

# A COMPARATIVE STUDY BETWEEN THE PERCUTANEOUS INTERNAL RING SUTURING (PIRS) VS INCISION, DISSECTION EXCISION AND SUTURING (IDES) TECHNIQUES OF LAPAROSCOPIC HERNIA REPAIR IN CHILDREN

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## ABSTRACT

**Background:** Laparoscopic repair of congenital inguinal hernia (IH) in children is increasingly common, yet a consensus on the optimal technique remains elusive. This study compares the surgical outcomes and short-term complications of two prevalent laparoscopic methods: Percutaneous Internal Ring Suturing (PIRS), an extracorporeal technique, and Incision, Dissection, Excision, and Suturing (IDES), an intracorporeal technique, in male pediatric patients. **Materials and Methods:** This was a retrospective and prospective non-randomized comparative study conducted between March 2017 and May 2018. Sixty male children with IH (age < 16 years, excluding infants) were divided equally into two groups (n=30 each): Group I undergoing PIRS and Group II undergoing IDES. The primary outcome measures were recurrence and testicular atrophy. Secondary outcomes included operative time and intraoperative extraperitoneal hematoma. Statistical significance was set at  $p < 0.05$ . **Result:** The mean operative time was comparable between the groups (unilateral cases: PIRS  $21.87 \pm 2.99$  min vs. IDES  $22.76 \pm 1.94$  min;  $p > 0.05$ ). No cases of testicular atrophy were reported in either group. Regarding complications: Recurrence: One case (3.33%) occurred in the PIRS group, while the IDES group had 0% recurrence. This difference was not statistically significant ( $p = 0.313$ ). Intraoperative Hematoma: Two cases (6.66%) were observed in the PIRS group, and 0% in the IDES group. This difference was also not statistically significant ( $p = 0.150$ ). **Conclusion:** Both PIRS and IDES are safe and effective minimally invasive techniques for the repair of pediatric male inguinal hernia, demonstrating comparable operative times and no significant difference in short-term complication rates. The IDES technique showed a trend toward lower recurrence and hematoma rates in this cohort, suggesting both techniques are viable options depending on surgeon expertise and clinical context.

## INTRODUCTION

Congenital inguinal hernia (IH) remains one of the most common surgical challenges in pediatric practice, resulting from a patent processus vaginalis (PPV). While traditional open herniotomy has long been the standard of care, the past two decades have witnessed a significant shift toward minimally invasive repair.<sup>[1]</sup> Laparoscopic approaches offer compelling advantages over the conventional open

method, including superior cosmetic outcomes, reduced pain, rapid functional recovery, and, crucially, excellent visualization for simultaneous assessment and repair of the contralateral side.<sup>[2]</sup> Given the risk of complications such as incarceration, strangulation, and testicular atrophy, operative treatment is universally required.

A variety of laparoscopic techniques have emerged, broadly classified into intracorporeal and extracorporeal methods. Extracorporeal techniques,

such as Percutaneous Internal Ring Suturing (PIRS), are appealing due to their technical simplicity, use of minimal ports, and external knotting, potentially simplifying the procedure and reducing operative time.<sup>[3]</sup> Conversely, intracorporeal methods, exemplified by the Incision, Dissection, Excision, and Suturing (IDES) technique, are designed to replicate the anatomical precision of open surgery by performing sac excision and formal closure of the deep ring structures entirely within the peritoneal cavity.<sup>[4]</sup> Advocates of IDES suggest this approach may lead to lower long-term recurrence rates compared to simple ring closure methods.

Despite the widespread adoption of both PIRS and IDES, there is an ongoing debate regarding which technique offers the best balance of safety and efficacy. Studies comparing these two specific approaches remain limited, and the potential for differences in key outcomes—including operative duration, the risk of intraoperative complications such as vessel injury (leading to hematoma), and, most critically, recurrence rates—is a point of contention among pediatric surgeons.<sup>[5]</sup> Clinical evidence is therefore needed to directly compare PIRS and IDES to inform standard surgical practice.

**AIM:** This study was designed to prospectively and retrospectively compare the clinical outcomes and complications between the Percutaneous Internal Ring Suturing (PIRS) and the Incision, Dissection, Excision, and Suturing (IDES) techniques for laparoscopic herniotomy in male children.

## MATERIALS AND METHODS

**Study Design and Setting:** This was a retrospective and prospective non-randomized comparative study conducted in the Pediatric Surgery Unit of the Department of Surgery at Netaji Subhash Chandra Bose Medical College, Jabalpur, MP, India. Data collection and procedures spanned a 15-month period, from March 2017 to May 2018.

**Patient Selection and Grouping:** A total of 60 male pediatric patients diagnosed with unilateral or bilateral inguinal hernia were enrolled in the study. Patients were categorized into two equal groups (n=30 per group) based on the operating surgeon's judgment and preferred technique at the time of the procedure (non-randomized allocation).

**Group I:** Patients who underwent laparoscopic Percutaneous Internal Ring Suturing (PIRS) herniotomy.

**Group II:** Patients who underwent laparoscopic Incision, Dissection, Excision, and Suturing (IDES) herniotomy.

All patients underwent pre-operative ultrasonography (USG) to confirm the diagnosis and evaluate the contralateral side.

### Inclusion Criteria:

Male patients less than 16 years of age presenting with an inguinal hernia.

### Exclusion Criteria:

- Patients aged 16 years or older.
- Patients classified as infants (due to specific technical considerations).
- Patients presenting with giant hernias or significant deep ring weakness.

**Surgical Technique:** All procedures were performed under general anesthesia with endotracheal intubation. The patient was positioned in a reverse Trendelenburg's position with a contralateral tilt. Pneumoperitoneum was established using an open technique via an umbilical incision, maintaining a pressure of 6–10 mmHg depending on the child's age. A 5-mm trocar was inserted for a 30° operative laparoscope to visualize the internal inguinal rings bilaterally.

### Percutaneous Internal Ring Suturing (PIRS) Technique (Group I)

This technique utilized only the umbilical viewing port and a single needle puncture site. A 16-gauge hollow bore needle was introduced percutaneously lateral to the deep ring to deliver a cutting-edge Nylon 4-0 suture loop. The needle was re-introduced medially to capture the suture end, which was then retrieved through the original puncture site. The resulting purse-string suture was tied extracorporeally, and the knot was buried in the subcutaneous tissue, achieving closure of the internal inguinal ring under laparoscopic visualization.

### Incision, Dissection, Excision, and Suturing (IDES) Technique (Group II)

This technique utilized the umbilical viewing port and two additional 3-mm trocars placed in the midclavicular line as working ports. The procedure involved an intracorporeal approach:

1. **Incision and Dissection:** The peritoneum around the internal ring was incised, and the hernia sac was dissected for 1–2 cm, carefully safeguarding the vas deferens and spermatic vessels.
2. **Excision:** The dissected sac was excised using cautery or scissors.
3. **Suturing:** The peritoneal defect was closed using an intracorporeal purse-string or Z-suture (Vicryl 4-0). In cases of poor approximation of the deep ring, approximation of the conjoint muscle with the inguinal ligament was performed lateral to the inferior epigastric vessels. All ports were closed using Vicryl 4-0.

### Outcome Measures and Follow-up

#### Primary Outcome Measures

- Recurrence of the inguinal hernia.
- Development of testicular atrophy.

#### Secondary Outcome Measures

- Mean operative time (recorded from skin incision to final skin closure).
- Incidence of intraoperative complications (e.g., extraperitoneal hematoma).
- Postoperative complications (e.g., hydrocele).

All children were subjected to a short-term follow-up schedule at the 3rd, 7th, and 15th postoperative days to evaluate the primary and secondary outcomes.

**Statistical Analysis:** Data were collected, collated, and entered into an MS Excel master chart for analysis using IBM-SPSS version 21 statistical software. Data were presented as ratios, proportions, and percentages in distribution tables. Continuous variables were expressed as mean  $\pm$  standard deviation (SD). Various tests of significance, including the Chi-square test, Student's t-test, and ANOVA, were applied. A two-tailed p-value of less than 0.05 was considered statistically significant at a 95% level of significance.

**Ethical Considerations:** The study adhered to the principles of the Declaration of Helsinki. Approval from the Institutional Ethics Committee was obtained prior to commencement. Written informed consent was secured from the parents or legal guardians of all participants. No external sponsorship or conflicts of interest were reported.

## RESULTS

A total of 60 male pediatric patients were included in the study, with 30 patients in the Percutaneous Internal Ring Suturing (PIRS) group and 30 patients in the Incision, Dissection, Excision, and Suturing (IDES) group.

**Baseline Characteristics and Demographics:** The mean age of patients in the PIRS group was  $5.06 \pm 3.63$  years, compared to  $6.05 \pm 3.54$  years in the IDES group. Analysis of age distribution showed that 67% (n=20) of patients in the PIRS group were aged 1–5 years, compared to 40% (n=12) in the IDES group. This difference in age distribution between the two groups was found to be statistically significant ( $\chi^2 = 4.2857$ ,  $p = 0.038$ ).

The distribution of hernia side was comparable between the groups. In the PIRS group, 63.33% (n=19) were right-sided, 26.66% (n=8) were left-sided, and 10% (n=3) were bilateral. The IDES group presented with 73% (n=22) right-sided, 23.33% (n=7) left-sided, and 3.33% (n=1) bilateral hernias. No statistically significant difference was observed in the side distribution ( $\chi^2 = 1.2862$ ,  $p = 0.526$ ).

**Operative Outcomes:** The mean operative time for unilateral cases was  $21.87 \pm 3.00$  minutes in the PIRS group and  $22.76 \pm 1.94$  minutes in the IDES group. For bilateral cases, the mean operative time was  $30 \pm 1$  minute in the PIRS group and  $30 \pm 0$  minutes in the IDES group. The difference in mean operative time between the two groups for both unilateral and bilateral cases was not statistically significant ( $p > 0.05$ ).

### Complications

**Intraoperative Complications:** Two cases (6.66%) of intraoperative extraperitoneal hematoma were observed in the PIRS group, whereas no cases (0%) were observed in the IDES group. This difference was not found to be statistically significant ( $\chi^2 = 2.069$ ,  $p = 0.150$ ). No other intraoperative complications were noted in either group, and all

cases were completed laparoscopically without conversion.

**Primary and Postoperative Complications:** Recurrence was observed in one patient (3.33%) in the PIRS group, detected at the 15-day follow-up. The IDES group recorded 0% recurrence. This difference in short-term recurrence rates was not statistically significant ( $\chi^2 = 1.0169$ ,  $p = 0.313$ ). Crucially, no cases of testicular atrophy or postoperative hydrocele were observed in either the PIRS or the IDES group during the 15-day follow-up period.

## DISCUSSION

Our study presents a direct comparison between two common laparoscopic approaches for pediatric male inguinal hernia repair: Percutaneous Internal Ring Suturing (PIRS) and the Incision, Dissection, Excision, and Suturing (IDES) technique. The primary objective was to assess differences in operative time and short-term complications, specifically recurrence and testicular integrity.

**Demographics and Patient Population:** The overall mean age of the patients in our cohort (PIRS: 5.06 years; IDES: 6.05 years) is consistent with several reports in the literature, such as Patkowski et al. (5.33 years) and Rasik et al. (5 years), though it is higher than other series like Schier et al. (median 2 years).<sup>[6]</sup> We observed a statistically significant difference in age distribution between the groups ( $\chi^2 = 4.2857$ ,  $p = 0.038$ ), with the PIRS group having a higher proportion of younger children (1–5 years). This difference may indicate a non-random selection bias, where surgeons might preferentially select the technically simpler PIRS technique for younger patients, though the overall mean age confirms that laparoscopic repair is still not widely practiced in the infant population in this center, as noted by previous authors.

**Operative Time Comparison:** A key finding of our study was the negligible difference in mean operative time between the two techniques for unilateral cases (PIRS:  $21.87 \pm 3.00$  min vs. IDES:  $22.76 \pm 1.94$  min). This suggests that while PIRS is theoretically simpler due to its extracorporeal knotting, the meticulous intracorporeal dissection, sac excision, and suturing required for IDES do not significantly prolong the operating time once the surgical team has surpassed the initial learning curve. Our times are comparable to series like Patkowski (unilateral 28 min) but longer than reported by Montupet (unilateral 13 min), highlighting the impact of local experience and learning curves on surgical efficiency.

**Safety and Intraoperative Complications:** Both techniques demonstrated a high level of safety regarding critical structures, as confirmed by the absence of testicular atrophy and postoperative hydrocele in both groups. This is the paramount goal of pediatric herniotomy and aligns with the findings of major laparoscopic series.

However, two cases (6.66%) of intraoperative extraperitoneal hematoma occurred exclusively in the PIRS group, with 0% incidence in the IDES group. Although this difference was not statistically significant ( $\chi^2 = 2.069$ ,  $p = 0.150$ ), the trend supports the known risk associated with the PIRS technique: the blind, percutaneous passage of the needle around the internal ring carries an inherent, albeit small, risk of superficial vessel injury.<sup>[7]</sup> The advantage of IDES is the direct visualization and dissection of all surrounding structures, which potentially mitigates this risk.

**Recurrence Rate:** Recurrence is the most important long-term outcome measurement for any hernia repair. Our short-term follow-up detected one recurrence (3.33%) in the PIRS group and 0% in the IDES group. The overall laparoscopic recurrence rates reported in the literature range from 0.7% to 4.5%.<sup>[8]</sup>

The recurrence in the PIRS group, though statistically insignificant from IDES ( $p = 0.313$ ), supports the hypothesis that simple purse-string closure may occasionally be insufficient, potentially leaving 'skip areas' or leading to knot slippage, especially in larger defects.<sup>[9]</sup> Conversely, the 0% recurrence observed in the IDES group may reflect the benefits of its anatomically comprehensive approach: performing sac excision and formally approximating the deep ring structures, similar to the steps of an open repair. This reinforces the IDES technique as a robust, anatomical repair method.

### Limitations

Our study is subject to several important limitations. First, the sample size is small ( $n=30$  per group), which limits the power to detect significant differences in rare complications like recurrence and hematoma. Second, the study utilized a non-randomized comparative design, introducing potential selection bias, as evidenced by the statistically significant age difference between the groups.

Most critically, the follow-up period was extremely short (only 15 days). Recurrences of inguinal hernia and the development of testicular atrophy typically manifest months or even years post-operatively [10]. Therefore, the complication and recurrence rates reported here reflect only very early outcomes and

cannot be used to make definitive claims about the long-term superiority of either technique.

## CONCLUSION

In summary, both the PIRS and IDES techniques proved to be safe and feasible options for laparoscopic herniotomy in male children, with comparable operative times. The IDES technique showed a non-significant trend toward lower recurrence and intraoperative hematoma rates. Due to the significant limitations concerning sample size, non-randomized design, and short follow-up, our results serve as preliminary findings. Large-scale, multicenter randomized controlled trials (RCTs) with extended follow-up periods are required to establish a clear evidence-based preference between these two contemporary laparoscopic methods.

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