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Skipping The Cord During Laparoscopic Percutaneous Internal Ring Suturing in Children, Is It Reasonable?

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Abstract

Background: Laparoscopic inguinal hernia repair in children was introduced as a minimal invasive method. One of the most common method is percutaneous internal ring suturing (PIRS). The main concern is trapping the spermatic cord and/or damaging the vasculature of testes in boys. This may be avoided with a careful dissection or the surgeon may skip the peritoneum over the cord and/or the vessels. The aim of this study is to compare the recurrence and hydrocele rates of children in whom the peritoneum on the cord and/or vessels was skipped and did not during laparoscopic PIRS repair.

Methods: The charts of children who underwent laparoscopic PIRS repair between 2017-2021 due to inguinal hernia were analyzed. Recurrence and complications were evaluated. The video records were watched and the data on skipping(group 1) the peritoneum on vas deferens or not skipping(group 2) the peritoneum on vas deferens was noted. Recurrence and complication rates were compared between groups.

Results: A total of 101 boys with 125 inguinal hernia were enrolled. Among these 45 had right-sided, 32 had left-sided and 24 had bilateral inguinal hernias. The video investigation was revealed that there were 63 hernias in group 1 and 62 hernias in group 2. There were two recurrences in each group. No other postoperative complications were observed.

Conclusions: For avoiding spermatic cord or vessel damage, skipping the cord seems an acceptable path which seems not to increase recurrence or complication rates and also ensures spermatic structures' safety.

Introduction

Inguinal hernia (IH) is one of the most common surgical conditions of childhood. Although, conventional open repair (OR) is the standard surgical method, laparoscopic repair has been emerged as unequally safe and effective method, recently [1,2]. A feared concern with the OR is possible complications that may occur due to unavoidable manipulation of vas deferens and testicular vessels during the dissection of hernia sac along with the main concern of recurrence. Although the risk of injury to these structures persists in laparoscopic repair; it has been reported very rare with almost all different laparoscopic approaches [2,3]. First described by Schier, laparoscopic IH repair in children evolved in many aspects [1]. Currently, percutaneous internal ring suturing (PIRS) method which was described by Patkowski et al. is one of the most common laparoscopic IH repair method worldwide [4] .

Even though PIRS method prevent hernia sac dissection, entrapment of the vas deferens and vessels is still a possible risk that cannot be ignored. Although some studies reported undisturbed testicular blood flow and testicular volume after laparoscopic PIRS repair in children [5–7], there is a lack of data on spermatic cord position and function after percutaneous IH repair techniques in the literature. Considering that the evaluation of the spermatic cord after IH repair is not easy due to various reasons, the lack of

publications is better understood. Also individual intraoperative findings make it very difficult to perform a standard operation each time, especially in newborns and infants. Dissecting the peritoneum on the spermatic cord and vessels may be extremely difficult in some children since the peritoneal folds and inflammated peritoneum may shadow the edges of vas deferens and the angle of vas at the level of inguinal ring vary.

In the authors' practice, the technique of choice for IH repair was PIRS. Contrary to the original description of the method, authors choose to skip the peritoneum over the vas deferens and/or the vessels in some cases. The aim of this study is to compare the recurrence and postoperative complication rates of hernia repair in children of whom the peritoneum over the vas and/or vessels was skipped or not during laparoscopic PIRS repair.

Materials And Methods

The study was designed as a retrospective video analysis study. Videos of the children who underwent laparoscopic inguinal hernia repair between 2017-2021 were evaluated. This study was reviewed by the ethics committee of Ankara University with the number 2021000301 and ethics committee approval was obtained. Videos of girls were excluded from the analysis. In addition; procedures without video recordings, children whose parents and/or themselves did not approve to be included to the study, children with recurrent inguinal hernia were also excluded from the study (Figure 1). All of the videos were evaluated by two surgeons blindly to other one's evaluation and suspicious cases were reevaluated by the third surgeon. The video records were watched and the data on skipping(group 1) the peritoneum on vas deferens or not skipping(group 2) the peritoneum on vas deferens was noted.

Demographic data of the children, age and weights, side of the hernia, operation duration, intraoperative complications and events, and postoperative complication and recurrence rates were analyzed. Postoperative recurrence rates were the main point of interest. Operative times were not compared due to possible confusion secondary to the fact that in some bilateral cases, the cord is skipped in one side but not skipped in the other side.

The study was performed in adherence to the Declaration of Helsinki. Written informed consent was obtained from legal guardians of each child and Ethical Committee Approval was provided.

Surgical method

The IH repair was performed uniformly in all patients. All children underwent PIRS procedure. In children in whom anatomical topography of spermatic cord and vessels did not let the surgeon easily dissect the overlying peritoneum due to the reasons such as inflammated and thin peritoneum, the peritoneum on these structures was skipped and purse string suture was completed without this part. Hydrodissection was not performed in any of cases due to lack of experience in this method. Cauterization was also not performed due to the possible thermal injury. The choice of skipping (Figure 2) or not skipping this area (Figure 3) was depended on the surgeons' decision and had no objective criteria.

All of the children were called to the outpatient clinic first and sixth months and first year postoperatively. Afterwards they were told to come visits in case of any complications.

Statistical analysis

Normally distributed variables were compared by Student's t test. Mann Whitney U test was used to compare the non-normally distributed variables. The comparison of categorical variables between the two groups were performed by the Pearson Chi square test. A $p<0.05$ value was considered as statistically significant.

Results

A total of 101 boys are enrolled in the study with 125 IH repairs. Among these children 45 had right sided, 32 had left sided and 24 had bilateral IH. Median weight of the children was 4 kilograms (IR: 4,00). Demographic data and data on outcomes were presented in Table 1. There were nine intraoperative complications but none of them required additional intervention. All these complications were iliac hematomas due to the accidental puncture of iliac vessels. Recurrence rate was similar in 2 groups within a similar follow up period (3% vs 3%, 2 patients in both groups). Recurrence rates were not significantly different between the groups ($p = 0.98$) but the rate was higher in younger and smaller infants regardless of the surgical method ($p < 0.01$). All of the recurrences were treated with laparoscopic PIRS technique. Complications rates were also similar statistically; although in group 2 there were 6 complications and there were 3 in group 1($p > 0,05$).

Table 1
Demographic data and patient outcomes

	GROUP 1 (Skipping the peritoneum on vas deferens)		GROUP 2 (Not skipping the peritoneum on vas deferens)	
Median age (months)	4,00 (IR: 4,00)		4,00 (IR: 4,50)	
Median weight (kg)	5,00 (IR: 15,00)		7,00 (IR: 8,25)	
Side (Bilateral hernias seperated as right and left)	R	L	R	L
	33	30	36	26
Intraoperative complication	3		6	
Recurrence	2		2	
Follow up	18 months (6–36)		19 months (7–36)	

On detailed evaluation of the recurrent cases, one boy in Group 2 had extraperitoneal hematoma that resolved uneventfully while the perioperative process was uneventful and no obvious cause for

recurrence was identified in the rest three boys. Detailed information on recurrent cases was shown in Table 2.

Table 2
Characteristics of recurrent cases

	Case 1	Case 2	Case 3	Case 4
Group	1	1	2	2
Age	43 days	3 months	2 months	45 days
Side	Left	Left	Left	Right
Intraoperative complication	None	None	Iliac hematoma	None
Postoperative complication	None	None	None	None
Duration of recurrence	Postoperative 10th month	Postoperative 3rd month	Postoperative 3rd day	Postoperative first month
Additional findings in the first laparoscopy	None	None	None	None
Recurrence pattern	Totally opened inguinal ring	Partly opened inguinal ring (Lower part)	Totally opened inguinal ring	Totally opened inguinal ring
Additional findings in the second laparoscopy	None	None	None	None

Discussion

The present study with retrospective analysis of surgical videos in 125 PIRS procedures support that skipping the peritoneum over the spermatic cord or vessels during PIRS procedure may be an alternative option that does not increase recurrence rate when dissection of peritoneum appears hazardous.

Vas deferens and testicular vessels are regarded as the most vulnerable structures around the inguinal canal. The safety of these structures is the main concern of surgeons when performing IH repair, regardless of the method. During open repair of IH in boys, manipulation of vas and vessels while dissecting the hernia sac has the potential risk of injury to these structures. Driven by this concern, pediatric surgeons have been struggling to develop new methods that require less engagement with these delicate structures. PIRS is one of the most commonly used laparoscopic method currently, and the main principle is purse string closure of internal inguinal ring. However, one of the critical and challenging step of the procedure is including the peritoneum over the vas and vessels in the purse string while avoding injury to them. Thus the authors suggest that skipping the peritoneum over the vas deferens and - sometimes – vessels may be a reliable option. Although we do not have strong evidence to argue routine

skipping of the peritoneum at this site, our initial experience support that skipping the cord is safe and does not compromise the success of the repair when the surgeon feels uncomfortable to perform a total and perfect purse string knot. Main concern of performing an incomplete purse string knot is the theoretical risk of higher rate of recurrence, but to the best of our knowledge, there is no study that specifically evaluate this issue.

Although initial results of laparoscopic PIRS method demonstrated slightly higher recurrence rates compared to open procedure, recurrence rates have been decreased with increasing experience, and even become comparable recently [8] Using absorbable sutures, inadequate experience on laparoscopic repair and male gender may be the potential risk factors associated with higher recurrence rates of laparoscopic IH repair in children [9,10]. On the other hand, the fact that IH repair in younger children, (especially newborns), has higher rates of recurrence is a well-known pitfall [9]. In line with the literature, the recurrences in the present study were all males and the oldest child was 3 months old. There were two recurrences in each group consisting of 63 and 62 children, respectively and the recurrence rates in group 1 and 2 were not significantly different ($p > 0.05$). The overall recurrence rate in the study was 3.2% (4/125) and the rate was also in line with the literature. It is worth mentioning that all recurrences were in young male infants that IH repair may be very challenging.

In 125 IH repairs, there were no major intraoperative complication that required additional intervention was observed. There were nine bleedings all due to accidental puncture of iliac vein and they all resolved spontaneously. The intraoperative complication rates were also similar between groups despite a slight increase in group 2 which did not reach a statistical significance ($p > 0.05$). The authors may comment that insisting to achieve a complete purse string suture might be responsible for this slight increase in complications. On the other hand, skipping the peritoneum when regarded as difficult or hazardous may be safer in order to avoid complications such as accidental puncture of iliac and spermatic vessels or injury to the vas.

Although spermatic cord injury is very rare in IH repair, this low incidence may be secondary to unreported or undiagnosed injuries [11]. There is evidence that even though the surgeons thought that they did not harm the spermatic cord, sections of vas deferens are demonstrated in 0.05% of the hernia sac specimens in pathological examination [12]. In addition to concern about major trauma, minor and microvascular trauma due to tissue handling and dissection may cause catastrophic results as it was demonstrated in animal studies [13]. Although PIRS repair has theoretical advantage over open approach in terms of cord injury, it is still unclear whether the spermatic cord or vessels are injured with accidental punctures when trying to dissect the overlying peritoneum. And although some studies demonstrated undisturbed testicular blood flow after PIRS repair, demonstrating the patency and welfare of the vas deferens is quite impossible in children and relevant literature data is inadequate. Celebi et al and Parelkar et al. claimed that testicular blood flow is not affected by laparoscopic IH surgery in their well-designed study [6,7]. One of the unique studies about the impact of PIRS procedure on vas deferens was performed by Xu et al, and they concluded that the orientation of vas deferens does not change after the

procedure [14]. To the best of our knowledge, a study evaluating the functional integrity and welfare of vas deferens after the procedure does not exist so far. Additionally, a study on fertility of boys after PIRS repair does not exist since the introduction of the method is relatively new, and even in total injury of one side, paternity rate would not be impaired if the other side intact. However, we know that this is a major and well described complication of open IH repair [15]. Even though the tissue handling and dissection of vas deferens and vessels is remarkably minimal in PIRS repair compared to open hernia, it is not zero and it may be a risk factor for infertility as well. Considering these complications, it may be reasonable to not to engage with vas deferens and just skip the peritoneum over it. The worst scenario would be a recurrent IH and our study suggest that the recurrence rate is not higher to raise a significant concern.

The present study designated as retrospective video analysis showed that the recurrence rates are not increased by skipping the peritoneum over the vas deferens and testicular vessels during laparoscopic PIRS repair in a short follow up period. Lack of objective criteria on the decision of skipping or not skipping the peritoneum on the vas deferens and the bias it caused are the greatest limitations of this study. Retrospective nature of the study, relatively low number of patients, short length of follow up and evaluation of only one method of IH repair among many are the other main limitations. But the authors suggest that the results of this analysis may encourage future randomized controlled studies regarding this issue.

Abbreviations

PIRS - Percutaneous Internal Ring Suturing

IH – Inguinal Hernia

OR – Open Repair

Declarations

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Authorship Confirmation/Contribution Statement

Author 1: Conceptualization (lead); writing – original draft (lead); formal analysis (lead); writing – review and editing (equal);

Author 2: Methodology (lead); review and editing (equal);

Author 3: Conceptualization (supporting); Software (lead); writing – review and editing (equal).

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Figures

Figure 1

Patient Selection

Figure 2

2.1: Right indirect inguinal hernia

2.2: Peritoneum over vas deferens was skipped

2.3: The loop was sent into the peritoneal cavity

2.4: Last view after repair

Figure 3

3.1: Right indirect inguinal hernia

3.2: The loop which contains all the peritoneum was sent into the peritoneal cavity

3.3: Last view after repair