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RESEARCH ARTICLE

A prospective study to assess the feasibility of single port laparoscopic needle assisted repair of pediatric inguinal hernias

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ABSTRACT

Background: Congenital inguinal hernias are very common paediatric surgical conditions with incidence of 0.8–4.4% in children and up to 30% in preterm babies, which occur due to the failure of closure of the processus vaginalis. While the gold standard treatment remains to be open herniotomy, in the last two decades minimally invasive surgeries have revolutionized the hernia surgery and have evolved from 3 port to single port, intracorporeal knotting to extracorporeal knotting and 5 mm camera port to 3 mm camera port with multiple benefits.

Methodology: This is a prospective study conducted at a single tertiary care centre over 1 year. All the patients admitted under the Department of Paediatric Surgery, with a clinical and/or radiological diagnosis of inguinal hernia and planned for single port laparoscopic needle assisted repair were included in the study. Data was collected in terms of intra operative finding, duration of procedure, complications, pain and post operative hospital stay.

Results: A total of 40 patients were included in the study with a male predominance. Clinically majority were right inguinal hernia which was reducible. Intraoperatively, 7 cases of bilateral hernia were identified which were not detected pre operatively. 2 patients who underwent this procedure had complications and majority of the patients had mild pain.

Conclusion: Single port laparoscopic herniotomy is at par with gold standard open herniotomy in the paediatric population. This procedure has better cosmesis, lesser post operative pain, hospital stay and most importantly it could identify occult hernias.

Introduction:

Inguinal hernia, which is the abnormal protrusion of the abdominal viscera into the inguinal canal¹ is one of the most common paediatric surgical conditions encountered in routine practice^{1-3,5-7} and is known to occur due to the patent processus vaginalis (PPV)^{1,2}.

While open herniotomy remains the gold standard treatment^{1,2}, minimally invasive surgical (MIS) procedures have gained popularity over the past few decades^{1,2,3,5}. With the advancements in minimally invasive techniques, the 3-port technique has evolved to 2 port and then to single port surgeries, from intracorporeal knotting to extracorporeal knotting².

The drawback of the open procedure includes injury to vas and vessels, large groin incision, technical difficulty in small babies and inability to assess the contralateral side^{4,7}. These can be overcome by minimally invasive surgeries. Multiple benefits of the same have been reported in medical literature⁹, including, visualisation of contralateral side, lesser post operative stay, cosmetically better results^{1,2,7}.

Our study included patients of paediatric age group who underwent single port laparoscopic, needle assisted repair of inguinal hernia using a 3mm camera port. We have aimed to demonstrate that this novel technique is a feasible procedure with multiple advantages and is at par with the gold standard technique.

Materials and Methods:

This is a prospective study conducted at a single tertiary care centre. All the paediatric patients admitted in the Department of Paediatric Surgery, with a clinical and/or radiological diagnosis of inguinal hernia and

planned for single port laparoscopic needle assisted repair were included in the study. The guardians/ parents were explained about the surgical procedure and consent was taken from them. An extended consent was taken in clinically unilateral cases wherein the guardian/ parents were explained that intraoperatively, if the hernia was noted on the contralateral side, it will be repaired in a similar fashion. They were reassured that in case they deny to give consent for participation or withdraw from study, the standard of patient care will still be maintained.

Inclusion Criteria:

Patients aged less than 16 years diagnosed with inguinal hernia and planned for single port laparoscopic needle assisted repair.

Exclusion Criteria:

1. Age >16 years with inguinal hernia.
2. Patients with obstructed hernia / incarcerated hernia.

Surgical Procedure:

All the surgeries were performed under general anaesthesia with the patient in supine position. After painting and draping, pneumoperitoneum was created using veress needle. A 3 mm laparoscope was introduced through an umbilical port and the internal ring of either side were inspected for the presence of a patent ring.

A 22G spinal needle was introduced via stab incision placed externally near the internal ring, under vision. A 3-0 PDS suture was used to encircle the neck of the hernia sac extra peritoneally and was knotted extra-corporeally. In case of an incidentally found patent ring on the contralateral side, it was repaired similarly.

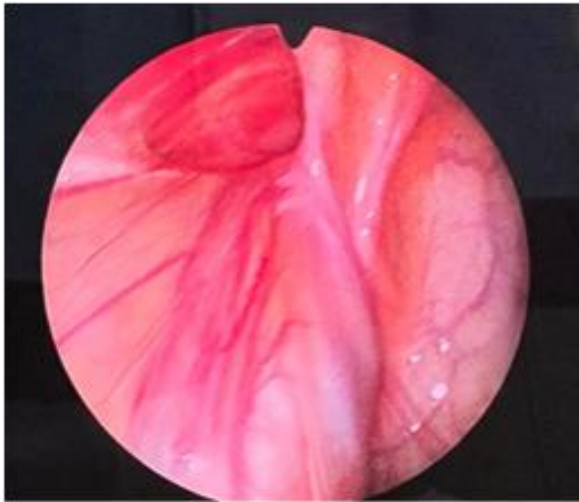


Figure 1 : Intra operative Left Inguinal Hernia

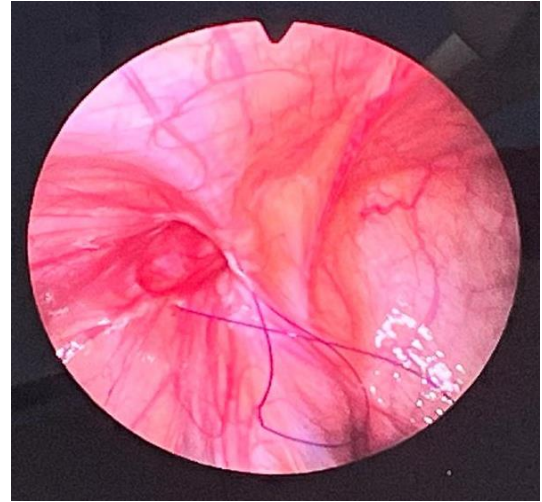


Figure 2: Loop through internal ring

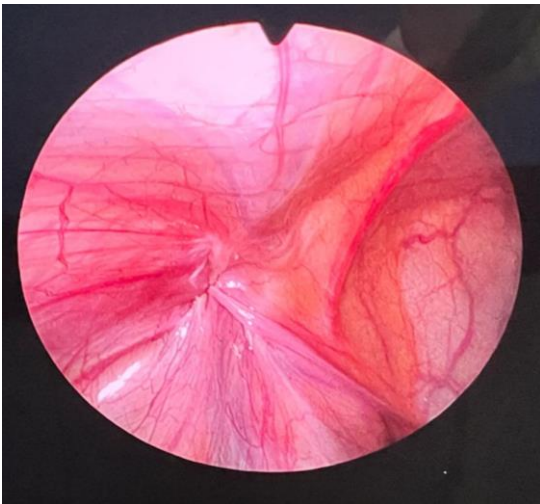


Figure 3: Post extracorporeal knotting of the deep ring



Figure 4: Immediate post operative scar

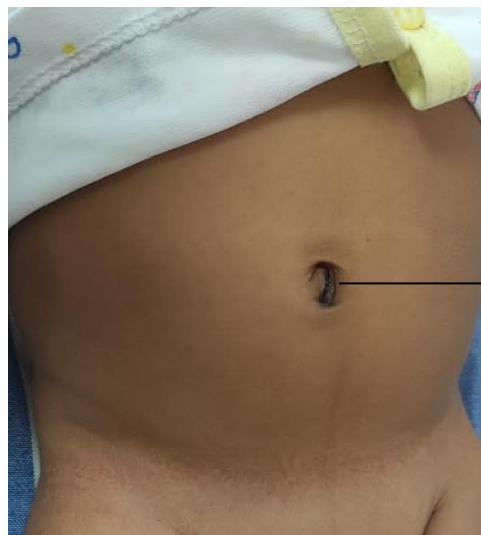


Figure 5: 1month post procedure no scar noted

Study Parameters:

The data was collected in terms of pre operative findings, intra operative findings and post operative findings. The pre- operative findings included the demographic profile of the patient, side and reducibility of the hernia and the ultrasound findings. Intra operatively contents, side of the hernia and duration of surgery were noted. Post operative findings were further classified into immediate post operative findings (pain and duration of post op stay) and late post operative findings (clinical and/or radiological findings at 2week, 1 month and up to 6 months, if in case of any problem).

Statistical Analysis:

Data was collected in an excel sheet. Descriptive and summary measure will be used to describe the data. One – way repeated measures, ANOVA test will be used to test the difference in the follow – up. All this test will be performed using SPSS software. P – value of <0.05 will be considered significant.

Results:

A total of 40 children were included in the study. The overall gender distribution was predominantly male with a ratio of 5:3. Majority of the children were diagnosed clinically with right inguinal hernia (67.5%) and 87.5% of the hernias were reducible on clinical examination. (Table 1)

Age		7.29±3.841 years
Gender	Male	25(62.5%)
	Female	15(37.5%)
Clinical Diagnosis	Left inguinal Hernia	10(25%)
	Right Inguinal hernia	27(67.5%)
	Bilateral	3(7.5%)
Reducibility	Reducible	35(87.5%)
	Irreducible	5(12.5%)

The radiological diagnosis was consistent in all the children were consistent with the clinical diagnosis. The most common content

noted on ultrasound scan was omentum (75%). (Table 2)

Table 2: Radiology finding		
Diagnosis	Bilateral	3(7.5%)
	Left	10(25%)
	Right	27(67.5%)
Content	Bowel	4(10%)
	Omentum	30(75%)
	Fluid	3(7.5%)

The children underwent single port laparoscopic inguinal herniotomy, intraoperatively 10 children were diagnosed with bilateral inguinal hernia, 7 out of 10 bilateral inguinal hernia were occult, showing a statistically significant chance of diagnosing occult hernia with a p value of <0.05 (Table 3). The average

duration of the procedure was 22minutes. The degree of pain post procedure was mild in 90% of the children. Majority of the children (95%) had no significant complications and the average post operative stay was 1.20days. (Table4).

		Intraoperative finding			Total	p Value
		left	right	bilateral		
Clinical Diagnosis	left inguinal hernia	9	0	1	10	<0.05
	right inguinal hernia	0	21	6	27	
	bilateral	0	0	3	3	
Total		9	21	10	40	

Duration of Procedure	Unilateral	19.50 ± 4.224minutes
	Bilateral	29.50 ± 4.378 minutes
Duration of post op stay		1.20±0.564 days
Complication	Yes	2(5%)
	No	38(95%)
Pain	Mild	36(90%)
	Moderate pain	4(10%)

Discussion:

Congenital inguinal hernias are a very common paediatric surgical condition with incidence of 0.8 – 4.4% in children and up to 30% in preterm babies². The basic defect in paediatric inguinal hernias is the failure of the processus vaginalis to close^{1,2}. The gold standard surgery for inguinal hernia is open inguinal herniotomy through a groin crease incision^{1,2}, which involves the dissection of the hernia sac from the spermatic cord and suture ligating its base². The disadvantages of this procedure included injury to vas deferens and vessels, large groin incision, technical challenges in younger age group. Moreover, the contralateral side could not be assessed, thus requiring a separate incision to tackle the other side^{2,6}.

Due to high incidence of an occult contralateral hernia, 23% - 37%^{2,14} in a clinically unilateral hernia, reported in 1992, diagnostic laparoscopy for the visualisation of the deep ring on the contralateral side was introduced, which if found patent would be repaired through a separate groin incision¹². This was followed by introduction of a trans - inguinal approach, to visualise the internal ring of the contralateral side in which an angled scope was introduced through the ipsilateral patent internal ring and the opposite side was visualised. However, if it was found patent it could only be repaired by open technique^{1,12}. These approaches minimized the need for negative scrotal exploration^{10,11}. There have been reports of surgeons performing open inguinal exploration on contralateral side⁸. With increasing expertise in laparoscopic surgeries and introduction of small calibre laparoscopic instruments the laparoscopic

inguinal hernia repair gained popularity¹. Advances in laparoscopic approach continued and there was a shift from intracorporeal knotting to extracorporeal knotting. Moreover, the 3 – port technique evolved to 2 – port technique using special instruments namely curved Reverdin needle and Lapaher closure and involved purse string closure of the patent ring^{2,13}.

Innovations continued, and in 2005, Ozdegiz et. al. reported a new technique wherein a single port was used and the deep ring was closed using extracorporeal knotting^{2,14}. Similar technique was used in our study where a 3mm camera port was inserted and a spinal needle and 3-0 PDS suture material was used to close the deep ring.

As mentioned previously, a notable benefit of laparoscopic methods in paediatric hernia cases is the capability to detect hidden patent processus vaginalis (PPV), thereby avoiding the occurrence of metachronous hernia². In the study conducted by Ameet Kumar and T S Ramakrishnan, 16.66% of cases had an occult PPV which is comparable to our study where 7 occult (18.9% of all unilateral hernias) were identified intraoperatively which were missed pre operatively.

Multiple other benefits of the laparoscopic approach have been reported which include, lesser post operative pain, shorter duration of post operative hospital stay and better cosmesis^{1,2,9}. This is analogous to our study wherein patients reported to have mild pain post operatively. Furthermore, the average post operative stay was 1-2 days and patient had better cosmesis as a single 3 mm port was used which did not require suturing. In our study, the average duration of the procedure

for unilateral and bilateral hernia repair were 19.5 minutes and 29.5 minutes respectively, which is comparable to the study by Miyake et al. (21.2 minutes and 25.4 minutes respectively). They also reported that in duration of surgery was significantly reduced in the bilateral cases when treated laparoscopically¹⁶. As mentioned in numerous other studies, the laparoscopic procedure gains an upper hand by better visualisation of the vital cord structures and hence avoiding injury to the same which is a common complication of the open surgery⁵.

As per the literature, the recurrence rates after an open herniotomy, laparoscopic 3 port technique and single port techniques have been reported to be around 2-6.3%, 0-5.3 % and 0-4.8% respectively². In our study, recurrence was limited to a case of Marfan's Syndrome who had undergone laparoscopic bilateral inguinal herniotomy and presented with a recurrent unilateral inguinal hernia which was later corrected by open method. During the postoperative period, hydroceles are a commonly recognized complication. This can arise from a persistent distal sac that facilitates fluid accumulation, exacerbated by a minor defect resulting from bypassing the vas and vessels, acting akin to a one-way valve. Alternatively, it may result from incorporating additional tissue in the purse-string suture around the peritoneum. Nevertheless, it is noteworthy that the majority of these hydroceles tend to resolve on their own, necessitating a follow-up procedure only in rare instances^{2,14}. However, no such complication was noted in our study. Additionally, the laparoscopic procedure involves the need for a transperitoneal access which predisposes the patient to the risk of

visceral and vascular injuries² In our study there was a hematoma secondary to the inadvertent puncture of the inferior epigastric artery that was managed conservatively. Furthermore, laparoscopic surgery also predisposes the patient to general anaesthesia related complications which can be avoided in open surgeries wherein there is an option of performing the surgeries under regional anaesthesia.

Conclusion:

Single port laparoscopic needle assisted repair can be safely performed for paediatric inguinal hernias with multiple benefits including detection of occult contralateral hernia in a symptomatically unilateral hernia, better cosmesis, faster recovery with a recurrence rate similar to the gold standard open inguinal herniotomy procedure. However, a larger cohort study with a longer follow up period is required in order to extrapolate it to the general population.

Conflict of Interest:

None

Funding Statement:

None

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None

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