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“Stab Incision–Based Instrument Access in Pediatric Laparoscopic Herniotomy: A Prospective Sequential Comparative Study”

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Abstract

Background

Pediatric laparoscopic herniotomy is commonly performed using trocar-cannula systems for instrument access, which may introduce workflow interruptions and increase reliance on disposable equipment. Technique modifications that streamline operative flow without compromising safety are of clinical interest.

Aim

To evaluate stab incision–based instrument access as a workflow-oriented modification of pediatric laparoscopic herniotomy.

Methods

This prospective, non-randomized sequential comparative study included 60 children undergoing elective laparoscopic inguinal herniotomy. The first 30 procedures were performed using a conventional trocar-cannula technique, followed by 30 procedures using stab incisions for working instrument access with a single camera port. Operative time, postoperative analgesic requirement, recovery parameters, complications, and cosmetic outcomes were assessed.

Results

The stab incision group demonstrated a shorter mean operative time and lower postoperative analgesic requirement compared to the conventional cannula group. Recovery, hospital stay, complication rates, and cosmetic satisfaction were comparable, with no major complications or recurrences observed.

Conclusion

Stab incision–based instrumentation represents a feasible workflow-optimizing modification of pediatric laparoscopic herniotomy without compromising safety or outcomes.

INTRODUCTION

Inguinal hernia is among the most frequently encountered surgical conditions in children, with indirect hernias accounting for the vast majority due to persistence of the processus vaginalis. Early surgical repair is recommended to prevent complications such as obstruction, irreducibilty and rarely gonadal compromise. While conventional open herniotomy has long been considered the standard approach,

laparoscopic techniques have gained increasing acceptance in pediatric surgical practice owing to advantages in visualization, evaluation of the contralateral internal ring, and cosmetic outcomes.

Laparoscopic inguinal herniotomy in children is traditionally performed using trocar-cannula systems for instrument access. Although effective, trocar-based access introduces certain practical challenges in the pediatric population, including cannula instability, gas leakage, difficulty during needle insertion and retrieval, and increased reliance on disposable hardware. These issues may not affect surgical outcomes directly but can interrupt operative flow and increase procedural complexity, particularly in smaller children with thin abdominal walls.

In the context of pediatric laparoscopy, Workflow optimization refers to procedural modifications that streamline instrument access and handling, reduce intraoperative interruptions, and improve operative efficiency without altering surgical principles or compromising patient safety.

Direct insertion of laparoscopic instruments through small stab incisions represents one such modification. By minimizing dependence on multiple cannulas, this approach has the potential to simplify instrument handling, facilitate intracorporeal suturing, and reduce access-related interruptions during surgery. While previous studies have demonstrated the feasibility and safety of stab incision–based instrumentation in select pediatric laparoscopic procedures, its implications for operative workflow and resource utilization during laparoscopic herniotomy have not been adequately explored.

The present study evaluates stab incision–based instrument access as a workflow-oriented modification of pediatric laparoscopic herniotomy. By comparing operative efficiency, intraoperative handling characteristics, and postoperative recovery parameters with those of conventional trocar-cannula techniques, this study aims to assess whether such a modification can enhance operative flow without compromising clinical outcomes.

MATERIALS AND METHODS

This prospective, non-randomized, sequential comparative study was conducted at a tertiary care pediatric surgery unit from January 2023 to July 2024 and included 60 consecutive children undergoing elective laparoscopic inguinal herniotomy. Patients with complicated hernias, emergency presentations, significant comorbidities, obese children and those undergoing additional procedures were excluded. The first 30 patients underwent herniotomy using a standard three-port trocar-cannula technique (Group A), followed by 30 patients operated using stab incisions for insertion of working instruments with a single transumbilical camera port (Group B). All procedures were performed by a single surgeon under standardized anesthesia, with pneumoperitoneum maintained at 10–12 mmHg using a 5-mm, 30-degree laparoscope (Fig. 1). Either 3 or 5 mm hand instruments are used in these patients basing on the baby age and size. Herniotomy was performed at the internal ring using diathermy, followed by peritoneal closure with 4 – 0 vicryl sutures, and contralateral patent processus vaginalis was repaired when identified. Operative time, intraoperative handling characteristics, postoperative analgesic requirement, recovery, hospital stay, complications, and cosmetic outcomes were recorded prospectively. Data were

analyzed descriptively, with continuous variables expressed as mean ± standard deviation and categorical variables as frequencies and percentages; p-values < 0.05 were considered significant. Institutional Ethics Committee approval was obtained, and informed consent was secured from parents or guardians.

RESULTS

Sixty pediatric patients undergoing laparoscopic inguinal herniotomy were included, with 30 patients in each group. Baseline demographic characteristics were comparable (Table 1). The mean operative time was shorter in the stab incision group than in the conventional cannula group (26.37 ± 15.05 minutes vs. 31.68 ± 11.35 minutes). Postoperative analgesic requirement (3 doses of paracetamol in conventional and 1 dose in stab incision group)and pain scores were lower in the stab incision group. Early recovery and duration of hospital stay were similar in both groups, with most patients discharged within 24 hours. Complication rates were low and comparable, consisting mainly of minor, self-limiting events such as transient scrotal edema, temporary hydrocele, and mild erythema. No major complications or recurrences were observed. Parental satisfaction with cosmetic outcomes was high in both groups.

Table 1

Parameter	**Conventional cannula (n = 30)**	**Stab incision (n = 30)**
Mean age (years)	Comparable	Comparable
Male : Female	Predominantly male	Predominantly male
Mean operative time (minutes)	31.68 ± 11.35	26.37 ± 15.05
Postoperative analgesic requirement	Higher (3 doses)	Lower (1 dose)
Early recovery (< 24 hours)	Majority	Majority
Hospital stay (> 24 hours)	Few patients	Rare
Minor complications*	5	3
Major complications	0	0
Recurrence	0	0
Cosmetic satisfaction	High	High

DISCUSSION

The present report describes the use of stab incision–based instrument access as a simple modification of conventional pediatric laparoscopic herniotomy. The technique eliminates the need for additional trocar-cannula systems while maintaining standard laparoscopic principles. In our experience, stab incision instrumentation was associated with comparable clinical outcomes and complication rates,

with a tendency toward reduced operative time, simplified needle handling, and lower postoperative analgesic requirements.

Direct insertion of laparoscopic instruments through small abdominal wall stab incisions reduces dependence on multiple cannulas and minimizes access-related interruptions such as cannula dislodgement, gas leakage, and difficulty with needle introduction and retrieval. These factors, although individually minor, may collectively improve operative workflow during short pediatric laparoscopic procedures.

The concept of trocarless instrument access is not new. Ostlie and Holcomb first described the use of stab incisions for laparoscopic instrument access in pediatric surgery and reported no increase in access-related complications. Hanson et al. subsequently demonstrated the safety and practicality of the same approach in pediatric laparoscopic urological procedures. Trocarless techniques have also been successfully applied in pediatric laparoscopic pyloromyotomy, where reduced instrumentation was associated with technical simplicity and acceptable outcomes. Our earlier experience with trocarless laparoscopy has been reported previously; however, the present report specifically focuses on stab incision–based instrument access as a workflow-oriented technical modification rather than on overall feasibility or clinical outcomes.(9)

From a practical standpoint, this technique may be particularly useful in high-volume pediatric surgical units and resource-constrained settings. Reduction in the use of disposable trocar-cannula systems can contribute to meaningful cost savings without compromising safety. Furthermore, in smaller children with thin abdominal walls, stab incision access may reduce instrument crowding and cannula instability. Similar considerations regarding efficiency and simplification of minimally invasive surgery have been highlighted in broader reviews of laparoscopic surgery and pediatric inguinal hernia repair.(4–8)

The limitations of this report include the relatively small number of patients and the non-randomized sequential design. All procedures were performed by a single surgeon, which may limit generalizability. In addition, the technique was evaluated primarily in laparoscopic herniotomy, and its applicability to more complex pediatric laparoscopic procedures requires further study.

In conclusion, stab incision–based instrument access is a simple, safe, and reproducible modification of pediatric laparoscopic herniotomy. The technique reduces reliance on additional trocar-cannula systems and may improve operative workflow without altering established surgical principles. Further prospective studies are required to define its role across a broader spectrum of pediatric minimally invasive procedures.

Declarations

Author Contribution

SRM provided the idea, data collection, compiled the results and discussionSSE and MSS provided the discussion part and conclusion

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Figures

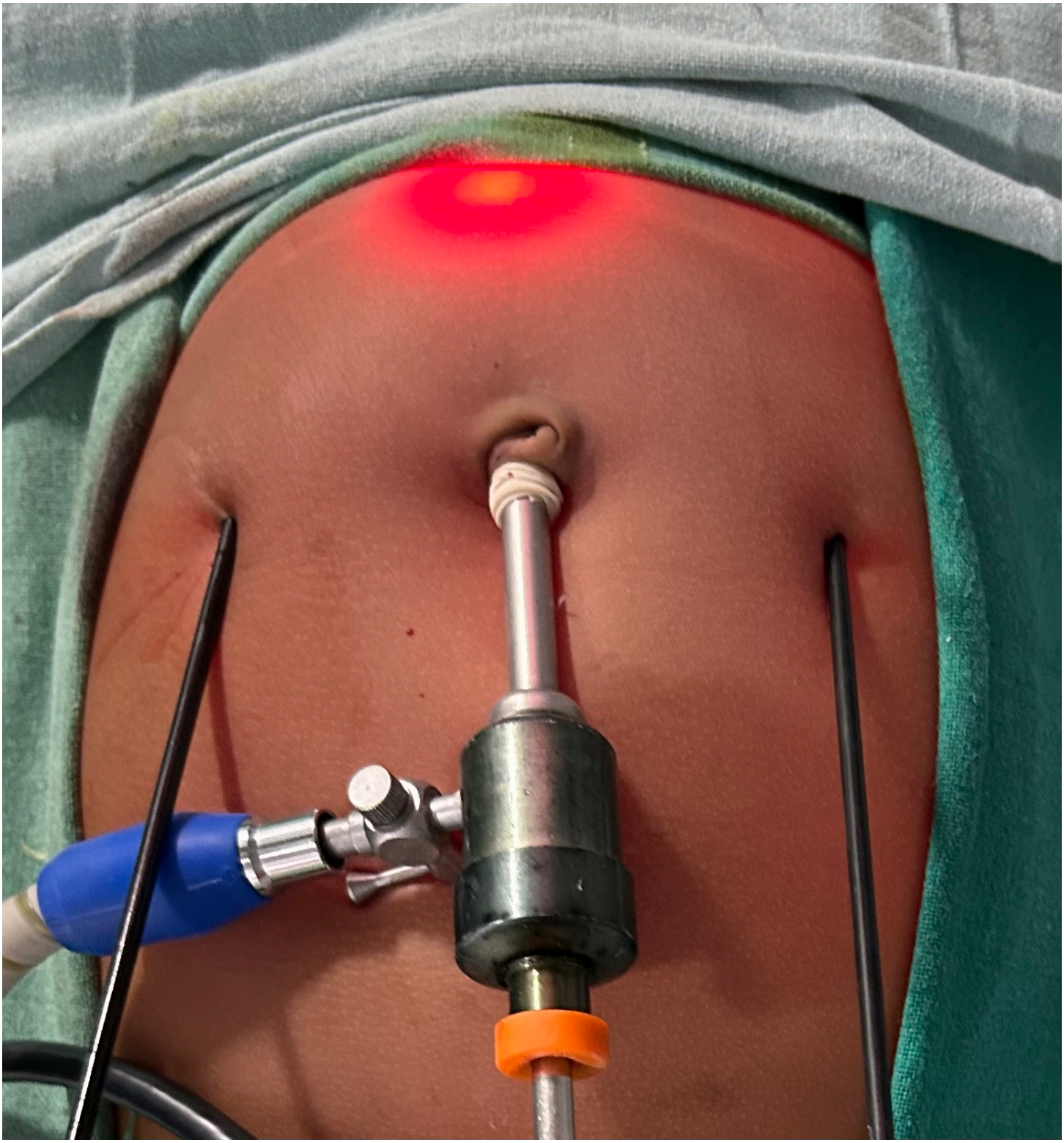


Figure 1

Legend not included with this version.