Original Article	
	

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Title	**Use of the Intramural Trocar and Reverdin Needle in Laparoscopic Treatment of Inguinal Hernia in Children: A Technical Adaptation in a Country with Limited Resources (Preliminary Study)**
Authors	Madawase Mboup[1], Birame Ndiaye[1], Daniel Yonga[2], Florent Tshibwid A Zeng[3], Doudou Gueye[4] Mbaye Fall[5]
Affiliation	[1]Department of Surgery, Hospital Principal of Dakar, Teaching Military Hospital, Dakar, Senegal [2]Department of Pediatric Surgery, Regional Hospital Center of Thiès, Thiès, Senegal [3]Department of Surgery, Faculty of Medicine, Université de Lubumbashi, Lubumbashi, Democratic Republic of the Congo [4]Département of Pediatric surgery, Albert Royer National Children's Hospital Center, Dakar, Senegal [5]Department of Pediatric Surgery, Aristide Le Dantec University Teaching Hospital, Dakar, Senegal

ABSTRACT

Introduction

We report our initial experience with the laparoscopic management of pediatric inguinal hernias in a resource-limited setting.

Methods

A series of eight patients (seven boys and one girl) was prospectively studied between June and August 2023. FLEP of the inguinal canal was performed using a 12G intramural trocar and a Reverdin needle under visual control. Suturing was done with 2/0 or 3/0 Prolene. Data collected included age, sex, hernia diameter, operation duration, recurrence rates, and postoperative complications.

Results

The mean age was 4.5 years (range: 3–12 years), with a male-to-female ratio of 7:1. Six hernias were right-sided, and two were left-sided. The diameter of the hernia ranged from 0.5 cm to 2 cm. The average operating time was 35 minutes (range: 20–45 minutes). All patients were discharged within 24 hours, and the average follow-up duration was six months (range: 3–9 months). One case of postoperative hydrocele was observed, which resolved spontaneously. No infections, recurrences, or persistent pain at the ligation site were reported.

Conclusion

This preliminary study demonstrates that percutaneous laparoscopic closure of the peritoneovaginal canal is feasible and safe in resource-limited settings. Larger studies are needed to confirm its generalizability.

Keywords: Inguinal hernia, patent vaginal process (PVP), laparoscopy, resource-limited settings

PVP : patent vaginal process

PIRS : percutaneous internal ring suturing (PIRS)

IH : inguinal hernia

M : male

F : female

MIH : metachronus inguinal hernia

INTRODUCTION

Inguinal hernia (IH) is a common pediatric condition caused by the patent processus vaginalis. (PVP). Complications such as incarceration may lead to intestinal and gonadal necrosis, necessitating emergency surgery. Traditionally, inguinal hernias are repaired through open surgery. However, this approach carries risks, including potential injury to the vas deferens and spermatic vessels.

Laparoscopy has emerged as a viable alternative, offering comprehensive cavity exploration and contralateral side assessment. Various techniques have been developed, including percutaneous laparoscopic closure of the internal ring. This study describes a modified laparoscopic technique using an intramural trocar and a Reverdin needle in a resource-limited setting, aiming to evaluate its feasibility and safety. This is a modification of the PIRS technique described by Darius Patkowski in 2006. [1]

MATERIALS AND METHODS

1. Patients and Study Design

We conducted a prospective, descriptive study at the Pediatric Surgery Unit of hôpital principal of Dakar, between July 1, 2023, and September 30, 2023. The inclusion criteria encompassed children under 16 years who underwent the described laparoscopic technique with a follow-up period of at least six months. Informed consent was obtained from the parents, and the study was approved by the institutional ethics committee.

2. Data Collection

Patient data were collected prospectively, including age, sex, hernia location, associated conditions, hernia diameter(we used the scope to estimate the diameter of the internal hernia orifice) operative details, and postoperative outcomes (hematoma, testis atrophia, recurrence, hydrocele and infection). Data were recorded in Excel and analyzed using R software (version 3.4.1).

3. Surgical Technique

The equipment included a laparoscopic column, a 30° laparoscope Storz, 5 or 10 mm trocar, a Reverdin needle, a 14G or 16G intramural trocar, and 2/0 Prolene sutures(figure 1).

Figure 1 : Required Equipment for Performing the Surgical Procedure

Under general anesthesia, the patient was placed supine. A slight contralateral tilt of the operating table will be applied. The bladder is emptied by voiding before surgery, by manual pressure under general anesthesia, or by placing a urinary catheter, which should be removed at the end of the procedure.

The surgical monitor was positioned at the patient's feet. The abdomen was accessed using Hasson's open technique through a 1 cm umbilical incision. Pneumoperitoneum was achieved with pressures regulated between 6 and 12 mmHg based on the patient's age and weight(figure 2).

Figure 2: Umbilical single-port access with 30-degree optic

The trocar was introduced for cavity inspection, including evaluation of the contralateral internal ring (figure 3). Adhesions, if present, were managed using a secondary trocar. This second trocar was placed in the right iliac fossa for left hernia.

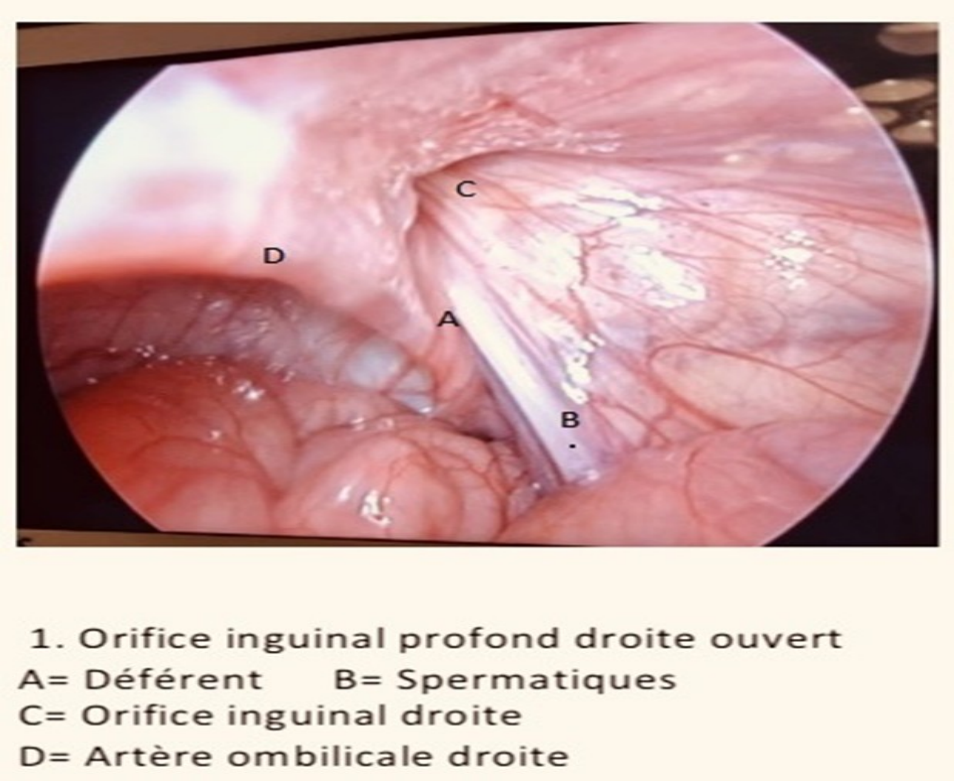

Figure 3 : Laparoscopic view of the right deep inguinal ring showing a patent processus vaginalis

The suture thread was passed through the trocar of the intramural forming a loop. The intranule trocar was inserted via a puncture in the inguinal region into the preperitoneal space under laparoscopic guidance. The intranule trocar was advanced extraperitoneally along the medial aspect of the internal inguinal ring until it crossed the spermatic vessels and the vas deferens and perforated the peritoneum. The "hydrodissection" approach using saline solution could be employed to lift the peritoneum when it was difficult to separate the spermatic vessels and the vas deferens from the peritoneum, thereby minimising damage to the vessels and the duct. The loop of the suture thread was pushed into the intraperitoneal space. The intranule trocar was then slowly withdrawn along its initial path, leaving the suture loop in place(figure 4).

The Reverdin needle was inserted via a puncture at the entry point of the intramural trocar. It was advanced extraperitoneally along the lateral aspect of the internal ring until its tip perforated the peritoneum and its hook became visible, ready to retrieve the suture loop. Once the loop was securely placed in the needle's hook, it was closed, and the needle was carefully withdrawn along its original path. The suture loop was then divided into two parts. After the gas was expelled from the hernia sac, the two ends of the suture were tied extracorporeally, completely closing the hernia sac (Figure 4).

To conclude the surgical procedure, the pneumoperitoneum was released, the trocar was removed, and absorbable 0 sutures were used to close the umbilical incision. The small inguinal incision was left unsutured, and a small dressing was applied. Extreme caution was

exercised throughout the procedure to avoid injuring the inferior epigastric, femoral, and external iliac vessels.

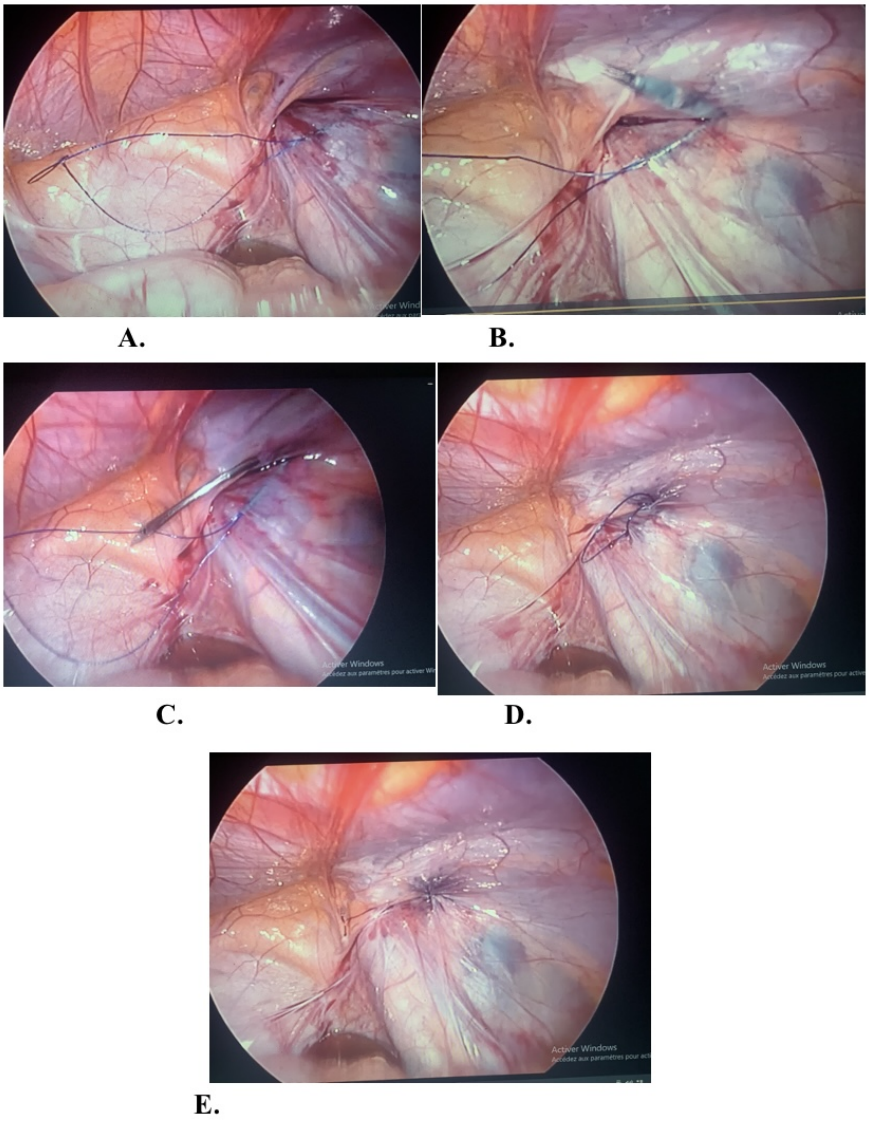

Figure 4 : The different steps of the procedure: A: Placement of the suture in a subperitoneal plane along the medial aspect of the deep inguinal ring. B: The Reverdin needle is inserted along the lateral aspect of the deep inguinal ring. C: The suture loop is hooked with the crochet of the Reverdin needle. D : The suture is withdrawn after closing the needle's hook. E: The two ends of the suture are tied extracorporeally.

RESULTS

Eight patients were included in the study. The mean age was 4.5 years(ranging: 2 - 12 years), with 7 male and 1 female. Six hernias were right-sided, and two were left-sided. Three patients had concurrent umbilical hernias, and two had a history of metachronous inguinal hernia repairs(table I).

Table I: Patient characteristics.

Variables	Age	Sexe	Side	Diagnosis	Associated abnormalities	Contralateral side	Neck diametr(cm)	Follow up
Patient 1	4	M	Right	MIH	None	Closed	1	Simple
Patient 2	3	M	Right	IH	Umbilical hernia	Closed	1.5	Simple
Patient 3	2	M	Left	IH	None	Closed	0.5	Simple
Patient 4	12	M	Right	MIH	None	Closed	2	Simple
Patient 5	5	F	Right	IH	Umbilical hernia	Closed	1	Simple
Patient 6	2	M	Left	IH	Umbilical hernia	Closed	1.5	Simple
Patient 7	3	M	Right	IH	None	Closed	1	Simple
Patient 8	4	M	Right	IH	None	Closed	0.5	Hydrocele

The mean diameter of the hernia was 1.25 cm (range: 0.5–2 cm). In seven cases, only one trocar was required. In one case, a secondary trocar was necessary to manage omental adhesions. The average operative duration was 35 minutes. All patients were discharged within 24 hours.

Postoperatively, one patient developed hydrocele, which resolved spontaneously. No infections, recurrences, or persistent pain were reported during the six-month follow-up period.

DISCUSSION

This is a technical adaptation for a country with limited resources, using resources and tools that are accessible and not at all expensive. It can be reproduced and is a way of improving the learning curve for laparoscopic trainees.

Percutaneous laparoscopic closure of the deep inguinal orifice has been described in the literature by several authors,[1-5]but carrying out this procedure with our instruments is highly original in terms of the equipment used.

Beyond the age of 2 years, the advantages of laparoscopy are obvious as an external oblic aponevrosis opening is often required and locoregional anaesthesia is not recommended.[6]

The advantage of this technique is that there is no inguinal scar, but especially for children with a combination of inguinal and umbilical hernia, the operation can be performed with a single scar instead of two. This combination is very common in sub-Saharan Africa. This justifies the relevance of this technique in our context.

It reduces post-operative pain and shortens the convalescence period, enabling patients to return to school more quickly.

It also offers the possibility of prophylactic closure on the opposite side in the event of persistence, in order to minimise the risk of metachronous inguinal hernia. This reduces the risk of a second anaesthetic for contralateral recurrence. In our series, two patients presented with metachronous inguinal hernia following inguinal repair. Laparoscopy during their first operation would have prevented such a recurrence. However, the need to repair a persistent peritoneovaginal canal discovered during laparoscopy is highly debated.[7,8]

The risk of contralateral recurrence after inguinal repair varies between 10 and 15%.[2,8]

Percutaneous closure of the processus vaginalis can lead to postoperative hydrocele because the distal portion of the canal may remain in place m. One of our patients presented this complication with spontaneous disappearance of the hydrocele without recourse to surgical treatment.

Our study is not without limitations. The main limitations of our study are: the small sample size and the relatively short follow-up period.

CONCLUSION

This study demonstrates the feasibility and safety of a modified laparoscopic technique for inguinal hernia repair in children within resource-limited settings. It holds promise for broader application, particularly in cases of combined inguinal and umbilical hernias and patients at high risk of recurrence. Larger studies are needed to confirm its efficacy and generalizability.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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Editorial Comment - The Concept is original and authors have taken great effort in execution and assessment, for which they deserve appreciation. However passing two large bore needles blindly in a child's inguinal canal appears inherently risky and unnecessary when open herniotomy is a safe and simple option, especially in resource limited settings.

Address for correspondence	Madawase Mboup Department of Pediatric Surgery, Hôpital Principal de Dakar, Dakar, Senegal madawase@gmail.com

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