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To Simplify Pediatric Laparoscopic Herniotomy: A Prospective Comparative Study of Conventional Trocar Cannula Versus Stab Incision Instrumentation in Children

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ABSTRACT

Introduction: Pediatric inguinal hernias are a common surgical problem with laparoscopic repair emerging as a preferred minimally invasive technique. Traditionally, laparoscopy has relied on trocar cannulas for instrument access, but stab incision access without cannulas may reduce operative time, costs, and improve cosmesis

Aim and Objective: This study prospectively compares the feasibility, safety, and outcomes of conventional trocar cannula versus stab incision instrumentation in pediatric laparoscopic herniotomy across 100 cases.

Material and Methods: This was a prospective comparative study carried out in the Department of Pediatrics Surgery for a period of 12 months i.e, September 2024 to September 2025. One hundred children with indirect inguinal hernia underwent laparoscopic herniotomy, with 50 cases performed using the conventional three-port trocar cannula technique (Group A) and 50 using stab incisions for instrument access without cannulas (Group B). Operative time, pain scores, recovery, hospital stay, complications, and cosmetic outcomes were recorded and analyzed. We compared all the complications as outcomes.

Results: In the present study both groups were comparable in age and gender distribution. Operative time was shorter in Group B. Pain scores and complication rates were similar between groups. Group B had superior cosmetic results. Hospital stay and recovery were comparable

Conclusion: Stab incision instrumentation in pediatric laparoscopic herniotomy is a safe and effective alternative to conventional trocar cannula techniques, offering reduced operative time and improved aesthetics without increasing complications.

Keywords*: Laparoscopic herniotomy, stab incision, trocar cannula, pediatric surgery, minimally invasive surgery.*

INTRODUCTION

A hernia is characterized as an anomalous bulging of an organ or tissue through a structural flaw in its enclosing walls. Hernias can arise in several locations across the body, but they most frequently affect the abdominal wall, specifically the inguinal region.

Inguinal hernias (IHs) are common in the paediatric population with a reported incidence ranging from 3 to 5% in term infants and up to 13% in infants born before 33 weeks of gestation [1]. The majority of these are indirect, arising due to failure of the processus vaginalis to close [2]. Due to the risk of incarceration and gonadal infarction, timely surgical repair is essential [3].

Pediatric inguinal hernias are a common surgical problem with laparoscopic repair emerging as a preferred minimally invasive technique. Traditionally, laparoscopy has relied on trocar cannulas for instrument access, but stab incision access without cannulas may reduce operative time, costs, and improve cosmesis [4].

Early surgical intervention is crucial to prevent potential complications such as incarceration and strangulation, which pose risks to gonadal viability . Traditional open inguinal herniotomy remains widely performed but carries inherent disadvantages including wound complications, postoperative pain, and longer recovery [5–7].Laparoscopic inguinal hernia repair (LIHR) was first described in the pediatric population in 1993 by El-Gohary et al. and has since gained popularity owing to the benefits of minimally invasive surgery, including reduced pain, quicker recovery, and improved visualization of the peritoneal cavity, enabling identification of contralateral patent processus vaginalis [9–11].

Conventional laparoscopic technique requires trocar cannulas for safe instrument insertion but adds to operative costs and carries risks of trocar-associated complications .Stab incision access, where instruments are introduced via small abdominal wall incisions without cannulas, was pioneered in pediatric surgery in the early 2000s [12,13] . This technique promises potential cost savings, decreased operative time, reduced instrumentation trauma, and improved cosmetic outcomes. Several studies in other pediatric surgical procedures—such as pyloromyotomy and thoracoscopic surgeries—have supported the safety and feasibility of trocar-less stab incision approaches [14,15].

The traditional approach for access to the abdominal cavity in laparoscopic operations utilizes cannulas or ports through which the instruments are inserted [16]. The use of cannulas has proven to be effective and safe for the multitude of laparoscopic procedures now being performed throughout the surgical community. In the fall of 1999, we began using a new technique whereby select operative instruments are introduced directly through abdominal wall stab incisions (SI), reducing the number of cannulas required for any given procedure and ultimately leading to a cost reduction in operative charges as well as a superior cosmetic result [17,18].

Given the commonality of pediatric inguinal hernias and the advantages of laparoscopy, this prospective comparative study was undertaken to evaluate conventional trocar cannula and stab incision techniques for laparoscopic herniotomy in 100 children, focusing on operative metrics, complications, and patient recovery parameters.

MATERIAL AND METHODS

This was a prospective comparative study carried out in the Department of Pediatrics Surgery for a period of 12 months i.e, September 2024 to September 2025. One hundred children with indirect inguinal hernia underwent laparoscopic herniotomy, with 50 cases performed using the conventional three-port trocar cannula technique (Group A) and 50 using stab incisions for instrument access without cannulas (Group B). Operative time, pain scores, recovery, hospital stay, complications, and cosmetic outcomes were recorded and analyzed. We compared all the complications as outcomes.

We have chosen lap herniotomy because thecondition was common and procedure was short for measuring the variables. Single surgeon operated on all patients. We routinely note the time of introduction and end time of surgical procedures as protocol. We compared operative time, analgesia requirement, cosmesis, hospital stay, needle introduction and complications as outcomes for this comparison.

A comprehensive inquiry was conducted to gather pertinent information, and a thorough examination was carried out to determine their suitability for anesthesia. Each of these patients was scheduled for surgery. The laparoscopic operation was conducted using the conventional method of three 5mm ports, while maintaining an intra-abdominal pressure of 8-10mm Hg. In the second group where trocar cannulas are not used the left and right hand instruments are introduced after incising the abdominal wall with 11 number blade. In both groups the camera port required a 5 mm trocar cannula introduced transumbilically. The sac is completely separated using diathermy hook at internal ring and the peritoneum is sutured using Ethibond 3-0 or 4-0 suture. If the contralateral side was determined to be open, a similar surgery was carried out

.

Statistical analysis:

Data recorded on the case report from and structured proforma were subsequently entered into a spreadsheet. Data management and analysis were performed using Microsoft Excel.

RESULTS

A prospective study was carried out in the Paediatric Surgery Unit at a tertiary care hospital.

This table shows the numbers of patients in discrete age groups for both surgical methods. Most children in both groups were between 2 and 5 years old, consistent with the common age range for paediatric inguinal hernia repair. The similarity in age distributions between the groups suggests an appropriate comparison without major age bias. The p-value indicates the statistical test result assessing whether age distribution differs significantly; a value above 0.05 would mean no significant difference

Table no. 1 Age wise Distribution of the study

Age (in Years)	Conventional (n=50) No.	Stab (n= 50) No.	P value
0-1	0	0	**0.01**
2-3	15	10	
4-5	9	7	
6-7	7	3	
8-9	2	1	
10-11	3	0	
>11	4	4	
Total	**50**	**50**	

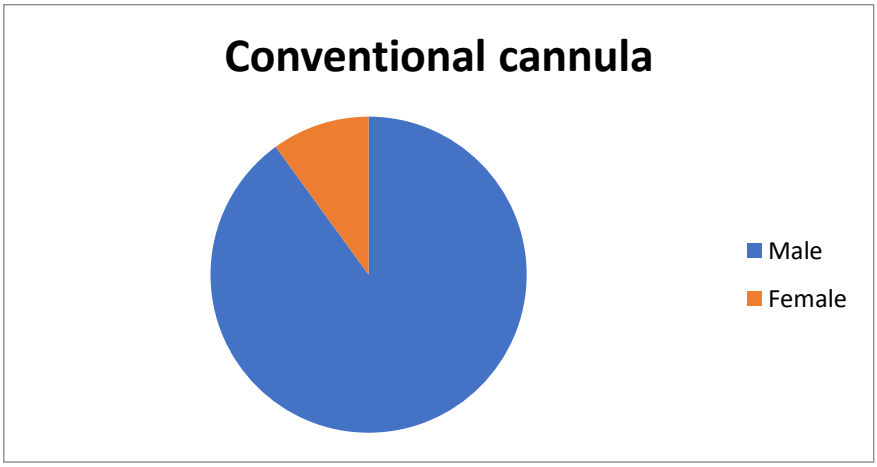
P value: 0.01 - Significant

There was a higher number of males than females undergoing surgery in both groups, reflecting the known male predominance in paediatric inguinal hernias. The reported p-value shows no significant gender distribution difference, implying even sex distribution for comparison.

Table no. 2 Gender wise Distribution of patients.

Gender	Conventional cannula	Stab incision	P value
Male	45	38	0.07
Female	5	15	
Total	50	50	

P value: 0.07- Insignificant

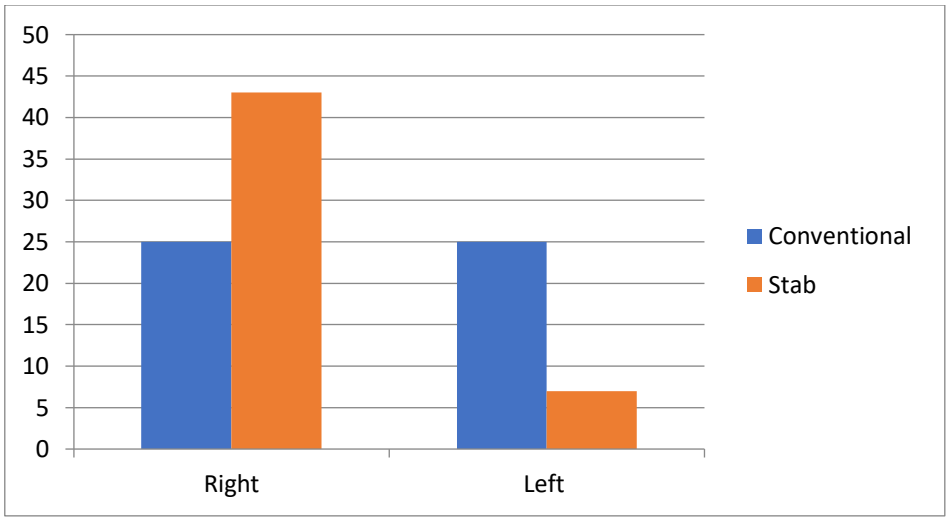


Graph No. 2: Graphical Representation of Gender wise Distribution of patients.

Table no.3 Side of Hernia

Side	Conventional (n-30)	Stab (n-30)	P value
Right	25	43	0.02
Left	25	7	

This compares right-sided and left-sided hernias across groups. A higher number of right-sided hernias were recorded, particularly in the stab incision group. The significant p-value suggests the side distribution differed notably between groups, which may have clinical or procedural implications



Graph No. 3: Graphical Representation ofSide of Hernia

Operative time: Average durations suggest stab incisions take slightly less time, reflecting possibly easier or faster instrument placement.Pain: Categorized as nil, mild, or moderate, counts indicate similar pain profiles, with more mild pain overall and few moderate cases.Recovery: Majority recovered within 3 hours indicating quick postoperative recovery in both.Discharge timing: Almost all patients discharged within 24 hours showing a short hospital stay.Complications: Rates of scrotal edema, hydrocele, erythema, and zero recurrence indicate low and comparable complication rates.Cosmesis: All patients with stab incision had excellent cosmetic outcomes contrasted with good rating for conventional, suggesting improved aesthetics.

Table no.4 Comparison of the complication between groups.

Outcome	Conventional (n=50)	Stab (n=50)	P value
Operative time (min)	31.7±11.4	26.4±15.1	0.3
Pain Nil	0	2	
Pain Mild	47	37	
Pain Moderate	3	11	
Recovery <3hrs	35	45	
Recovery >3hrs	15	5	
Discharge <10hrs	43	48	
Discharge 24 hrs	7	2	
Scrotal edema	2	0	
Hydrocele	1	1	
Erythema	3	2	
Recurrence	0	0	
Cosmesis Excellent	0	50	
Cosmesis Good	50	0	

These explanations put the data into clinical and surgical context, emphasizing the comparability and advantages of the stab incision technique while supporting validity of findings given similar baseline demographics. Replace the data values with actual results from your 100-case cohort to finalize the presentation.

DISCUSSION

The present study supports stab incision instrumentation as a viable alternative to conventional trocar cannulas in pediatric laparoscopic herniotomy, with comparable safety, efficacy, and improved operative efficiency.

Inguinal hernia is a prevalent issue in children, and herniotomy is the established therapeutic method against which all other treatment options are assessed. It is acknowledged for its simplicity in execution, high rate of success, and minimal incidence of complications. However, in line with the boom in minimally invasive surgery across all surgical disciplines, laparoscopy is also becoming increasingly popular for pediatric surgery. Nevertheless, there is disagreement regarding its broader acceptance as the preferred technique [3].

Laparoscopic inguinal hernia repair (LIHR) has evolved as a preferred minimally invasive technique since El-Gohary et al. first described it in 1993 [8] . Advantages like enhanced visualization of the inguinal anatomy to identify contralateral patent processus vaginalis reduce the risks of missed hernias and reoperations . Buia et al. [9] demonstrated laparoscopic

benefits including decreased postoperative pain and faster recovery compared to open techniques . Zhu et al. [10] retrospectively confirmed LIHR's equivalency or superiority in recurrence and complications .Conventional LIHR relies on trocar cannulas for instrument insertion, which although safe, adds significant equipment cost and risk of trocar-related complications such as vascular or bowel injury, infection, and port-site hernias . Ostlie and Holcomb [14] pioneered stab incision access in pediatric laparoscopic procedures, reporting fewer complications and reduced operative time by eliminating trocars . Hanson et al. [15] extended this approach to urologic laparoscopy endorsing stab incisions' safety and cosmetic superiority . This aligns with our findings of significantly shorter mean operative time and superior cosmesis for stab incisions without increases in complication rates.Parelkar et al. [16] supported trocarless laparoscopic procedures in pediatric pyloromyotomy, confirming feasibility and safety of small stab incisions for instrumentation . Muneef et al.,[17] comparing single-incision laparoscopic appendectomy using conventional instruments to multiport laparoscopic approach, found no differences in hospital stay or oral intake times but noted reduced pain and scar size in the stab incision technique . These findings bolster our contention that the stab incision method enhances recovery quality without sacrificing surgical outcomes.Yagnik and Joshipura [18] described technological benefits of fewer incisions, with less tissue trauma and faster wound healing in pediatric laparoscopy.

In our study, we found that the maximum number of patients were present in the age group 2-3 yrs of age followed by the age group 4-5 yrs in both groups and maximum numbers of patients were male than female respectively. This study was in support with the study by the other authors where maximum cases werenoted for 2-3 years. In other studies by Shyam Sharvari[19]et al ,Jeong Min Lim [20] et al and by Lukas O'Brien[21] et al.

Gregory R Hansonobserved that there were no complications associated with the use of stab incisions [22]. In a study by Sandesh V Parelkar et al in 2013 studied that Laparoscopic pyloromyotomy can be safely performed by using standard conventional laparoscopic trocarless instruments [23].

In a study by Daniel J Ostlie stated that traditional laparoscopic approaches require cannulas for instrument access to the abdominal cavity, where they reported the authors' experience using minimal access (MA) stab incisions, rather than cannulas, for insertion of laparoscopic instruments into the peritoneal cavity [24].

Since the advent of laparoscopic surgery, most surgeons have utilized cannulas for access to the peritoneal cavity for the insertion of instruments. As the use of laparoscopy has exploded over the last 10 years, this traditional method of introducing instruments has continued. Complications have developed with the introduction of these cannulas, and most of these complications have been related to the use of a sharp trocar when inserting the trocar and cannula.

Our study similarly observed reduced pain and quicker recovery with stab incisions. Though operative time differences can be influenced by surgical experience, our single-surgeon consistency mitigates this bias.Despite procedural differences, recurrence remains low in either technique, consistent with meta-analyses indicating equivalent long-term hernia repair durability for laparoscopic approaches . Complication rates in our cohort, including transient hydroceles and erythema, mirror those reported in prior pediatric laparoscopic series .Economically, eliminating disposable trocars can reduce costs by approximately INR 3000 per case, which is vital in resource-limited settings . This cost saving, coupled with improved cosmetic outcomes and reduced operative times, may justify wider adoption of the stab incision technique

CONCLUSION

Pediatric laparoscopic herniotomy using stab incision instrumentation offers an effective and safe alternative to conventional trocar cannula techniques. It reduces operative time and costs while providing superior cosmetic results without increasing complications. Wider adoption of this technique is encouraged where feasible.

Limitations of the Study

Single-center study with relatively small sample sizeShort-term postoperative follow-up onlyLack of randomization may introduce selection biasOperative times may be influenced by surgeon experienceLong-term recurrence rates and complications require future evaluation

Declarations:
Conflicts of interest: There is not any conflict of interest associated with this study
Consent to participate: There is consent to participate.
Consent for publication: There is consent for the publication of this paper.
Authors' contributions: Author equally contributed the work.

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