

Laparoscopic Pediatric Inguinal Hernia Repair with and without Excision of the Hernial Sac

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ABSTRACT

Background: In skilled hands, laparoscopic repair of inguinal hernias has become an integral part of pediatric inguinal hernia management. **Objective:** The aim of the current study is to compare the outcome of laparoscopic inguinal herniotomy with excision of the hernial sac with laparoscopic inguinal herniotomy with just disconnection of the sac.

Patients and methods: A randomized controlled clinical trial was conducted at Pediatric Surgery Department at Zagazig University Hospital, on 24 patients who had inguinal hernia. All cases were divided into two groups: **Group A** (n=13): Laparoscopic inguinal herniotomy by closure of the hernial defect by intracorporeal purse-string suture ligation of the peritoneum with excision of the hernial sac. **Group B** (n=11): Laparoscopic inguinal herniotomy by closure of the hernial defect by intracorporeal purse-string suture ligation of the peritoneum with just disconnection of the sac.

Results: Testes size in **Group (A)** pre-operative was mean 238.58 (SD 133.507) mm² and it was increased to be postoperative with a mean value of 256.33 (SD 127.278) mm², while in **Group (B)** pre-operative mean 117.07 (SD 33.878) mm² and it was increased to be postoperative with a mean value of 214.31 (SD 229.928) mm². Preoperative data showed statistically significant variations between groups. Patients outcome in **Group (A)** show that 1 (7.7%) had scrotal hematoma, 1 (7.7%) had scrotal edema and 1 (7.7%) had wound infection, while in **Group (B)** 1 (9.1%) had scrotal edema, 1 (9.1%) had wound infection and 1 (9.1%) had recurrence.

Conclusion: Laparoscopic closure of the internal inguinal ring in pediatric inguinal hernia with excision of the sac and closure after just disconnection of the sac have similar effect on pediatric laparoscopic inguinal herniotomy.

Keywords: Laparoscopic Pediatric Inguinal Hernia, Excision, Hernial sac.

INTRODUCTION

One of the most common children diseases, the incidence of pediatric inguinal hernia (PIH) is between 0.8% and 4.4%. Having the processus vaginalis not properly close is the most common cause of this inguinoscrotal malformation. All children diagnosed with an inguinal hernia should undergo surgical repair to avoid confinement and significant complications such intestinal necrosis and testicular/ovarian dysfunction or mortification⁽¹⁾.

Any case of inguinal hernia requires surgical repair. Traditional treatment involves an open incision called a herniotomy (OH). Although Laparoscopic herniotomy (LH) has been around for over two decades, there is still some disagreement over whether or not it is the preferred method of inguinal hernia repair. An intraperitoneal (IP) technique was initially described, together with partial sac incision and a periorificial purse-string suture at the internal inguinal ring (IIR). Subsequently, effective extraperitoneal (EP) methods were developed to eliminate the requirement for intracorporeal knot tying⁽²⁾.

One of the main benefits of laparoscopy is that it provides unparalleled visibility, allowing for bilateral exploration of the inguinal canal using the same small trocar incisions and without making any additional incisions. Parents of kids with inguinal hernias were persuaded in large part by the lowered chance of cord injury, decreased postoperative pain, faster recovery, and improved cosmesis offered by this method⁽³⁾. When compared to the standard herniotomy, laparoscopic methods still differ in that the Sac must be transected

and partially excised. The hernial sac is divided and the upper part is sutured. An intra-corporeal laparoscopic approach with the IIR is a simulation of an open herniotomy⁽⁴⁾.

An alternative to open herniotomy is the laparoscopic transection and intracorporeal closure of the hernia sac has been shown to be both safe and successful⁽⁵⁾. The aim of the current study is to compare the outcome of laparoscopic inguinal herniotomy with excision of the hernial sac with laparoscopic inguinal herniotomy with just disconnection of the sac.

PATIENTS AND METHODS

A randomized controlled clinical trial was conducted at Pediatric Surgery Department at Zagazig University Hospital, on 24 patients who had inguinal hernia.

Inclusion criteria: Congenital inguinal hernia patients, age group between 2 years old and 14 years old, and recurrent inguinal hernia.

Exclusion criteria: Patients with major cardiac anomalies, ascites, hernia with undescended testicles, previous major lower abdominal surgery, parental refusal, and contraindications for laparoscopy.

All cases were divided into two groups:

Group A: Laparoscopic inguinal herniotomy by closure of the hernial defect by intra-corporeal purse-string suture ligation of the peritoneum with excision of the hernial sac.

Group B: Laparoscopic inguinal herniotomy by closure of the hernial defect by intra-corporeal purse-string suture ligation of the peritoneum with just Disconnection of the sac.

All patients have gone through:

A. History taking: Guardians of each patient had a thorough clinical history taken, with an emphasis on their current symptoms.

B. Clinical Examination: Every patient had a full physical, including a thorough general and local examination.

C. Laboratory investigations: Full blood count, coagulation profile, liver and kidney functions, fasting blood sugar, and a viral screen.

D. Imaging studies: An ultrasound of the abdomen, an ultrasound of both scrotums, and a Doppler ultrasound of both testicles. After surgery, both groups were monitored closely for a full two months so that differences could be seen.

Operative procedure:

After the patient had been given general anesthesia and laid in the supine position on the operating table, the usual scrub of the entire abdominal wall from the nipple line to the mid-thighs was performed. A urinary catheter has been placed. Nasogastric tube of sufficient size was placed for decompressing a bloated stomach. Trendelenburg position was used for the patient, and the table was slanted to face the surgeon (after trocar inserted). The monitor was placed at the patient's feet on the hernia side, while the surgeon stood on the opposite side of the operating table, at the patient's shoulder. Two trocars were placed at the right and left mid clavicular lines at the level of the umbilicus to create a 5-mm/10-mm trans-umbilical port with 5-mm/10-mm optics and 0°/30°. To achieve optimal triangular wasation, the functioning port on the hernia side may be slightly elevated while the opposite side is lowered. The infusion ports in newborns and infants were positioned just above the umbilical cord. Children aged 2 to 6 were insufflated with 10 mm Hg CO₂ at a 1 L/min infusion rate; patients aged 6 and up received 12 mm Hg CO₂.

The inguinal region and its critical anatomical markers, including the umbilical ligament, the epigastric arteries, the triangle of death, and the triangle of pain, were initially located using exploratory laparoscopy. In the event of a non-reducible hernia, the assistant used external manual pressure to gently diminish the hernia content in laparoscopy, and the freed organs were checked for ecchymosis and peristalsis at the procedure's conclusion.

In **Group A:** Sac separation from the peritoneum required an incision at the internal peritoneal ring. After dividing the peritoneum behind the internal ring, the anterior dissection was carried out with the vas and arteries being swept away in plain view. Veins and arteries were carefully avoided.

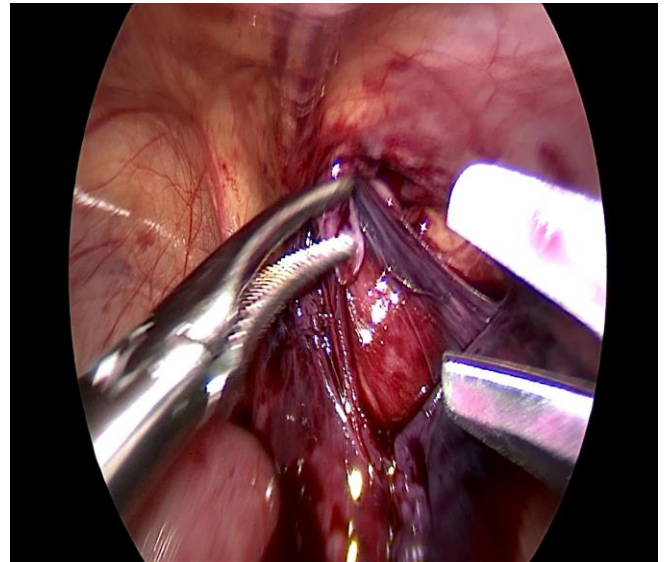


Figure (1): Separation of the hernia sac from peritoneum.

After peritoneal dissection, the hernial sac was removed. A 3-0 polyglycolic acid needle with a round body is then utilised to seal the peritoneal defect. A deep ring suture, either a purse string or a Z-suture, is taken after a needle has been introduced trans-abdominally. The needle was held reasonably still while the peritoneal defect was being closed, and the dissector was used to feed small pieces of peritoneum onto the needle. All of the trocars and the needle were taken out once the suturing was finished. After deflation of the abdomen, a polyglycolic acid 3-0 incision was closed supra-umbilically. The steri-strips were used to create approximations for three mm trocar locations.

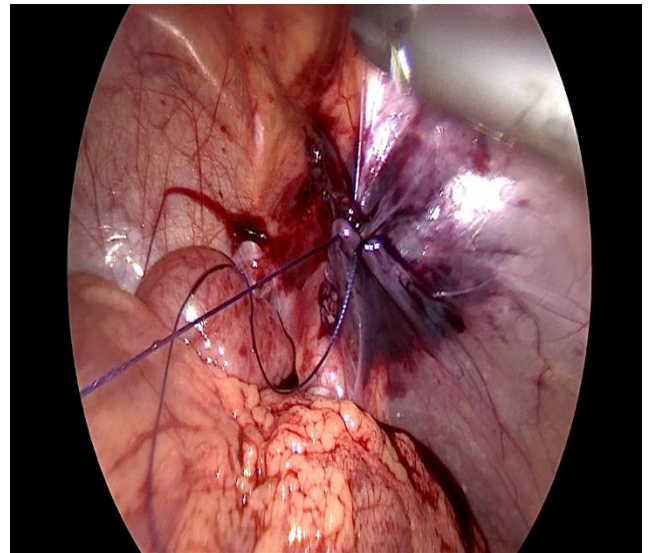


Figure (2): Surgical closure of the deep inguinal ring with a purse-string suture.

In **Group B:** The sac and peritoneum were separated through an incision made in the peritoneum's internal ring. Before beginning the anterior dissection, the vas and arteries were removed under direct visualisation, and the peritoneum posterior to the internal ring was separated. In particular, they focused on the cardiovascular system. To prevent sac excision, a 3-0 polyglycolic acid on round body needle is used to close

the peritoneal defect. A deep ring suture, also known as a purse string suture, is taken after a transabdominal needle incision. Needle is held reasonably motionless as the dissector feeds tiny pieces of peritoneum onto it to seal the peritoneal defect. All of the trocars and the needle were taken out once the suturing was finished. After deflation of the abdomen, a polyglycolic acid 3-0 incision was closed supra-umbilically. The steri-strips were used to create makeshift trocar sites at around 3 mm.

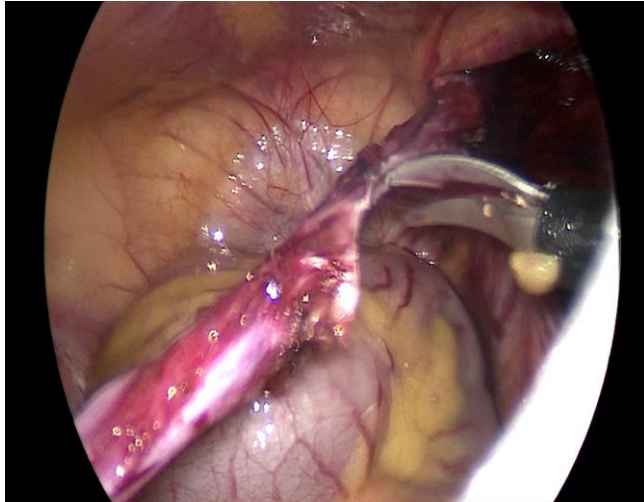


Figure (3): Dissection of the hernial sac from peritoneum.

D. Postoperative management and follow up: Patients were sent home the day of or the day following their procedures, with the all-clear to resume normal activities. Analgesics were given after surgery for the first two days. Doppler U/S of both testes were taken on the second postoperative day and again two weeks later to compare pre- and post-operative measurements of testicular size and vascularity. Follow-up parameters: All patients were contacted again at the designated one-week, two-week, one-month, two-month, and beyond intervals using a standardised telephone script by the paediatric surgery outpatient clinic. The patients were urged to contact us at the first sign of anything out of the ordinary.

Ethical Consideration:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Zagazig University (IRB number #9601/19-6-2022). Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis:

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher's exact test were used for

comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and Student's t-test/Mann-Whitney U test was used for comparison between groups. P value ≤ 0.05 was considered to be statistically significant.

RESULTS

When comparing the two studied groups regarding the age, gender and sites of hernia, there were no statistically significant differences (**Table 1**).

Table (1): Characters of patient's age, gender, and patient's site of the studied groups.

Age	Group (A) (n = 13)	Group (B) (n = 11)	t-test	P-value
Min. - Max.	2-13	2-12	0.270	0.789
Mean ± S.D	6.46 ± 3.711	6.06 ± 3.447		
Gender				
Male	8 (61.5%)	9 (61.5%)	81.8	0.386
Female	5 (38.5%)	2 (38.5%)	18.2	
Total	13 (100%)	11 (100%)	100	
Site				
Left	1 (7.7%)	2 (18%)	18.2	0.497
Right	11 (84.6%)	7 (64%)	63.6	
Bilateral	1 (7.7%)	2 (18%)	18.2	
Total	13 (100%)	11 (100%)	100	

Preoperative data showed statistically significant difference between the two studied groups, regarding testes size (**Table 2**).

Table (2): Comparing testes size among studied groups.

Testes Size (mm ²)	Group (A) (n = 13)	Group (B) (n = 11)	U test	P-value
Pre-operative				
Min. - Max.	147.42 - 461.7	94.25 - 174.84	3.50	0.023*
Mean \pm SD	238.58 \pm 133.507	117.07 \pm 33.878		
Post-operative				
Min. - Max.	152 - 461.7	94.5 - 680	10.0	0.116
Mean \pm SD	256.33 \pm 127.278	214.31 \pm 229.928		

No statistical significant differences between the two studied groups, regarding pre-operative and postoperative resistant indexes (**Table 3**).

Table (3): Comparing patient's RI (resistant index) among the studied groups.

RI (resistant index)	Group (A) (n = 13)	Group (B) (n = 11)	U test	P Value
Pre-operative				
Min. - Max.	0.55 - 0.75	0.45 - 0.78	8.000	0.392
Mean \pm S.D	0.62 \pm 0.078	0.58 \pm 0.144		
Post-operative				
Min. - Max.	0.5 - 0.72	0.51 - 0.9	13.000	0.250
Mean \pm S.D	0.59 \pm 0.077	0.67 \pm 0.142		

No statistically significant differences were found between the two studied groups, regarding peak systolic volume (Table 4).

Table (4): Comparing patient's peak systolic volume of the studied groups.

Peak systolic volume	Group (A) (n = 13)	Group (B) (n = 11)	U test	P-value
Pre-operative				
Min. - Max.	2.8 - 7.3	2.7 - 7.6	5.500	0.858
Mean ± SD	4.7 ± 2.223	4.4 ± 2.773		
Post-operative				
Min. - Max.	2.8 - 5.2	2.6 - 7.6	7.000	0.599
Mean ± SD	3.6 ± 0.961	4.33 ± 2.831		

Table 5 shows no significant differences between the two studied groups, regarding the outcomes.

Table (5): Comparing patient's outcome of the studied groups.

Outcome	Group (A) (n = 13)		Group (B) (n = 11)		P-value
	No.	%	No.	%	
Scrotal hematoma	1	7.7	1	9.1	1.000
Hydrocele	0	0	0	0	----
Scrotal edema	1	7.7	2	18.2	0.576
Wound infection	1	7.7	1	9.1	1.000
Emphysema	0	0	0	0	----
Port site hernia	0	0	0	0	-----
Testicular atrophy	0	0	0	0	-----
Recurrence	0	0	1	9.1	0.458

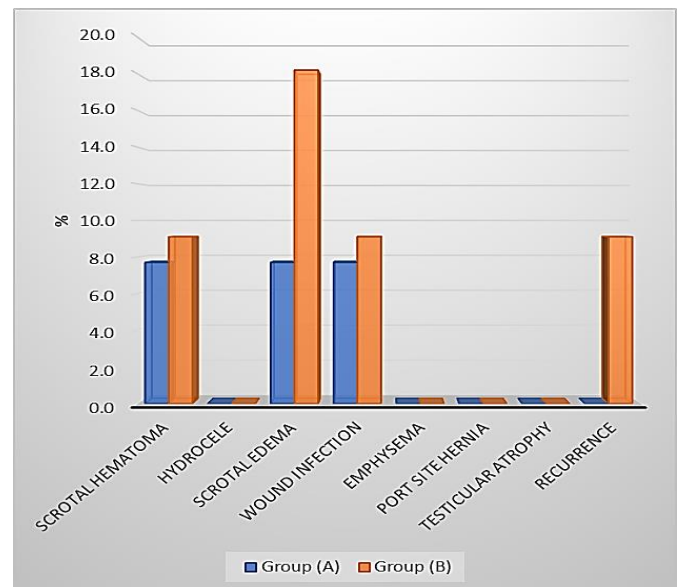


Figure (4): Patient's outcome among studied groups.

DISCUSSION

Inguinal hernia repair (IHR) surgery has been transformed by the introduction of laparoscopic techniques. In recent years, laparoscopic correction of children's hernias has become a common alternative to open surgery ⁽⁶⁾.

A favorable cosmetic result is the primary focus of the many procedures that have been developed for a simpler, safe, and low recurrence rate operation, suture closure of the neck of the hernia sac at the deep ring with or without its transection; periperitoneal stitching; purse-string suture; and intracorporeal versus extracorporeal suturing; are only few of the procedures documented for repairing a hernia ⁽⁷⁾.

As regard demographic data; mean Age in **Group A** was years while in **Group B** was 6.06 (SD 3.447) years with no significant difference between groups. Gender in **Group A** show that 8 (61.5%) were male and 5 (38.5%) were female while in **Group B** 9 (81.8%) were male and 2 (18.2%) were female with no significant difference between groups.

This was in line with **Abd-Alrazek et al.** ⁽⁸⁾ findings, 157 hernia problems were found in a sample of 132 male kids from the Pediatric Surgery Department at Al-Azhar University Hospitals in Cairo, Egypt. **Group I** consisted of 66 patients with 77 hernia defects and **Group II** consisted of 66 patients with 80 hernia defects, for a total of 132 male patients. Each patient was randomly assigned to either **Group I** (n=66) where the hernia sac was left untied with an intracorporeal purse string suture ligation at the internal inguinal ring [IIR] or **Group II** (n=66) where the hernia sac was cut open with an intracorporeal suture of the proximal part at the IIR. No statistically significant variations in age were found.

The present study showed that site of inguinal hernia in **Group A** show that 1 (7.7%) were left, 11 (84.6%) were right and 1 (7.7%) were bilateral while in **Group B** 2 (18.2%) were left, 7 (63.6%) were right and

2 (18.2%) were bilateral with no significant difference between groups.

Our results were supported by study of **Elbatarny et al.** ⁽⁹⁾ as Laparoscopic hernia sac disconnection was performed on **Group A**, while laparoscopic hernia sac disconnection with peritoneal closure was performed on **Group B**. Twenty-three (67.7%) cases were right-sided clinical hernias, and preoperative U/S examination found a latent left (subclinical) hernia in 5 cases; conversely, 11 (32.4%) cases were left-sided clinical hernias, and U/S examination found a latent left (subclinical) hernia in 1 case. As far as could be determined, there were no discernible differences between the groups. Similarly, **Abd-Alrazek et al.** ⁽⁸⁾ shown that right inguinal hernias were more common than left ones, with no discernible differences between the groups.

In our study testes Size in **Group A** pre-operative was ranged between 147.42 - 461.70 mm² with mean 238.58 (SD 133.507) mm² and it was increased to be postoperative with a mean value of 256.33 (SD 127.278) mm² while in **Group B** pre-operative was ranged between 94.25 - 174.84 mm² with mean 117.07 (SD 33.878) mm² and it was increased to be postoperative with a mean value of 214.31 (SD 229.928) mm² with statistically significant difference between groups.

However, in the study of **Elbatarny et al.** ⁽⁹⁾, for every preoperative metric studied, there was no discernible difference between the two groups.

Laparoscopic repair of inguinal hernias in children has the benefit that the outer anterior abdominal wall can be left uninjured because the hernia is approached from the place of origin. Growing evidence of the laparoscopic method's potential, safety, and effectiveness has contributed to its meteoric rise in popularity. Laparoscopic methods such as the Z-type suture, the W-type suture, flip-flap procedures, subcutaneous endoscopically aided ligation of IIR, etc. have all been developed over the past two decades. Intracorporeal suturing of the IIR through three ports is the most common and time-tested laparoscopic procedure ⁽¹⁰⁾.

Our results showed that Patients outcome in **Group A** show that 1 (7.7%) had scrotal hematoma, 1 (7.7%) had scrotal edema and 1 (7.7%) had wound infection while in **Group B** 1 (9.1%) had Scrotal edema, 1 (9.1%) had wound infection and 1 (9.1%) had recurrence with no significant difference between groups.

Shalaby et al. ⁽¹¹⁾ reported that 4% of their patients who acquired scrotal hydrocele had non-surgical conservative treatment. In the study of **Tam et al.** ⁽¹²⁾ 1% of patients experienced postoperative hydrocele, which was managed medically instead of surgically. **Lee et al.** ⁽¹³⁾ stated that treatment of children inguinal hernias by laparoscopic purse-string suture of the internal inguinal opening of the hernia sac has shown to be a safe, effective, and reliable approach. Moreover,

Mohammad et al. ⁽¹⁴⁾ demonstrated that patients could drink fluids orally 2 to 3 hours following surgery. Everyone got a 15mg/kg/dose dosage of paracetamol intravenously. Three (15%) of the occurrences were repeats. All cases of recurrence had an internal ring diameter more than 10mm and occurred on the right side. In 2 cases, the recurrence arose within the first 24 hours following surgery, and in 1 case, it appeared 1 week after surgery. Two of the patients experienced an early recurrence, and surgical repair with peritoneal closure was performed the following day. The patient who presented after a week required open surgery for repair. Three (15%) patients experienced a transient scrotal edema. After 2 to 4 days of conservative care, it went away on its own. Neither a hernia at the port site nor an infection of the wound occurred.

The present study has some limitations. The limited sample size is the primary caveat of this research. This study only looked at one location and followed participants for a short amount of time. A larger sample size from more institutions is required to confirm that hernias can be safely disconnected using IRD alone.

CONCLUSION

Laparoscopic closure of the internal inguinal ring in pediatric inguinal hernia with excision of the sac and closure after just disconnection of the sac have similar effect on pediatric laparoscopic inguinal herniotomy.

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Competing interests: Nil.

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