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Laparoscopic Treatment of Inguinal Hernia in Female Children – National Experience

Toni Risteski

University Clinic for Pediatric Surgery, University "St. Cyril and Methodius", Skopje, Republic of North Macedonia
E-mail: drtonirist@yahoo.com

Abstract. *Background.* Although, laparoscopic inguinal hernia repair in children is gaining ground as a safe, feasible, and popular method, still many pediatric surgeons continue to debate its safety, efficacy, and cosmesis in comparison with conventional open repair. *Materials and methods.* This was a prospective clinical study, that elaborated 98 female children aged 1–14 with clinically diagnosed indirect inguinal hernia. Equal proportions of 49 children were treated via laparoscopic (PIRS) either conventional open repair (OR). Outpatient clinic follow up was performed regardless of the type of the intervention, on the 7th day and 6 weeks after discharge. *Results.* The mean age of children in PIRS vs. OR group was 5.3±2.7 vs. 5.9±3.3 years. There was no significant differences between the groups related to age (p = 0.4221), weight (p = 0.5482), family history (p = 0.5377), and residency rural/urban (p = 0.3161). The average length of unilateral vs. bilateral PIRS repair (29.5±6.8 vs. 43.6±7.2 min) was significantly shorter than OR (44±4.2 vs. 97±8.1 min) for consequently p = 0.0023 vs. p = 0.00001. The post-operative hospitalization after PIRS repair was 14.1±3.1 hours and was significantly shorter compared to OR – 44±4.2 hours (p = 0.00001). In OR group, 4 (8.2%) children had postoperative nausea compared to none in PIRS group. Significantly bigger cosmetic satisfaction was found in PIRS compared to OM group (p = 0.0001). *Conclusion.* With due respect to OR as a gold standard, the proven advantages of PIRS are motivation for further improvement of this technique for the purpose of treatment of inguinal hernia of female children.

Key words: inguinal hernia of children, percutaneous internal ring suturing, laparoscopic surgery, minimal invasive.

Introduction

Inguinal hernias are the most common form of abdominal wall hernias to which attributed approximately 7% of surgical consultations and 12% of the total surgery time [1]. Pediatric inguinal hernias are the most common diagnosis for which pediatric surgeons are consulted, while their surgical treatment is one of the most common pediatric surgical procedure. Inguinal hernias can occur at any age, with developmental origin in childhood and dominant frequency among premature infants. About 1–5% of all children have a possibility to develop inguinal hernia, while this percentage increases to 10% in children with a positive family history [1].

The incidence of inguinal hernia varies according infant maturity: 3–5% in full-term infants, 10–30% in premature infants, 13–21% in infants born before the 33rd gestational week, and 30% in newborns with birth weight lower than 1 000 grams [2–4]. The average age of occurrence is 3–4 years, while almost 1/3 of the cases are manifested before the age of six months [5]. The incidence in males is much higher than that of female children [2, 5, 6].

Surgery is required for all pediatric patients diagnosed with inguinal hernia. The surgical procedure for inguinal hernia is safe, and it prevents the occurrence of complications, such as incarceration and obstruction, which may potentially result in ischemia and necrosis of the hernia content, as well as of the surrounding tissue

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[7–9]. In infants younger than 6 months, inguinal hernia should be carried out as soon as possible due to the high incidence of incarceration [10, 11]. In girls, there is a possibility of torsion along with ovarian ischemia [8, 9]. In comparison with boys, girls with inguinal hernia, whose content are the ovaries and Fallopian tubes, are at risk of compression or torsion of the gonad structures, which leads to ovarian ischemic stroke [12, 13].

In the last decade, with the technological developments in surgical sets of minimally invasive techniques, the treatment of inguinal hernia in childhood started to converged from traditional open to laparoscopic surgery. For many authors the advantages of laparoscopic hernioplasty offers the excellent visual exposition, minimal dissection, reduced trauma of the inguinal canal. Different studies underlines that this method keeps the external abdominal wall unchanged, gives possibility for the evaluation on the contralateral side with minimal dissection, had no trauma and resulted with reduced duration especially in bilateral hernioplasties. In laparoscopic hernioplasty there is no longitudinal skin incision in the anterior-lateral abdominal wall with the opening and separation of the muscles in that area, which improved esthetic results, with lower risk of infection and pain [14]. Still the traditional open approach is the gold standard for this procedure and there is a need more results to be shown to convince many generation of pediatric surgeons in countries in transition to accept the advantages of new laparoscopic procedures.

The aim of this study was to compare the outcomes from the conventional open and laparoscopic (PIRS) repair of inguinal hernia in female children.

Patients and methods

This was a prospective clinical study, carried out at the University Clinic for Pediatric Surgery, University "St. Cyril and Methodius", Skopje, Republic of North Macedonia, which is a single national center for laparoscopic (PIRS) repair of inguinal hernia in female children. The study was performed from April 2015 to August 2017. The study elaborated 98 female children aged 1–14 with clinically diagnosed indirect inguinal hernia. Equal proportions of 49 children were treated via laparoscopic (PIRS) or conventional open repair (OR). Outpatient clinic follow up was performed regardless of the type of the intervention, on the 7th day and 6 weeks after discharge. During the period of the implementation of this study, the University Clinic for Pediatric Surgery was the only place where the PIRS treatment of clinically diagnosed indirect inguinal hernia of female children was performed.

The study work was approved by the Ethic Committee of the Medical Faculty, University "St. Cyril and Methodius", Skopje. Children underwent either OR or PIRS treatment based on preferences of their parents/guardians and already signed informed consent. The variables of interest for comparison were operative time, time to verticalization (normal position in bed, standing/walking), hospital stay, nausea, pain and cosmetic effects (size and visibility of mark). We asked parent/guardian in collaboration with their children to filled in the visual analogue scale – from 0 (no pain) to 10 (worst possible postoperative pain).

Statistical analyses

The data was statistically analyzed in SPSS software package, version 22.0 for Windows (SPSS, Chicago, IL, USA). We used Shapiro-Wilk test for testing the normality. Quantitative series were present as mean, median and standard deviation. The Mann-Whitney U test was used to compare the differences between two independent groups when the dependent variable was either ordinal or continuous, but not normally distributed. To determine the association between qualitative variables we used Pearson Chi-square test. A two-sided analysis with a significance level of $p < 0.05$ was used to determine the statistical significance.

Results

Total of 98 female children with 114 inguinal hernia repairs were performed by the two pediatric surgery teams, each specialized either in PIRS or OR technique. Equal proportions of 49 children were treated via one of the two surgical treatments. The mean age of children in PIRS vs. OR group was 5.3±2.7 vs. 5.9±3.3 years. There was no significant differences between the groups related to age (p = 0.4221), weight (p = 0.5482), family history (p = 0.5377), and rural/urban residency (p = 0.3161). In PIRS vs. OR group, the number of children with right side inguinal hernia was 29 (59.2%) vs. 27 (55.1%), with left side was 19 (38.8%) vs. 18 (36.7%), while those with hernia on both sides was 1 (2.0%) vs. 4 (8.2%) (p = 0.3871).

In the PIRS group, 22 (44.9%) of the children had hernia for 1–2 years, followed by 11 (22.4%) that had it for 6–12 months, 8 (16.3%) for 2–5 years, and 3 (6.1%) for more than 5 years. Nobody in this group had hernia less than 1 month. In the OR, about 12 (24.5%) had hernia for 1–6 months, followed by 11 (22.4%) for 6–12 months, 9 (18.4%) for more than 5 years, 8 (16.3%) for 1–2 years, and 3 (6.1%) for less than 1 month.

In PIRS vs. OR group about 32 (65.3%) vs. 24 (59%) of the children feel discomfort (p = 0.1025), 18 (36.7%) vs. 13 (26.5%) had symptoms (p = 0.2774), 9 (18.4%) vs. 13 (26.5%) experienced pain (p = 0.3328) and 43 (87.8%) vs. 44 (89.9%) had swelling (p = 0.7489) respectively.

The length of the inguinal opening in PIRS vs. OR group was 3±21.7 cm vs. 2.8±1.3 cm, with a min/max of 2/5 cm in both groups. In PIRS group, 2 (4.1%) cases had conversion in the open technique, and 16 (32.7%) had presence of hidden hernia.

The average length of unilateral vs. bilateral PIRS repair (29.5±6.8 vs. 43.6±7.2 min) was significantly shorter than OR repair (44±4.2 vs. 97±8.1 min) for consequently p = 0.0023 vs. p = 0.00001. The postoperative hospitalization after PIRS repair – 14.1±3.1 hours was significantly shorter compared to OR repair – 44±4.2 hours (p = 0.00001). The time needed for full return to a normal position in bed as well as standing/walking was 2.6±0.6 vs. 3.6±0.8 hours in PIRS repair and 4.2±0.6 vs. 5.7±0.7 hours in OR repair (p = 0.00001).

None of the patients in PIRS and 4 (8.2%) in OR group had postoperative nausea. In PIRS group the average grade of pain according to the VAS scale was 0.3±0.5, with a min/max of 0/2 and 50% of the children with no pain for Median IQR = 0 (0–1). In the OR, the average grade of pain was 2.6±1.6, with a min/max score of 0/7 and 50% of children with pain higher than 2 for Median IQR = 2 (1–3).We found postoperative pain to be significantly lower in PIRS compared to OR group (p = 0.00001).

In the PIRS group, with analgesic therapy, were 4 (8.2%), while in the OR group 37 (75.5%) of the children with significant differences in higher of lower number in PIRS group (p = 0.0001). The probability that the patients from OR group would take analgesic therapy was 34.7 times significantly higher compared to the patients from the PIRS group [OR = 34.7 (10.3–116.6) 99% CI]. In PIRS group, all 4 (100%) participants who took analgesic therapy, took only one dose while in OR group most or 15 (40.5%), took two doses of analgesics, followed by 11 (29.7%) who took one dose, 9 (24.3%) who took three doses, and 2 (5.4%) participants who took four doses.

We also analyzed the participants in regards to the size of the mark, for which measuring of the mark in both directions was done: inguinum right and inguinum left. Differences between the groups related to the length of inguinum left as well as right was in favor of PIRS group (p = 0.00001) (Table 1).

The analysis showed that none of the patients from the PIRS group thought the mark disrupted the esthetics, and the 11 (22.4%) weren't determined in their answer, while in the OR group about 36 (73.5%) thought that the mark disrupted the esthetics, while 23 (23.5%) answered that they weren't determined in their answer. In the PIRS vs. OM group, esthetics is important for 37 (75.5%) vs. 44 (89.8%) participants. In regards to this question, those that didn't have a particular opinion were 12 (24.5%) vs. 5 (10.2%) par-

ticipants (p = 0.0618). Satisfied by the esthetic look in the PIRS vs. the OR group were 46 (93.9%) vs. 5 (10.2%) of parents/guardians with 3 (6.1%) vs. 31 (63.3%) of those that didn't have a particular opinion regarding this question (p = 0.00001).

Table 1. Analysis of mark's size for inguinum right and left

Groups	N	Average (Mean)	Standard Deviation	Min	Max	Percentiles		
						25th	50th (Median)	75th
Mark – infvinum right – Z = –7.2726, p = 0.00001*								
PIRS	39	2.21	0.41	2	3	2	2	2
OR	33	38.24	4.09	31	45	35	38	42
Mark – ingvinum left – Z = –5.710, p = 0.00001*								
PIRS	25	2.20	0.41	2	3	2	2	2
OR	20	38.40	4.83	30	45	35	40	42.5
Mann-Whitney U Test (Z)					*significant for p < 0.05			

Discussion

Surgery is always necessary in the treatment of congenital inguinal hernia in infants and children [4, 15]. Because of the risk for incarceration, that is up to 31% in the first couple of months of life beginning. The laparoscopic era introduced wide range of changings in surgical approach followed by alteration in needed anesthesia, and design of instruments. During the years, it grown into an alternative to open hernioplasty in children [16–19].

As opposed to the European and global experiences with the laparoscopic treatment of inguinal hernia in children, our national experience are much smaller even, bearing in mind the negative experiences of other countries, we moved directly on to one-port technique. The last decade marks an evolution in techniques, from three-port to two-port, and today minimally invasive one-port technique [20].

At the beginning, the laparoscopic treatment often lasted longer than the open technique treatment [21]. However, once the learning curve was passed, the duration gradually decreased [16, 22–24].

Based on published experience, the laparoscopic treatment of inguinal hernia lasted between 20 and 74 min. The total operating time decreased once the learning curve was passed [24, 25]. Our operative time for bilateral intervention was 43.6±7.2 min, and for the unilateral was 38±9 min which was shorter than Chang et al. [26] who reported 42.9±24.7 min due to the time needed to set up the additional instruments in 7 (3.3%) patients. In our study, all the interventions were completed without the use of additional trocars.

According to Patkowski, on the sample of 140 hernias the average PIRS operative time for unilateral hernias was 19 min, while for bilateral was 24 min [27]. Wolak and Patkowski in reported the average PIRS time of 31.6 min for bilateral, and 28.2 (15–45 min) for unilateral hernias [28]. For Lipskar's the average operative time was 37±10 min [29]. In our study average length of PIRS repair was significantly shorter than OR repair as was found by Hammad et al., on 133 hernias, Shalaby et al. on 874 hernias, and Takehara et al. on 972 treated hernias [1, 4, 30, 31].

In the series by Li et al., the postoperative hospital stay after laparoscopic intervention was 48 (26–52) hours, which was double compared to our study [32]. Bharathi, reported dismissing all the patients, except for 1, within 10 hours after the surgery [14].

In studies published by N. Saha et al. and S.A. Nah et al. demonstrate similar time of total intake of food and length of hospital stay of the laparoscopic as opposed to the conventional technique [33, 34]. Yang et

al. in their meta-analysis showed that there was no significant difference regarding the issue of intake of food and hospital stay [21]. We found 8.2% children with postoperative nausea in OM, compared to none in PIRS repair group.

In our analysis, the time needed for full return to a normal position in bed as well as standing/walking was 2.6 vs. 3.6 hours in PIRS and 4.2 vs. 5.7 hours in OM repair, which is quite quicker than 6 vs. 10 hours respectively found in laparoscopic group in other studies [31].

The difference in postoperative pain regarding the laparoscopic and open technique is a subject of controversy. Some report less pain, while others report more pain in the immediate postoperative period after the laparoscopic, i.e. the open technique [35, 36]. In our study we found significantly less pain as well as less need for analgesic therapy in PIRS group.

Bharathi et al., reported cuts of 5 mm in the laparoscopic group and 3–4 cm in the open technique [35]. Patkowski et al., reported nearly no visible scars and Chan et al. stressed the superiority of the laparoscopic technique as one with an excellent aesthetic effect [27, 37]. In a retrospective study by Amano et al., from 995 OM patients and 1.033 patients with laparoscopic hernioplasty, regarding the visibility of the scar, on a scale of 1–5, the results were 4.7±0.6 for the open group, and 4.9±0.5 for the laparoscopic group with no significant differences (p = 0.58) [38]. In our study, PIRS patients were significantly more satisfied with mark aesthetics compared to OM patients.

Limitations

Even this study covered the cases of inguinal hernia in female children at national level, still the limitation was the small number of patients, surgical procedures performed at a single center by two pediatric surgery teams as well as the lack of follow-up period for evaluation of the long-term postoperative result, including recurrence of contralateral inguinal hernias.

Conclusion

We found PIRS as safe and efficient procedure. Although this study compared a small number of cases and the surgical experience was rather limited, still the results show that PIRS could be a valuable alternative to an open surgical approach in inguinal hernia repair due to simplicity, short operative time, minimal invasiveness, and excellent cosmetic results. With due respect to OR as a gold standard, the proven advantages of PIRS are motivation for further improvement of this technique for the purpose of treatment of inguinal hernia of female children.

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