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**The laparoscopic repair of inguinal hernia in female children in the
Republic of North Macedonia**

Лапароскопска операција ингвиналне херније код женске деце у
Републици Северној Македонији

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The laparoscopic repair of inguinal hernia in female children in the Republic of North Macedonia

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SUMMARY

Introduction/Objective Laparoscopic inguinal hernia repair in children is a minimally invasive method, and with its safety, feasibility and excellent cosmesis is an acceptable alternative in comparison with open repair.

Methods This is a prospective clinical study, with national data of 49 female children aged 1-14, treated via laparoscopic approach. Operative time, time to verticalization (normal position in bed, standing/walking), hospital stay, nausea, pain and cosmetic effects (size and visibility of mark), were elaborated.

Results The results revealed that 5 (10.2%) children had a family history of inguinal hernia. A total of 29 (59.2%) children had hernia located on the right side, 19 (38.8%) on the left side and 1 (2%) on both sides. The average diameter of the inguinal opening was 3 ± 2.17 cm. Sixteen children (32.7%) had presence of hidden hernia. The average operation time of the unilateral intervention was 29.5 ± 6.8 min, and for bilateral hernias it was 43.6 ± 7.2 minutes. The average length of hospitalization was 14.1 ± 3.1 hours, and the time needed for a full return to a normal position in bed was 2.6 ± 0.6 hours. The average length of scar in the right, as well as in left groin region was 2.2 ± 0.4 mm. A total of 46 (93.9%) parents/guardians were satisfied by the aesthetic look, while 3 (6.1%) had no particular opinion regarding this question.

Conclusion The introduction of laparoscopic surgery in the treatment of inguinal hernia is a promising method, which plays an important role as an alternative surgical technique because of the minimal invasiveness of the technique and improved recovery of the children.

Keywords: children's inguinal hernia; PIRS – percutaneous internal ring suturing; minimal invasive surgery

САЖЕТАК

Увод/Циљ Лапароскопска техника решавања ингвиналне киле код деце је минимално инвазивна метода, са великом сигурношћу, изводљивошћу и одличним козметским резултатом, прихватљива је алтернатива у поређењу са стандардном отвореном процедуром.

Метод Ово је проспективна клиничка студија, са националним подацима о 49 девојчица узраста од 1 до 14 година оперисаних лапароскопским приступом (*PIRS-Percutaneous Internal Ring Suturing*). Анализирано је оперативно време, време до вертикализације (нормалан положај у кревету, стајање / ходање), боравак у болници, мучнина, бол и козметски ефекти (величина и видљивост ожиљка).

Резултати Породичну анамнезу о постојању ингвиналне киле имало је 5 (10,2%) деце. Килу локализовану на десној страни имало је 29 (59,2%), на левој 19 (38,8%) и обострано 1 болесник (2%). Просечан дијаметар ингвиналног отвора износио је $3 \pm 2,17$ cm. Шеснаесторо деце (32,7%) имало је скривену килу. Просечна дужина једностране интервенције била је $29,5 \pm 6,8$ минута, а билатералне киле $43,6 \pm 7,2$ минута. Просечна дужина хоспитализације била је $14,1 \pm 3,1$ сата, а време потребно за пуни повратак у нормалан положај у кревету било је $2,6 \pm 0,6$ сата. Просечна дужина ожиљка након операције била је $2,2 \pm 0,4$ mm. Четрдесет шест (93,9%) родитеља/старатеља били су задовољни естетским изгледом, а без посебног мишљења о овом питању била су 3 (6,1%) родитеља.

Закључак Увођење лапароскопске хирургије у лечење ингвиналне киле је обећавајућа метода која игра важну улогу као алтернативна хируршка техника, због минималне инвазивности технике и бољег опоравак деце.

Кључне речи: дечија ингвинална кила; перкутано ушивање унутрашњег прстена; минимално инвазивна хирургија

INTRODUCTION

Inguinal hernias are far more common in males [1, 2, 3]. Available data suggest that the overall incidence of inguinal hernias in childhood ranges from 0.8% to 4.4% (to more than

30% in preterm born infants), with the incidence in boys being 10 times higher compared to girls. Similarly, a study of almost 80.000 children in the USA showed that the cumulative incidence of inguinal hernia from birth to the age of 15 was 6.62% in males and 0.74% in females [4, 5].

Surgery is required for all almost pediatric patients with inguinal hernia. Unlike hernias in adults, hernias in children are treated when they are diagnosed, even if they are asymptomatic. It is the most common surgical procedure in children that makes up more than 95% of treatments of all hernias [6, 7]. Operation prevents the occurrence of complications, such as incarceration and obstruction, which may potentially result in ischemia and necrosis of the hernia content. In comparison with boys, girls with inguinal hernia, whose content are ovaries and Fallopian tubes, are at risk of compression or torsion of the gonadal structures, which leads to ovarian ischemic stroke [8].

The golden standard for treatment of inguinal hernia is open herniotomy and herniorrhaphy, a procedure with a high rate of success and a relatively low rate of complications [6]. Still, inguinal hernia treatment has achieved great advancements over the centuries [6]. The introduction of laparoscopic surgical treatment for inguinal hernia, first performed in 1993 and 1994, seems to play a significant role in terms of safety, visibility, as well as simultaneous treatment of the contralateral side, and a better aesthetic result [9].

The trend has been turned towards the application of laparoscopic techniques with a rapid movement forward and a number of different laparoscopic techniques, an upward trend of the use of extracorporeal knotting and decrease of the use of working ports and endoscopic instruments, as alternatives for open surgery [10–16].

The laparoscopically assisted technique of percutaneous internal ring suturing with one port, was initially introduced by Patkowski in 2004, as a minimally invasive method with a high success rate and rare complications [17].

It seems that among numerous techniques for treatment of inguinal hernias during childhood in the last decade, the one-port laparoscopic technique of internal ring suturing represents a very competitive achievement regarding this issue [18, 19].

The aim of this study was to present the national experience of Republic of North Macedonia in laparoscopic (PIRS) repair of inguinal hernia in female children.

METHODS

The analysis represents a prospective clinical study, which has elaborated national data of 49 female children 1-14 years old, with clinically diagnosed indirect inguinal hernia treated performing laparoscopic percutaneous internal ring suturing (PIRS). The study was carried out at the University Clinic for Pediatric Surgery, “Ss. Cyril and Methodius” University, Skopje, Republic of North Macedonia – as the single national center for laparoscopic (PIRS) repair. We started to implement this technique during 2015, as the only institution where the PIRS treatment of clinically diagnosed indirect inguinal hernia of female children was performed.

The PIRS method we used had been introduced by Patkowski and involves the percutaneous closure of the internal inguinal ring under the control of a telescope placed in the umbilicus. The telescope was used to control all procedures, with optics of 5 mm, and an angle of view of 30°.

The insufflation pressure in the peritoneal cavity was maintained at 8 mm to 10 mm Hg. The internal ring of the inguinal canal was closed using non-absorbable 2-0 monofilament sutures. The wound in the umbilicus was closed using absorbable 3-0 sutures, and the skin was closed with non-absorbable 4-0 or 5-0 monofilament sutures. The patient condition allowed discharge on the first postoperative day.

The study covered all national cases of interest during the period between 2015 and 2017. We elaborated the operative time, time to verticalization (normal position in bed, standing/walking), hospital stay, nausea, pain and cosmetic effects (size and visibility of mark). All the children were asked for outpatient follow-up examination on the 7th day and 3 months after the laparoscopic surgery. At the time of the second follow-up visit parents were asked of symptoms, such as recurrent hernia, swelling or lump in the groin, local pain,

palpable stitches in the groin area, and their personal opinion on the appearance of the scar and whether, if necessary, they would choose this treatment again or recommend it to others.

The study was approved by the Ethics Committees of the University Clinic of pediatric surgery and Faculty of Medicine of the University of “Ss. Cyril and Methodius” Skopje. Written consents from parents/guardians were obtained according to the Declaration of Helsinki and local ethics committees.

RESULTS

The study presents national data of 49 female children with clinically diagnosed indirect inguinal hernia. All of them aged 1–14 year [mean age 5.3 ± 2.7 with Median IQR = 5 (3–7)] and were treated via PIRS during the three-year period (2015–2017).

Characteristics of inguinal hernia

The 5 (10.2%) children had a family history of inguinal hernia. A total of 29 (59.2%) children had hernia located on the right side, 19 (38.8%) had it on the left side, and 1 (2.0%) had it on both sides. About 22 (44.9%) children had hernia for a duration of 1-2 years, followed by 11 (22.4%) where the duration was 6-12 months, 8 (16.3%) with a duration of 2-5 years, and 3 (6.1%) with a duration of more than 5 years. None of the females had hernia with a duration of less than 1 month.

Pre-operative symptoms

About 32 (65.3%) children felt discomfort, 9 (18.4%) experienced pain and 43 (87.8%) had swelling. The average number of existent pre-operative symptoms in children was 2.1 ± 0.7 , with min/max 1 to 4 symptoms.

Intervention

The length of the inguinal opening was 3 ± 2.17 cm with a minimum of 2 cm and a maximum of 5 cm. During intervention, 2 (4.1%) cases had conversion in the open technique. In 16 (32.7%) children the presence of hidden hernia was found, 50% of them on the left side and 50% on the right side, all surgically treated during the same intervention. The average length of the unilateral intervention was 29.5 ± 6.8 min, with min/max time of 15/45 minutes. In the bilateral hernias, the average length of the intervention was 43.6 ± 7.2 minutes, with min/max time of the intervention 25/55 minutes, and 50% females where the length of the intervention was less than 45 minutes.

Hospitalization

The average length of hospitalization was 14.1 ± 3.1 hours, with min/max time of hospitalization of 10/24 hours, and 50% females where the length of postoperative stay in hospital was less than 12 hours.

Return to normal activities

The time needed for a full return to a normal position in bed was 2.6 ± 0.6 hours, with a min/max time of 2/4 hours and 50% patients where the time was shorter than 3 hours. The time to verticalization was 3.6 ± 0.8 hours, with a minimum of 2 and a maximum of 6 hours. In 50% of females this time was shorter than 4 hours.

Postoperative discomfort

None of the females had postoperative nausea. The average grade of pain according to the VAS scale 0 to 10 was 0.3 ± 0.5 , with a min/ max of 0/2. No pain was registered in 50% of the patients. Analgesic therapy with one dose was given to 4 (8.2%) children.

Aesthetics

The average length of the scar was 2.2 ± 0.4 mm, with min/max length of 2/3 mm and in 50% the scar was smaller than 2 mm for Median IQR=2 (2-2). Aesthetics was an important issue for 37 (75.5%) of parents/guardians. In our case, 38 (77.5%) parents/guardians thought that the mark did not disrupt the aesthetics, while 11 (22.5%) were undetermined. About 46 (93.9%) parents/guardians felt that they would recommend this intervention to others who have children with inguinal hernia.

DISCUSSION

Throughout the history many concepts of surgical treatments of hernia have changed and been applied by pediatric surgeons in their everyday practice [6]. The last decade marks an evolution in techniques, from three-port to two-port, and one-port laparoscopic technique [9–13].

Intracorporeal suturing and knotting are becoming unpopular among pediatric surgeons according to the results of various studies. Intraabdominal skills are necessary, such as intracorporeal suturing, knotting and needle handling, which in essence take up a lot of time in context of the time needed to carry out the procedure [16].

At the beginning, the laparoscopic treatment often lasted longer than the open technique treatment. However, once the learning curve was passed, the duration gradually decreased [16]. Researchers have shown that the operating time was in an interval between 20 and 74

minutes [17]. Patkowski on the sample of 140 hernias, discovered that the average PIRS operative time for unilateral hernias was 19 minutes, while for bilateral was 24 minutes [17].

Wolak and Patkowski reported the average PIRS time of 31.6 minutes for bilateral, and 28.2 (15-45) minutes for unilateral hernias [19]. For Lipskar the average operative time was 37 ± 10 minutes [20]. The average length of the unilateral intervention in our study was 29.5 ± 6.8 min, with min/max time of 15/45 minutes. In the bilateral hernias, the average length of the intervention was 43.6 ± 7.2 minutes, with min/max time of the intervention 25/55 minutes.

With the conventional open surgical techniques, patients have a relatively larger skin incision, while in the other laparoscopic treatments three or four skin incisions are necessary for inserting the trocars. The PIRS technique can be carried out with only one incision, concealed in the bellybutton region and extracorporeal suture. In comparison with open surgery, laparoscopic hernioplasty offers excellent visual exposition, minimal dissection and reduced trauma of the surrounding tissue. It offers the opportunity to identify unexpected conditions, such as direct or femoral hernia, as well as other intraabdominal processes and pathologies (intersexual anomalies) and other conditions [13-16].

Chan et al. discovered that children after the laparoscopic treatment of inguinal hernia had less pain and had made faster recovery, which is similar to our results [21]. We found that none of the children had postoperative nausea, and for full return to a normal position in bed as well as standing/walking the time was 2.6 vs. 3.6 hours.

One of the advantages of laparoscopic hernioplasty is the possibility of exploration of the contralateral side, which in fact means higher costs and distress to the child and their parents. Around 38-100% of children with unilateral inguinal hernia have contralateral open PPV(patent processus vaginalis) [22]. In 60% of children with unilateral hernia, contralateral PPV is present at 2 years of age, in 40% it is present for those over 2 years of age, while half of these children are at risk and can develop inguinal hernia. There is a risk of about 10% of development of hernia, if the hernia from the left is primarily treated.

However, Li et al. reported a rate of development of metachronous hernia of 5.2% [23]. It is believed that the sex of the child, girls as opposed to boys, has a slight influence on the

incidence of metachronous hernia (boys 6.05% as opposed to girls 6.59%; $r=0.202$) [24, 25]. In our research we found in 32.7% the presence of contralateral PPV, 4 on the left and 4 on the right side all treated during the same intervention. With contralateral exploration and suturing of the asymptomatic inner inguinal ring, the manifested contralateral inguinal hernia can be prevented, and the need for additional surgery later in life is omitted for the child.

As the PIRS technique has been offering excellent esthetic results, the majority of parents are satisfied with the use of this method for their children and recommend it to other parents whose children need to undergo surgery of this type.

Bharathi et al. reported scars of 5 mm in PIRS treatment [26], Patkowski et al. reported nearly no visible scars, and Chan et al. stressed the superiority of the laparoscopic technique as one with an excellent esthetic effect [17, 27]. In a retrospective study by Amano et al., from 1.033 children with laparoscopic hernioplasty, on a scale of satisfaction from 1-5 (5 being the highest), regarding the visibility of the scar, the results were 4.9 ± 0.5 points [28]. In our study 77.5% of the parents/guardians thought that the mark did not disrupt the esthetics and 93.9% of them were satisfied by the esthetic look.

According to the existent literature to date, there is no tool that would enable a view to the inside with a representation of the inner inguinal ring after its suturing. It is unknown whether the suturing of the inner inguinal ring keeps the inner ring closed for the patient's whole life, or whether some kind of fibrosis or reorganization of the peritoneum would contribute to that. Although there are data in the literature concerning recurrent laparoscopy in patients with previous laparoscopic hernioplasty, the sample of patients is simply too small to come to a conclusion [21, 22, 24]. Still, the lack of noted complications are making this technique an efficient and especially promising in girls [24].

CONCLUSION

The introduction of laparoscopic surgery in the treatment of inguinal hernia is a promising method, which plays an important role as an alternative surgical technique, while at the same time represents a diagnostic tool for exploration, and simultaneous treatment of

the contralateral inguinal ring. We found that this technique allows better recovery, quick return to full activity, and no visible scars. Most parents were satisfied with the treatment of their children by this method and would recommend it to others.

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