



Evaluation of One Trocar Needlescopic Assisted Peritoneal Disconnection and Closure in Pediatric Inguinal Hernia Repair

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Pediatric inguinal hernia is a common congenital anomaly, and herniotomy is the most commonly used method for treatment, including traditional open high ligation or laparoscopic approach.

Aim: Evaluation of feasibility, efficacy, operative time, cosmetic results, recurrence rate and possible complications of one trocar needlescopic assisted peritoneal disconnection and closure using Mediflex® Disposable Suture Grasper Closure Device, homemade long micro-diathermy probe and epidural needle in treatment of pediatric inguinal hernia.

Patient and methods: A prospective clinical trial included 33 cases with 50 inguinal hernias that was done in the Pediatric surgery unit, General Surgery department, Tanta University Hospitals.

Conclusion: Needlescopic assisted peritoneal disconnection and closure for congenital inguinal hernia is safe, simple, easy, effective, less invasive and more cosmetic way for repair. The procedure does not leave visible scars and doesn't require expensive instruments or advanced laparoscopic suturing skills.

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1. INTRODUCTION

Pediatric inguinal hernia is a common congenital anomaly, among which indirect inguinal hernia is the most common and rarely direct hernia. It mostly presents in the first year of life [1]. Herniotomy is the most commonly used method for treatment, including traditional open high ligation or laparoscopic approach [2,3].

Over the past two decades, laparoscopy has advanced and multiple techniques for inguinal hernia repair have been established.

Various methods of laparoscopic repair have been described with the basic principles to close the peritoneum of internal inguinal ring either by intracorporeal or by extracorporeal suturing with or without disconnection of the peritoneal sac. These laparoscopic studies have reported changing from 5mm to 2mm ports, and subsequently to a single-incision technique [4,5].

2. METHODOLOGY

A prospective clinical trial that was done in the Pediatric surgery unit, General Surgery department, Tanta University Hospitals. The study included a total of 50 pediatric inguinal hernias in 33 patients treated during the period from June 2019 to June 2020.

Inclusion criteria:

All children presented with pediatric inguinal hernia under 12 years old.

Exclusion criteria:

- 1-Complicated hernia.
- 2- Recurrent hernia.
- 3-Previous open lower abdominal surgery.
- 4-Internal inguinal ring (IIR) defect > 2 CM.
- 5-Age < 6 months.
- 6-Undescended testes with clinically diagnosed hernia.
- 7-Major anomalies that may affect the outcome.

Patient and methods:

- After Full history taking, routine lab investigation (CBC, PT, PTT). All patients received one dose of preoperative prophylactic antibiotic.

- **Instruments used:** Venous access cannula (VAC) #14 or #16, Epidural needle (EN), Mediflex® tissue grasper and suture closure device (MCD). Hand-made long diathermy probe (LDP).
- **Port sites:** Single trans-umbilical 5mm port was used for 30° telescope.
- **Procedure:** Anesthesia: *General anesthesia with endotracheal intubation. O.R Layout: * Patient was at the upper right end of the table with the surgeon to the Rt side of the patient, the scrub nurse to his right and the camera man at the head of the child. Patient's position: Supine position.



Fig. 1. Instruments used in our technique

Steps: Injection of local anesthesia at trocar site (Lidocaine 3-4.5 mg/kg per dose) to decrease post-operative pain.

* Vertical 5-mm trans-umbilical skin incision was created within the umbilical cicatrix and a 5 mm trocar was inserted into the abdomen using open technique.

* A 30-degree 5 mm telescope was used.

* Pneumoperitoneum was established, and insufflation pressure was between 8 and 12mm Hg with gas flow rate 1.5-6 L/min.

* First Step was laparoscopic exploration of the abdomen and pelvis with evaluation of both internal inguinal rings (IIR).

* Insertion of VAC (#14 or 16 gauge) which was used as a mini-port for insertion of LDP connected to open diathermy handle insulated from anterior abdominal wall by the sheath of the cannula for disconnection of peritoneal sac after dissecting away the important structures.

* In all cases, MCD acted as a left-hand working instrument for catching the peritoneal leaflets or the threads while VAC acted as a miniport for right hand working instrument.



Fig. 2. Operative photo showing LDP and MCD in place in a case of bilateral inguinal hernia (operating on the right side)

*Disconnection was done by handmade probe in the right hand using monopolar low voltage cutting current on **LDP** and **MCD** in the left hand for grasping the peritoneum applying some tension. Disconnection started from the medial side in the left sided hernia and from the lateral side on the right sided hernia.

*In males, blunt separation of vas deference and vessels was done using traction and counter traction forces by the **LDP** and **MCD** holding peritoneal leaflets.

*While in females, disconnection of round ligament was done.

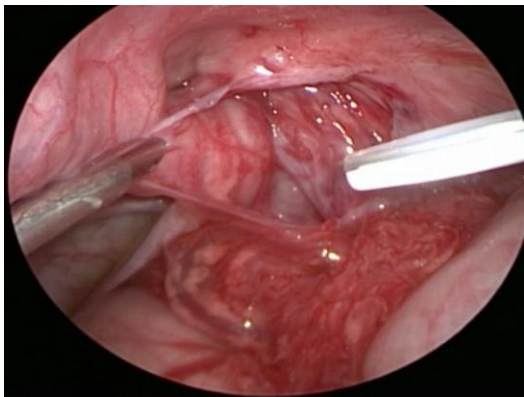


Fig. 3. Dissection of the hernial sac and identification of the vas deferens

*Peritoneal closure was performed by a curved epidural needle (18 guage) passing through the same puncture of **VAC** making peritoneal bites passing through the lower edge of the

disconnected peritoneum then 2/0 polypropylene suture line is passed through the EN till it appears intra-peritoneally then the suture line is brought outside the peritoneal cavity by the **MCD** in the left hand.

EN is then withdrawn outwards and passed again through the upper leaflet to complete a purse string around **IIR** using a 2/0 polypropylene suture and then the second limb of the thread is withdrawn outside by **MCD** again.

*We then inert MCD through the same puncture of VAC to withdraw both limbs of the suture line and a French sliding knot was made to close the purse string suture extracorporeally and secured with two single instrument knots (**Shalaby-Ismail Kont**) [5].

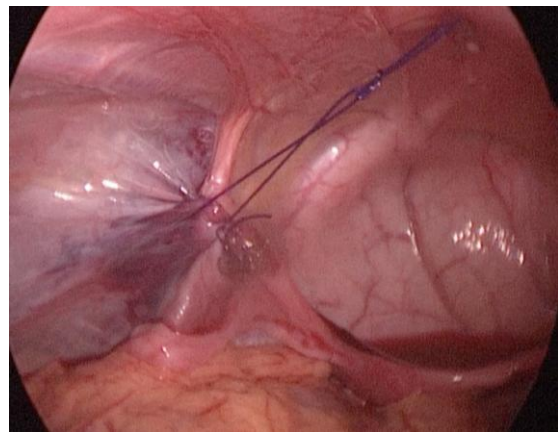


Fig. 4. Showing French Sliding Knot applied to close the purse string around the IIR

* The abdomen was deflated, the umbilical port was removed, and the umbilical fascia was closed with an absorbable suture (2/0 or 3/0 polyglactin).

*Needle punctures was closed by steri-strips only.

3. RESULTS

We achieved 100% success rate using a novel needlescopic technique in which we managed to accomplish an exact replica of the open technique by doing **complete disconnection of the hernial sac, closure of the peritoneal defect**, while others performed only disconnection and others did only ligation of the sac.

The age of the patients ranged from 6 months to 12 years old with mean of 3.893. We had slight male predominance with 19 males (58%) and 14

females (42%). We elected our cases to be older than 6 months as the peritoneum in younger children is thin and fragile for using 18-G epidural needle.

The operative time for unilateral hernias ranged from 22-29 mins, and ranged from 35-47 mins for bilateral hernias. Only one case with umbilical hernia the operative time of the laparoscopic part was 38 minutes and the time consumed for repair of the umbilical hernia was excluded from the study.

The patient started oral clear fluids or lactation after two hours, and they were discharged from the hospital on the evening of the same day.

The study included 50 hernias in a total of 33 cases. 51.51% of the cases were bilateral and also it was more common on the right side.

One case was diagnosed as bilateral by ultrasound proven to be unilateral during laparoscopy. Another was diagnosed as rt sided unilateral hernia clinically and turned out to be bilateral by laparoscopy.

Follow up:

Our follow up of cases ranged from 6 months to 1 year with a mean of 9 months.

In a total of 33 cases, there were no major complications in any case. In only two cases there was some minor bleeding which was controlled by external compression and irrigation done by cannula and aspirated by Verres needle. There was no conversion to conventional laparoscopic repair in any case, as all cases were fully managed and completed using needles only.

Table 1. Age and sex of patient ratio

Item	Value
Age of the patient (years)	(Range) 0.5 – 12Year
Sex of the patient	Mean ±SD (3,893± 3.16)
	Female (N:14) 42%
	Male (N:19) 58%
Operative time (Minutes)	Range
Unilateral	22-29
Bilateral	35-47
	Mean ± SD
	25 ± 1.802
	39.58 ± 3.614
Postoperative feeding (Hours)	2-4
Hospital stay (Hours)	4-6

Regarding the side of the hernia :

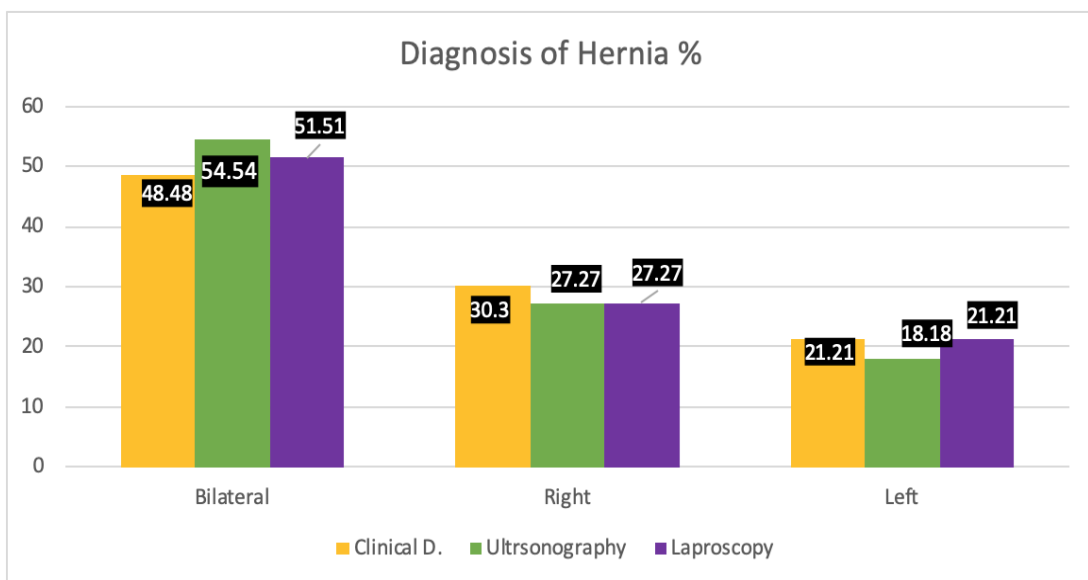


Fig. 5. Classification of side of hernia (clinical, ultrasonography, laparoscopic)

Table 2. As regards complications

Complication	N. of cases	Percentage %
No complications	31	94
Vascular injury	0	0
Injury to the vas deferens	0	0
Conversion	0	0
Minimal bleeding	2	6

Cosmetic results: We subjectively assessed parent's satisfaction of the postoperative cosmetic results and scar appearance.

It was excellent in 31 cases (93.93%), and very good in only 2 cases as they noticed a slight change in the shape of the umbilicus.



Fig. 6. Postoperative photo after 1 year of follow up of another case with left sided inguinal hernia (almost invisible scars)

4. DISCUSSION

In our study, we achieved 100% success rate in repairing the inguinal hernia using these updated multiuser instrument (Mediflex) with no obvious complications and without any recurrence. There was a great challenge in this study due to the wide diameter of the internal inguinal ring and the small size of the abdomen in some cases so the difficulty of intracorporeal suturing in this narrow abdominal space. Also, there was an extra advantage as repairing any associated conditions as the umbilical hernia.

When we compared our results to others, there were some similarities and differences. According to the age of the cases, in our study the cases ranged from 6 months to 12 years old (the mean was (3,9). F. Schier [6] described his initial experience in the laparoscopic surgery of inguinal hernias repair in 129 children. The age

ranged from 3 weeks to 13 years (average, 3.5 years; median, 3.5 years). In Shalaby R and Desoky A in [7] the age of their youngest patient was 6 months and the oldest aged 8 years (mean 61.56 months). In Shehata et al., [8] (6m – 15y) and Tsai Y et al., 2015 (9m – 11y) [9].

Others included younger children in their study starting from 1 month old or even younger. This was the case in the studies conducted by Patkowski et al. [10] (28d-14.5y) with mean age of 3.4 years, F. Schier 2000 [6] (3 wk- 13y), Muensterer J and Georgeson K [11] (1m-106m), Kim and Thomas Hui [12], (1-180 m), Novotny M et al., [13] (1m- 16y), García-Hernández et al., [14] (1m -15y), and Elbatarny A et al., [15] (1m-23m).

According to the gender of the patients, we had male predominance in our study (19 males, 14 females), almost as every other study which

concludes that our novel procedure is suitable for both sexes. According to the bilaterality of the hernias, the majority of the cases had bilateral hernias (17 bilat 51.51%, 9 Rt 27.27%, 7 Lt 21.21%). While in Shalaby R and Desoky A [7], the group of patients in this study was large, eighty-one (54%) presented with a right-sided IH, left-sided hernia was present in 30 (20%), bilateral in 19 (12.66%), recurrent in 15 (10%), and incarcerated in 5 (3.33%).

The mean operative time in our study was 25 minutes for the unilateral cases and 39.58 minutes for bilateral ones. Shalaby R and Desoky A [7], the mean duration of surgery was (20.6 ± 4.65 min) for unilateral and (26.4 ± 1.6 min) for bilateral and incarcerated unilateral hernia. Prasad et al, [16] reported that the time needed for the procedure ranged from 23 minutes for unilateral cases and 46 for the bilateral ones. These numbers are comparable to the time consumed in open hernia repair. As Regards to the hospital stay, those in favor of the open repair claimed that laparoscopic surgeries required overnight stay. In contrary, in our study the hospital stay was 4-6 hours (Mean 4.49) and all cases were discharged from the hospital after tolerating oral feeding on the same day. Also, Shalaby R and Desoky A [7], the mean hospital stay was eight hours. While in Tatekawa Y [17] and Tsai Y et al [9], all patients were discharged from the hospital within 24 hours postoperatively. While In Elbatarny A. et al, [15]. They elected to discharge all patients in the morning of the next day.

In our study, we reported zero recurrence among all patients during a mean follow up period of 9 months (6-12months). There was no remote postoperative complications, or any delayed recurrence recorded. Also, In Prasad et al. [16]., there was no complication or recurrence in their study. Harrison et al. [18], they had a major drawback in their technique as they jumped over the vas and vessels to avoid their injury which left a gap that contributed in recurrence which was 4.3%. Patkowski et al, [10] recorded four cases with postoperative complications, one boy with operated on for a direct inguinal hernia developed ileus with bowel strangulation 3 months postoperatively and there were 3 hernia recurrences (2.83%) noted in boys within 2 and 4 months post-operatively, one of them was re-operated. In 5 boys transient hydroceles were observed that disappeared spontaneously after 3 to 5 months. Shalaby R et al. [19] all cases were completed laparoscopically without major

intraoperative complications. No recurrence was detected in their study. But hydrocele occurred in five males (2.16%), without testicular atrophy or iatrogenic ascent of the testis.

Elbatarny A et al., [15] there was no conversion of any case and no intraoperative complications but they reported recurrences in some cases. Three recurrences occurred in group A (dissection only group) (15% of hernias/20% of cases) with no recurrences in group B (disconnection and closure. All 3 recurrences occurred in hernias with an internal ring diameter (IRD) >10 mm.

5. CONCLUSION

Needlescopic assisted peritoneal disconnection and closure for CIH repair is safe, simple, effective, less invasive and more cosmetic approach with no recurrence.

The procedure does not leave visible scars and doesn't require expensive instruments or advanced laparoscopic suturing skills.

We believe that this technique has a great potential to become a popular alternative for hernia repair in children.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical committee approval of Tanta University Hospital was obtained No. 3315/05/19 An informed agreement has been attained from all cases in this research.

All private data about the cases like names, addresses or phone numbers kept secret in this work. (Any surprising risks faced throughout the course of work were cleared to contributors and the ethical committee promptly.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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