

Comparative study between purse-string suture and peritoneal disconnection with ligation techniques in the laparoscopic repair of inguinal hernia in infants and children

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Background Laparoscopic hernia repair in children is becoming more popular nowadays. A lot of laparoscopic techniques were described to repair inguinal hernia in infants and children; however, there are few reports on laparoscopic disconnection of the hernia sac at internal inguinal ring (IIR) as a method for hernia repair.

Purpose The objective of this study was to compare intracorporeal purse-string suturing leaving the hernia sac in continuity and laparoscopic disconnection of the hernia sac at IIR and proximal closure of the peritoneum for repair of inguinal hernia in infants and children. A randomized prospective study was carried out in the Pediatric Surgery Unit of Alexandria University Hospitals (Alexandria, Egypt) on 40 male children.

Patients and methods Forty male patients (48 repairs) were randomized into two equal groups ($n=20$). Group A was subjected to intracorporeal purse-string suturing around the IIR leaving the hernia sac in continuity. Group B was subjected to disconnection of the hernia sac from the parietal peritoneum at the level of IIR, followed by proximal closure of the peritoneum. Inclusion criteria were as follows: male inguinal hernia, either unilateral or bilateral, and age between 6 months and 12 years. Exclusion criteria were as follows: female inguinal hernia, hernia with undescended testicles, recurrent inguinal hernia, and previous major lower abdominal surgery. The main outcome measurement was recurrence, and secondary outcome measurements were operative time, hospital stay,

intraoperative complications, postoperative hematoma, postoperative testicular atrophy, and postoperative hydrocele formation.

Results There were no significant differences between the two groups as regards age, sex, and mode of presentation. All cases were completed laparoscopically without conversion. Group A showed a significantly higher rate of recurrence as well as hydrocele formation compared with group B; however, there was no difference as regards the operative time, hospital stay, and testicular atrophy.

Conclusion Laparoscopic hernia repair using the peritoneal closure following disconnection of the hernia sac is a safe and feasible method for hernial repair with minimal complications. It has a lower recurrence rate compared with the purse-string suturing alone, with no added risk for injury to the vas and vessels. *Ann Pediatr Surg* 12:137–141 © 2016 Annals of Pediatric Surgery.

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Keywords: disconnection of the hernia sac, inguinal hernia, internal inguinal ring, intracorporeal sutures, laparoscopic hernia repair, purse-string suture

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Introduction

Inguinal hernia management is among the most common surgical techniques in infants and children, with a peak incidence during the first 3 months of life [1]. Open herniotomy stands for decades as the golden treatment method for pediatric inguinal hernia [2]. Laparoscopy is gaining popularity nowadays in the management of pediatric hernia [3]. Several laparoscopic techniques involving partial and circumferential peritoneal incision at the internal inguinal ring (IIR), or insertion of purse-string suture around the IIR either percutaneously or transperitoneally, have been described [4]. However, these laparoscopic techniques are still different from the conventional herniotomy, in which the transection and partial excision of the sac are essential steps. Disconnection of the hernial sac with suturing of its proximal part at the IIR is a modification of the intracorporeal laparoscopic technique, which mimics what happens in open herniotomy [4]. The aim of this study was to compare purse-

string suturing of the hernia defect leaving the hernia sac in continuity and laparoscopic disconnection of the hernia sac at IIR and proximal closure of the peritoneum.

Patients and methods

This prospective randomized study was conducted on 40 consecutive male children with 48 repairs (eight cases with bilateral hernia) in the Pediatric Surgery Unit of Alexandria University Hospitals, Egypt. The study protocol was approved by the hospital ethical committee and parents signed a detailed informed consent. Inclusion criteria were as follows: male hernia, either unilateral or bilateral, age between 6 months and 12 years. Exclusion criteria were as follows: female inguinal hernia, hernia with undescended testicles, recurrent inguinal hernia, parental refusal, and previous major lower abdominal surgery. Diameter of the diameter of inguinal ring was not a limiting factor for these techniques.

Cases were randomly divided into two equal groups (A and B) using a random number table sequence. Each group comprised 20 patients ($n = 20$). The allocations were enclosed in opaque sequentially numbered sealed envelopes. They received one dose of preoperative antibiotic prophylaxis in the form of ceftriaxone 50 mg/kg in the morning on the day of surgery. In group A, cases were subjected to intracorporeal insertion of a purse-string suture around the IIR, whereas in group B they were subjected to laparoscopic disconnection of the hernial sac at IIR with proximal closure of the peritoneum.

The main outcome measurements were operative time, hospital stay, intraoperative complications, postoperative hematoma, postoperative testicular atrophy, postoperative hydrocele formation, and the recurrence rate.

Description of the two techniques

In both groups, after induction of general endotracheal tube anesthesia, the patient was placed supine in Trendelenburg's position. Insertion of the main umbilical port (using telescope 5-mm at 30°) was accomplished using the open method. Pneumoperitoneum was established at a pressure of 8–10 mmHg. Initial visualization of the pelvis and IIRs on both sides was carried out. Two 3-mm accessory ports were inserted at the lateral borders of the rectus muscles on both sides at the level of the umbilicus. In group A, a shortened (8-cm long) 3-0 nonabsorbable Ethibond suture (Ethicon, USA) was used in all patients. The needle and thread were passed into the abdomen directly through the anterior abdominal wall. Two 3-mm needle holders were used for insertion of a purse-string suture around the IIR with intracorporeal knot tying. The stitch includes the peritoneum only along the lower margin of IIR and it includes the peritoneum and the underlying fascia transversalis along the upper margin of IIR (Fig. 1).

In group B, the hernial sac was completely disconnected (using hook diathermy on pure cutting mode and Maryland forceps 3-mm) from the parietal peritoneum by means of careful sharp dissection of the sac at the level of the IIR, protecting the vas deferens and testicular vessels. Following complete disconnection, the proximal part of the disconnected peritoneum was closed by means of intracorporeal suturing using 3-0 nonabsorbable Ethibond suture (Fig. 2).

Results

The study was conducted on 40 male patients with 48 repairs (eight cases of bilateral inguinal hernia) at the Pediatric Surgery Department, Alexandria University Hospitals. Patients were divided into two groups of 20 patients each. Follow-up visits were scheduled at 2 weeks, 2 months, 6 months, and 1 year.

There was no significant difference as regards the demographic data of patients of both groups (Table 1). All operations were completed laparoscopically without any conversion in both groups.

In group A, the mean duration for surgery was 32.50 ± 6.18 min (range = 25.0–45.0 min), whereas in group B it was 34.0 ± 7.88 min (range = 25.0–50.0 min). There was no significant difference between the two groups as

regards the operative time. No intraoperative complications were reported in both groups during this study.

All cases in both groups achieved full recovery and were discharged home in the evening of the same operative day after observation and complete assessment. Oral intake was started 4 h after the operation.

In group A, scrotal hematoma appeared in one case (5%), but resolved spontaneously without surgical intervention, and postoperative hydrocele appeared in one case (5%), and resolved spontaneously with no need for surgery. In contrast, in group B, only two cases developed scrotal hematoma, which resolved without surgery (Table 2).

In the two studied groups, no testicular atrophy or iatrogenic ascent of the testis was reported during the follow-up period. The testis was assessed after 6 months by means of clinical examination and testicular gross morphology. One case (5%) in group A developed postoperative recurrence after 6 months of follow-up. This case was subjected to open surgery, as he was presented to the emergency room with irreducible inguinal hernia. No recurrence was reported in group B (Table 2).

Discussion

Open inguinal hernia repair is an excellent method of repair in the pediatric population. However, it has the potential risk for injury to the testicular vessels and vas deferens, hematoma formation, wound infection, iatrogenic testicular ascent, testicular atrophy, and recurrence [5,6].

The advantage of laparoscopic inguinal hernia repair in children is that the hernial sac can be approached from the site of origin, leaving the outer abdominal wall intact [7,8].

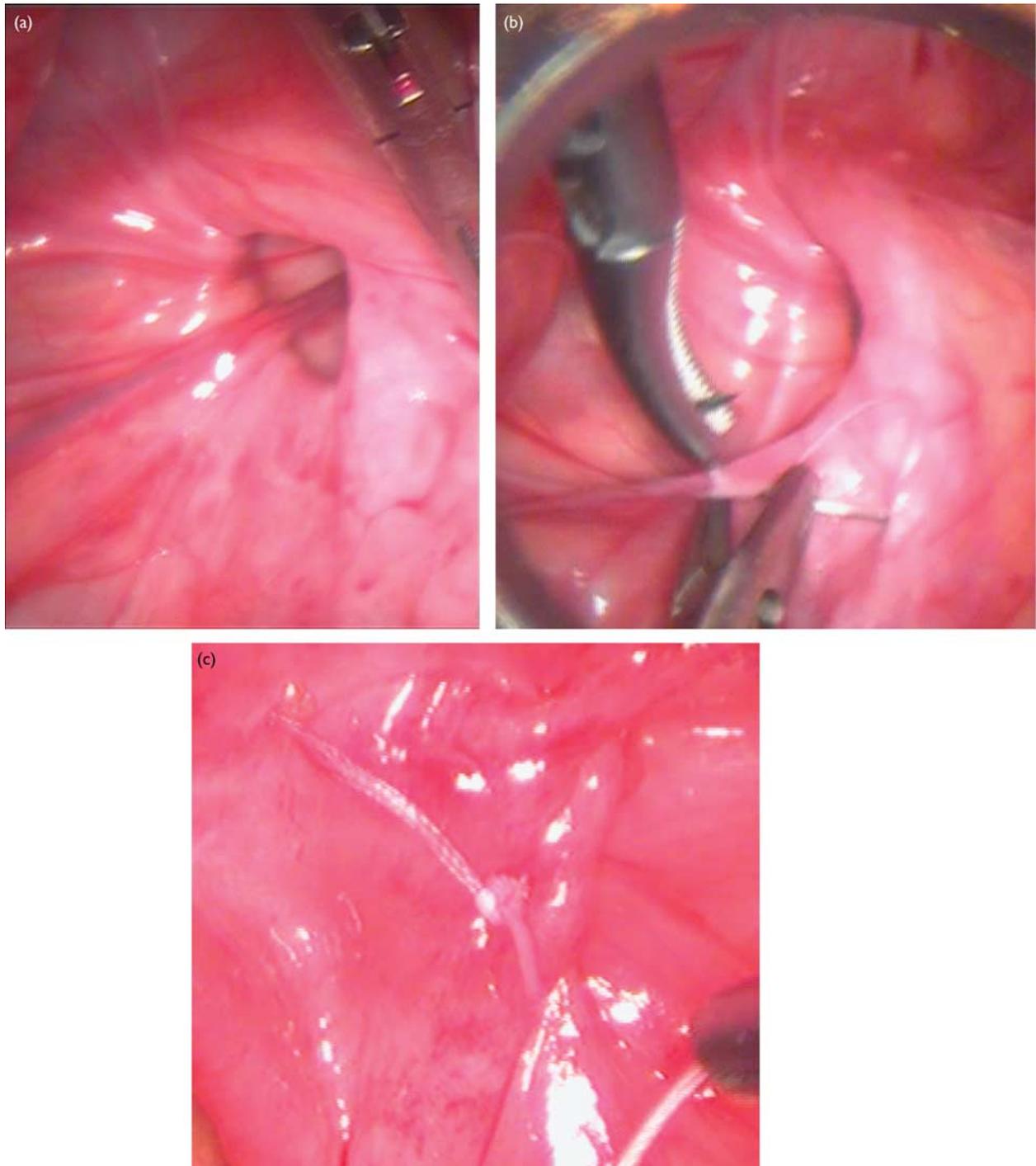
In the current study, there was no significant difference as regards age between the two groups. This is comparable to the age incidence reported in few other series [6,9,10]. This similarity could be attributed to the fact that laparoscopic hernia repair (LHR) is not yet widely practiced in neonates and premature babies, thus moving the age for surgical intervention above the neonatal period.

LHR in children is known to consume longer operative time. Many reports showed that it ranged from 25 to 74 min [7,11–13]. However, the operative time is reduced gradually with advancing learning curve.

In the current study, there was no significant difference as regards the operative time between the two studied groups, and this is comparable to that reported in few other series [9,14,15].

Tam *et al.* [9] performed LHR using the hook method in 433 children, and they reported a mean operative time of 23.8 min. Montupet and Esposito [14] used the LHR by sectioning the sac distally to the IIR and performing a purse-string suture around the proximal peritoneum using a 4-0 nonabsorbable suture with a median operating time of 19 min. Tsai and colleagues performed the same technique as described by Montupet and Esposito [14]; they reported a mean operative time of 42 min [15].

Fig. 1



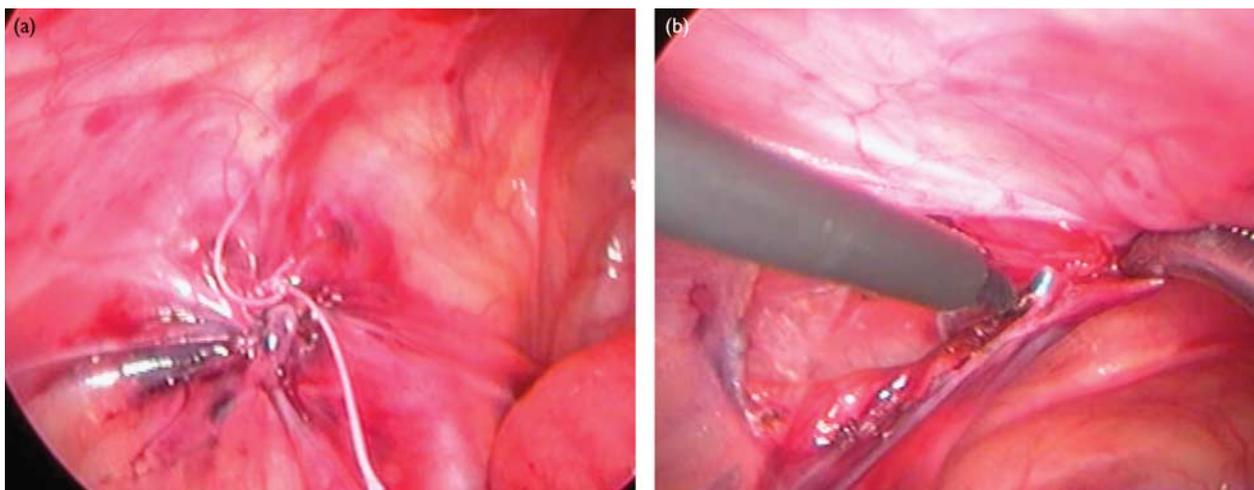
(a) Identification of the internal inguinal ring (IIR). (b) Purse-string suture around the IIR skipping the vas and testicular vessels. (c) Complete closure of the IIR.

No intraoperative complications were reported in the current study. Similarly, most of the published series showed no intraoperative complications [15]. Generally, the advantage of the laparoscopic approach is that it allows better visualization of the vas and vessels, and hence minimizes any direct mishap.

Scrotal hematoma appeared in 5% of cases in group A and in 10% of cases in group B after 2 weeks but resolved conservatively without surgical intervention. An overall 5%

of cases in group A developed postoperative hydrocele, which was spontaneously resolved. Postoperative hydrocele and hematoma are acceptable complications after LHR, as they usually resolve spontaneously. Different series reported the occurrence of postoperative hydrocele. Shalaby *et al.* [10] reported that 4% of their cases developed scrotal hydrocele. However, in another series, Shalaby *et al.* [16] reported an incidence of 0.57%. In a study by Tam *et al.* [9], postoperative hydrocele was reported in 1% of cases. In the current study, the incidence of postoperative hydrocele was

Fig. 2



(a) Disconnection of hernia sac. (b) Purse-string suture of the peritoneum.

Table 1 Age, presentation, and operative time

	Group A (n=20) [n (%)]	Group B (n=20) [n (%)]	χ^2	MCP
Age (months)				
Minimum–maximum	11.0–60.0	11.0–36.0	1.747	0.089
Presentation				
Unilateral	16 (80)	16 (80)	0.591	0.914
Bilateral	4 (20)	4 (20)		
Operative time (min)				
Minimum–maximum	25.0–45.0	25.0–50.0	0.670	0.507
Mean \pm SD	32.50 \pm 6.18	34.0 \pm 7.88		

Table 2 Postoperative complications

	Group A (n=20) [n (%)]	Group B (n=20) [n (%)]	χ^2	MCP
Hematoma	1 (5.0)	2 (10.0)	1.333	1.000
Hydrocele	1 (5.0)	0 (0)		
Recurrence	1 (5.0)	0 (0)	1.026	1.000

lower in group B, which may be attributed to the tight closure of the IIR and disconnection of the hernia sac.

In our study, neither testicular atrophy nor ascending of testis was reported during the period of follow-up on clinical examination and gross testicular morphology. In the study by Tam *et al.* [9], 0.23% of cases developed ascending testis 18 months after LHR and eventually required inguinal orchidopexy. In the same series, one infant was noted to have testicular atrophy few months after surgery that took place in a patient with an incarcerated hernia.

Recurrence rate after LHR in many series ranged from 0.7 to 4.5% [7,9,10,14–18]. In the current study, recurrence of hernia on the same side was reported in one case (5%) in group A after 6 months of follow-up. This patient had bilateral hernia and came back after 6 months with right recurrent irreducible hernia that needed urgent surgery to remove the hernia sac and narrow the IIR. No recurrence was reported in group B. As regards postoperative recurrence, purse-string suturing after hernia sac disconnection showed

that it is more effective and safe compared with purse-string suturing alone.

Finally, the current study showed that disconnection of the hernial sac at the IIR is an important step in preventing both postoperative recurrence and hydrocele formation. These results are comparable to different series that performed disconnection of the hernial sac [19–22].

In the study by Giseke and colleagues, the distal processus vaginalis was partially resected or dropped in the inguinal canal and the peritoneum closed using a figure-of-eight nonabsorbable suture. An overall 1% of hernia recurrences appeared postoperatively after 3 months [19].

Becmeur *et al.* [20] performed the same technique in 82 patients. After 6 months of follow-up no recurrences were reported.

Riquelme and colleagues the patent processus vaginalis and the parietal peritoneum surrounding the IIR. This allowed the peritoneal scar tissue to close the area of the ring. No recurrences were reported during the follow-up [21].

In another series, García-Hernández and colleagues performed the same repair as Riquelme *et al.* [21] by means of resection of the hernia sac without ligation. There were only two recurrences (0.53%), which were secondary to incomplete resection of the hernial sac and appeared in the first week after surgery [22].

In the current study, the results showed that disconnection of the hernial sac was effective and safe in reducing postoperative hydrocele formation and recurrence rate, and this conforms to that reported in other series [19–22].

Conclusion

LHR using the peritoneal closure following disconnection of the hernia sac is a safe and feasible method for hernial repair with minimal complications. It has lower recurrence and hydrocele formation rate, compared with the purse-string suturing alone, with no added risk for injury to the vas and vessels. The limitation of this study is the small numbers and the short follow-up.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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