhan Y, Sakarya A, Kara E, Ilkgül O, Can M. Effect of mesh and its localisation on testicular flow and spermatogenesis in patients with groin hernia. *Acta Chir Belg* 2003; **103**:607–610.
10 Dilek ON, Yucel A, Akbulut G, Degirmenci B. Are there adverse effects of herniorrhaphy techniques on testicular perfusion? Evaluation by color Doppler ultrasonography. *Urol Int* 2005; **75**:167–169.
11 Glick PL, Boulanger SC. Inguinal hernia and hydroceles. In: Grosfeld JL, O'Neill JA, Fonkalsrud EW, Coran AG, editors. *Pediatric surgery*, 6th ed. Philadelphia, PA: Mosby; 2006. pp. 1172–1192.
12 Palabiyik FB, Cimilli T, Kayhan A, Toksoy N. Do the manipulations in pediatric inguinal hernia operations affect the vascularization of testes? *J Pediatr Surg* 2009; **44**:788–790.
13 Choi SE, Kook MC, Kim CJ, Lee SC, Park KW, Jung SE, Kim WK. Effects of compression/stretching of the spermatic cord and blunt dissection on testicular growth and fertility. *J Pediatr Surg* 2009; **44**:2163–2167.
14 Schier F, Turial S, Huckstadt TH, Klein KU, Wannik T. Laparoscopic inguinal hernia repair does not impair testicular perfusion. *J Pediatr Surg* 2008; **43**:131–135.
15 Suzuki M, Hatanaka M, Fujino J, Igarashi A, Hasegawa M, Tahara K, *et al.* Safety and efficacy of selective sac extraction method of inguinal hernia repair in children: results of a prospective study. *Pediatr Surg Int* 2014; **30**:499–502.
16 Ceylan H, Karakök M, Güldür E, Cengiz B, Bağci C, Mir E. Temporary stretch of the testicular pedicle may damage the vas deferens and the testis. *J Pediatr Surg* 2003; **38**:1530–1533.
17 Benge BN, Jordan GH. Prepubertal vassal injury: its effect on postpubertal vas deferens. *J Urol* 1993; **149**:906–909.