



Original Article

Pediatric Laparoscopic Inguinal Hernia Repair: A Comparison between Techniques

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Abstract

Background: Traditionally in herniotomy, indirect hernial sac is dealt by high ligation and removal of the redundant part, to avoid recurrence. However, some authorities are of the opinion that excision of the hernial sac without ligation is not associated with recurrence of the hernia. Some have even shown adverse events related to hernial sac ligation like increased post-operative pain and discomfort. There is no consensus on how the hernial sac should be managed during laparoscopic herniotomy.

Objectives: Present study aimed to determine the feasibility of laparoscopic sac excision without ligation in pediatric age group, by a randomized comparison.

Materials and methods: This interventional study was performed in the department of Paediatric Surgery, Rajshahi Medical College Hospital, Rajshahi, Bangladesh, over a period of one year. A total of 189 patients were included in the study as per inclusion and exclusion criteria and randomized in the three groups. Comparisons were made among three procedures of laparoscopic herniotomy, namely; Percutaneous extraperitoneal closure, Intraperitoneal purse-string closure and laparoscopic sac excision without ligation. The main outcome measures were recurrence rate, operative time, hospital stay, postoperative hematoma and hydrocele formation.

Results: Recurrence rate, operative time and hospital stay were not amplified in laparoscopic sac excision procedure than others. Postoperative hydrocele formation was significantly less.

Conclusion: Laparoscopic sac excision in indirect pediatric inguinal hernia is safe. The procedure is not associated with early recurrence when it is performed in cases with deep ring diameter less than 10 mm.

Key words: hernia, inguinal, pediatric, laparoscopic, sac excision, Recurrence rate, intraperitoneal purse-string, extraperitoneal closure

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Introduction

Congenital inguinal hernia repair is one of the most commonly performed elective operations in children. Traditionally in herniotomy, indirect

hernial sac is dealt by high ligation of the sac and removal of the redundant part.¹ This step was promoted as essential to avoid recurrence. Early recurrences were attributed to slippage of this

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ligature.² This view was first challenged in by many authors. Some authorities are of the opinion that non ligation of the hernial sac is not associated with recurrence of the hernia. In fact during laparoscopic and open orchidopexy, the hernia sac has been left unsutured without any adverse outcome.³ Some have even shown adverse

events related to hernial sac ligation like increased post-operative pain and discomfort.⁴

There is no consensus on how the hernial sac should be managed. This study was carried out to see whether there is increased recurrence with excision and non-ligation of hernial sac in pediatric age group.

Patients and methods

This prospective randomized study was conducted on 189 consecutive children in the Pediatric Surgery unit of Rajshahi Medical College Hospital, Bangladesh; over a period of two years from July, 2018. The study protocol was approved by the hospital ethical committee and parents signed a detailed informed consent. Patients with unilateral inguinal hernia aged between 2 to 13 years with no history of abdominal or inguinal operations, with completely descended testes were included in the study. Recurrent inguinal hernia, parental refusal, and previous abdominal surgery, sonographically detected inguinal ring diameter more than 10 mm, concomitant other medical or surgical disease, were excluded.



Figure 1: Insertion of verrus needle



Figure 2: Insertion of laparoscope

Cases were randomly divided into three groups (A, B and C) randomly; namely, a) Laparoscopic Percutaneous Extraperitoneal Closure. b) Intraperitoneal purse-string closure, c) Laparoscopic sac excision without ligation.

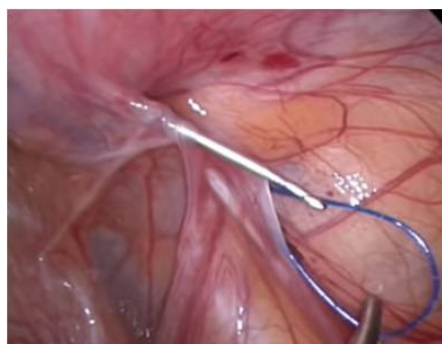


Figure 3: Laparoscopic Extraperitoneal Closure

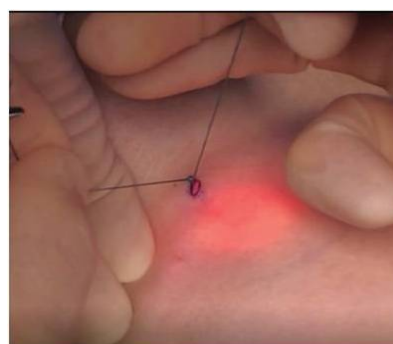


Figure 4: Extraperitoneal Closure

The main outcome measurements were recurrence of inguinal hernia, operative time, hospital stay, intraoperative complications, postoperative hematoma, post-operative pain scores, rate of conversion and postoperative hydrocele formation.



Figure 5: Laparoscopic sac excision



Figure 6: Intraperitoneal purse-string closure

Results

The study objectively evaluated the outcomes of three surgical techniques. The ultimate objective was to find out a better procedure of laparoscopic pediatric inguinal hernia repair. Statistical analysis was performed using SPSS software (version 16). P value was reached by Chi Square test, ANOVA test and t test. The important observations were tabulated and hereby briefly described.

The age-wise distribution of the patients of the current study was depicted in Table 1. Age ranged from 2 to 13 years and was divided into three age groups such as 2-5 years, 6-9 years and 10-13 years.

Table 1: Age distribution of failed hypospadias patients

Age (years)	Methods						Total
	Laparoscopic sac excision without ligation Group-1		Intraperitoneal purse-string closure Group- 2		Laparoscopic Percutaneous Extraperitoneal Closure Group- 3		
	male	female	male	female	male	female	
	19		16		13		
2-5	male	female	male	female	male	female	48
	17	2	15	1	13	0	
	27		21		29		
6-9	male	female	male	female	male	female	77
	26	1	19	2	27	2	
	15		32		17		
10-13	male	female	male	female	Male	female	64
	13	2	31	1	14	3	
Total	61		69		59		189

The operative time was calculated from the time of incision to the last suture in the skin. Table-1.2 demonstrated the comparison of Mean \pm SE of operation time in minutes among the three groups under study. The differences of mean operative time were not different, at $P < 0.05$.

Table 2: Comparison of operation time (minutes)

Name of operation	Operation time (minutes)		
	Laparoscopic sac excision without ligation group-1	Intraperitoneal purse-string closure group 2	Laparoscopic Percutaneous Extraperitoneal Closure (LPEC) group 3
MEAN TIME REQUIRED WITH SD	32.50 \pm 5.45a	35.20 \pm 4.11a	30.04 \pm 5.21a

Values (Mean \pm SE) followed by different letters (a, b, c) in a row were significantly different at $P < 0.05$ according to Duncan's multiple range test

The duration of hospital stays in days were calculated from the day of operation to the day of discharge from the hospital. Table 3 demonstrated the comparison of Mean \pm SE of hospital stays in days among the three groups under study, which shows no significant deference among the procedures.

Table 3: Comparison of Duration of hospital stays (Days).

Name of operation	Duration of hospital stay (Days)		
	Laparoscopic sac excision without ligation group-1	Intraperitoneal purse-string closure group 2	Laparoscopic Percutaneous Extraperitoneal Closure (LPEC) group 3
Hospital stay (calculated from day of operation)	2.33 \pm 1.20a	1.56 \pm 1.22a	2.72 \pm 0.91a

Values (Mean \pm SE) followed by different letters (a, b, c) in a row were significantly different at $P < 0.05$ according to Duncan's multiple range test

A significant post-operative scrotal swelling was found in procedures namely; Intraperitoneal purse-string closure and laparoscopic percutaneous extraperitoneal closure. The procedure of laparoscopic sac excision without ligation had less such post-operative events, as no sac remained for fluid collection. Table 4-6 demonstrated the comparison early post-operative complications among the three groups under study.

Table 4: Post-operative complications for scrotal swelling

Name of operation	Duration of hospital stay (Days)					
	Laparoscopic sac excision without ligation group-1		Intraperitoneal purse-string closure group 2		Laparoscopic Percutaneous Extraperitoneal Closure (LPEC) group 3	
Early complications	N	%	N	%	N	%
Scrotal swelling	(61)		(69)		(59)	
	2	3.27*	11	15.94	7	11.86

*significantly different at, $p < 0.05$

There was no conversion to open procedure in all three procedures under study as depicted in following table.

Table 5: Conversion to Open Procedure

Outcome measures	Conversion to Open Procedure					
	Laparoscopic sac excision without ligation group-1		Intraperitoneal purse-string closure group 2		Laparoscopic Percutaneous Extraperitoneal Closure (LPEC) group 3	
Conversion to open procedure	N	%	N	%	N	%
	(61)		(69)		(59)	
	0	0.00	0	0.00	0	0.00

Avoidance of recurrence of hernia is the goal of laparoscopic repair. The highest recurrence rate was reported in laparoscopic percutaneous extraperitoneal closure (6.77%), followed by intra peritoneal purse-string closure (4.34%). On the other hand the lowest frequency was recorded in laparoscopic sac excision without ligation technique (1.63%). The differences of recurrence of hernia rate was significantly less in (group A).

Table 6: Main outcome measure-recurrence rate

Outcome measures	Methods					
	Laparoscopic sac excision without ligation group-1		Intraperitoneal purse-string closure group 2		Laparoscopic Percutaneous Extraperitoneal Closure (LPEC) group 3	
Recurrence	N	%	N	%	N	%
	(61)		(69)		(59)	
	1*	(1.63%)	3	(4.34%)	4	(6.77%)

* Significantly different from other groups, $p < 0.05$. P value reached from t test.

Discussion

Herniotomy is considered as the standard surgical procedure for indirect inguinal hernia. Traditional teaching on open herniotomy emphasizes on suture ligation of the peritoneal end of the sac following its transection at the deep ring. However, there have been reports, both in adults and children, to suggest that leaving the sac unligated following transection does not make any difference in the outcomes of open hernia repair.^{5,6,7,8}

In fact during laparoscopic^{9,10} and open orchidopexy,¹¹ the hernia sac has been left unsutured without any adverse outcome. Ferguson¹² in 1978 claimed that hernial sac can be left open without increasing the risk of recurrence. After dissecting the hernia sac right up to the deep ring, he excised it and left it open. He followed his patients for a long period, and did not find increased recurrence. Smedberg *et al*¹³ in 1984 was left open and that leaving the hernia sac open was associated with less post-operative pain. This may be due to the fact that parietal peritoneum is sensitive to pain and a peritoneal ligature may lead to pain.

Similar results were shown by Shulman *et al*.¹⁴ and Abrahamson¹⁵ in adults. Kumari *et al*¹⁶ studied non ligation of hernial sac associated with undescended testis and found that hernial sac can be safely left open in such cases as well. Riquelme *et al*¹⁷ applied the technique of non-ligation of hernia sac in laparoscopic pediatric inguinal hernia repair. He found that non ligation is as safe in laparoscopic surgery as it is in open indirect inguinal hernia repair.

We want to emphasize on completeness of the excision of sac to prevent recurrence. In Riquelme's¹⁷ series a purse string closure of the ring was done for >10 mm size of the deep ring. He did not report any recurrence in a 4 year follow-up. In our series all the cases were having a ring diameter less than 10 mm, so recurrence rate were less in number. Our results show that all three techniques are comparable in terms of complication rate and recurrences.

Limitations of the study

Infants have not been included in the study. The length of the inguinal canal and obliquity develops during infancy to make an effective sealing mechanism at the deep ring. It is logical for the critics to believe that leaving the peritoneum

unsutured may invite more recurrences in infants due to a suboptimal sealing mechanism of the conjoint muscle. Total number of cases was too small to make a strong recommendation.

Conclusion

Paediatric laparoscopic herniotomy by sac excision without ligation, may develop as a preferred alternative technique, at least in hernias with ring size <10 mm, because of its simplicity.

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