Analysis of the efficacy of high hernia sac ligation in adolescent indirect hernia

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Research Article

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Abstract

Objective

To evaluate the efficacy of high hernia sac ligation in adolescent indirect hernia.

Methods

The data of adolescent patients underwent high hernia sac ligation in the The First People's Hospital of Foshan, China from January 2012 to December 2019 were analyzed retrospectively, mainly collecting their age, gender, weight, surgical method, the hernia ring diameter, operation time, postoperative recurrence rate and postoperative complications.

Results

A total of 71 patients were enrolled, including 62 males (87.32%) and 9 females (12.68%), all patients aged 13–18 years old (mean 14.90 ± 1.57 years), weighing 28-92 kg (mean 53.08 ± 10.53 kg), 70 patients underwent laparoscopic surgery except 2 with irreducible hernias converted to laparotomy, 1 patient underwent open hernia sac high ligation. The hernia ring diameter: 0.5-3 cm (mean 1.39 ± 0.49 cm), and the diameter of the hernia ring ≤ 2 cm in 69 cases (97.18%), The operative length: 12-105 min (average 25.45 ± 13.19 min), There were 38 (53.5%) right-sided hernias, 32 (45.1%) left-sided hernias, 1 (1.4%) performed simultaneously bilaterally. There were 68 (95.8%) reducible hernias, 2 (2.8%) irreducible hernias, 1 (1.4%) incarcerated hernia. Hospital stay: 1–5 days (mean 2.37 ± 1.04 days), Follow-up 24-119 months (mean 73.56 ± 28.56 months), no recurrence, one case of incision infection occurred, A second operation was performed 6 months after the operation, 4 (5.6%) patients had complaints of intermittent pain around the ligation incision site mostly during exercise.

Conclusion

High hernia sac ligation is feasible for treat indirect hernia with a diameter of the hernia ring ≤ 2 cm.

Introduction

Inguinal hernias may present at all ages. The overall incidence of inguinal hernias in childhood ranges from 0.8% to 4.4% [1]. Indirect hernias of children are due to incomplete closure of the processus vaginalis [2]. The treatment of indirect inguinal hernia in children is high ligation. The incidence of adult inguinal herniorrhaphy is 27-42.5% in males and 3-5.8% in females [3-6]. The pathophysiology in adults is a result of a defect in the transversalis fascia because of weakness [7]. Therefore, the standard treatment for adult inguinal hernia is posterior wall repair. Currently, tension-free repair with mesh is most commonly used. Adolescents are a unique patient population between children and adults.
hernias should be treated by high ligation or mesh repair? This study retrospectively analyzed the clinical data of high hernia sac ligation in the treatment of adolescent indirect hernia to make clear its efficacy.

**Materials And Methods**

**The general information**

We retrospectively reviewed the data of adolescent patients who underwent inguinal hernia repairs from January 2012 to December 2019 in The First People's Hospital of Foshan, Guangdong, China. The inclusion criteria for this study were: age 13-18 years; primary indirect inguinal hernia; informed consent was signed by the patient's legal guardian; no dysfunction of vital organs, including the heart, lungs, liver, and kidneys. Exclusion criteria: age <13 years or >18 years; direct hernia; femoral hernia; recurrent hernia; patient who refused to sign informed consent; heart, lung, liver, and kidney failure. The patients' gender, age, weight, hernia characteristics, operative approach, operative length, intraoperative blood loss, length of stay, postoperative recurrence rate and complications were collected. Postoperative complications were defined as surgical site infection or mesh infection, symptomatic Seroma or hematoma, symptomatic hydrocele, postoperative pain.

**Surgical method:** The procedures of laparoscopic high hernia sac ligation were performed with the patient in the supine position under general anesthesia. An above umbilical 5.0-mm incision was made, and a 5.0-mm trocar was used to create a CO2 pneumoperitoneum that was maintained at 10–12 mmHg. Another 5.0-mm instrument was inserted through a 5.0-mm stab incision on the left umbilical side.

The size of the hernia diameter was measured (Figure 1). A 2mm incision was made at the body surface of the deep ring, and the sled needle with a 2-0 non-absorbable suture was punctured into the preperitoneum, through the medial peritoneal membrane of the deep ring and the vascular surface, to the bottom of the deep ring, and then the needle was punctured into the abdominal cavity (Figure 2), the suture was left in the abdominal cavity, and the needle was withdrawed. A crochet was inserted through the original incision, through the lateral peritoneal membrane of the deep ring, punctured into the abdomen through the original puncture hole, the suture was hooked and took out of the body surface by the crochet (Figure 3), the suture was knot subcutaneously, the high ligation of the hernia sac was complete (Figure 4).

**Follow-up:** Patients were followed up in the outpatient department at 1 week, 1 month, and 3 months after the operation. After 3 months post-operation, patients were followed up by telephone. If recurrence was suspected, the patient would be called back to outpatient and excluded by physical examination or imaging. No patients were lost to follow-up. The follow-up time of entire cohort was 24-119 months (mean 73.56 ± 28.56 months).

**Statistical method:** All statistical analyses were performed using the SPSS21 statistical software. Continuous data were expressed as the mean ± standard deviation.
Results

A total of 71 patients were enrolled, including 62 males (87.32%) and 9 females (12.68%), all patients aged 13–18 years old (mean 14.90 ± 1.57 years). Body weight was between 28-92kg (mean 53.08 ± 10.53kg). 68 underwent elective laparoscopic high hernia sac ligation except 1 incarcerated hernia underwent emergency laparoscopic surgery. 2 patients underwent laparoscopic surgery converted to laparotomy because of irreducible hernias. 1 patient underwent open surgery. The hernia ring diameter: 0.5-3cm (mean 1.39 ± 0.49cm), among them, the diameter of the hernia ring of 1 patient was 3cm, another patient was 2.5cm, and the other 69 (97.18%) patients were ≤ 2cm. The operative length: 12-105min (average 25.45 ± 13.19min). The amount of intraoperative bleeding was minimal and difficult to make accurate statistics. There were 38 (53.5%) right-sided hernias, 32 (45.1%) leftsided hernias, 1 (1.4%) performed simultaneous bilaterally. 24 patients (33.8%) performed simultaneous contralateral hernias. There were 68 (95.8%) reducible hernias, 2 (2.8%) irreducible hernias, 1 (1.4%) incarcerated hernia. Hospital stay: 1–5 days (mean 2.37 ± 1.04 days), Follow-up 24-119 months (mean 73.56 ± 28.56 months), no recurrence, one case of incision infection occurred, a second operation was performed 6 months after the operation, 4 (5.6%) patients had complaints of intermittent pain around the ligation incision site mostly during exercise. There was no hydrocele, hematoma and seroma.

Discussion

At present, there is no consensus on the cause and surgical treatment of adolescent indirect hernias. One opinion is that adolescent indirect hernias are considered to be the continuation of children's indirect hernias, some of those develop symptoms early in children and are not treated until adolescents, and some are born with incomplete closure of the processus Vaginalis that do not show clinical symptoms until adolescence. Therefore, the treatment of adolescent indirect inguinal hernia is high ligation. However, the other main opinion is that postpubertal adolescents have similar anatomy to the adults with a larger internal ring diameter and variations on transverse fascia defects[7]. So the indirect hernia of adolescents need to be repaired with tissue or mesh to strengthen the posterior inguinal wall.

Whether high ligation or mesh repair is more appropriate for the treatment of adolescent hernias mainly depends on the postoperative recurrence rate. Most recurrences are likely to occurred within 2 years after inguinal hernia repair, but the recurrence rate will increase with the extension of follow-up time [8–13]. The recurrence rate of inguinal hernia after operation is 0-6.3% [14–16]. The tension-free mesh repair is helpful to reduce the recurrence rate and has become the mainstream operation for adult hernia. However, in adolescents, the body is still developing, the insertion of the mesh may result in foreign body rejection and infection, may affect the vas deferens, and may limit the body's development. If the recurrence rate do not increase with high ligation alone, it is better not to use a mesh for adolescent hernia patients. But the real situation is not so that, a study about the treatment of adolescent hernia emphasized the likelihood that the surgical procedure was driven by the surgeon's preferences, not necessarily the course of the disease or the outcomes of the patient[17]. The reason for this situation may be that there are rare studies on the treatment of adolescent hernias.
In this study, a retrospective analysis was made to evaluate the efficacy of high hernia sac ligation in the treatment of adolescent indirect hernias. After 24-119 months (mean 73.56 ± 28.56 months) of follow-up, the results showed the recurrence rate was 0%. Some other studies have shown that the recurrence rate of high hernia sac ligation without mesh for adolescent hernias was 0.95%-3.5%, which was also relatively low[7, 18]. The recurrence rate of high ligation for adolescent hernias was similar to that of mesh repair for adult hernias[19]. Another study reported that the recurrence rate of patients aged 18–25 years who underwent herniectomy without mesh placement or posterior wall repair is 0%[20]. These suggest that high hernia sac ligation without mesh placement or posterior wall repair is effective enough in treating adolescent hernias. However, none of these studies showed the size of the deep ring of the indirect hernia, as the size of the internal ring may affect the choice of the surgeon[17, 21]. The internal ring is small, the surgeon chooses the hernia sac high ligation more, the internal ring is large, and the surgeon chooses the mesh repair or tissue repair more. So how large the internal ring should the surgeon select mesh repair or tissue repair? How small select a simple high hernia sac ligation?

S. R. Lee et al[18] have done a comparative study of the high ligation of the laparoscopic hernia sac and the posterior wall repair in the adolescent indirect hernia. The size of the internal ring diameter in the two groups was 2.37 ± 0.52 (1.60–3.62) cm vs 2.41 ± 0.58 (1.59–3.65) cm (p = 0.592). The results showed that the recurrence rate in high ligation group (4/115, 3.48%) was higher than that in posterior wall suture repair group (0/129, 0%) (p = 0.048). Shen Yingmo et al[22] have done a prospective comparative study between high ligation and Lichtenstein hernioplasty using acellular tissue matrix (ACTM) grafts in adolescent patients. The diameter of the two groups was 2.2 ± 0.5 cm vs 2.3 ± 0.5 cm (p = 0.499). The results showed that the recurrence rate no difference between the two groups 6% (3/50) vs 0% (0 / 50) (p = 0.079), but subgroup (the patients with Gilbert type 3 hernias) analysis found that the recurrence rate of high ligation group was higher than mesh repair group. The results indicated that indirect hernia repair in adolescents with an internal ring diameter greater than 3 cm and severe transverse fascia defect, mesh repair may be a more suitable surgical method.

From the current literature[18, 22], the conclusion seems to be drawn. The diameter of internal ring more than 3 cm or severe transverse fascia defect of adolescent indirect hernias were recommended to use mesh repair; when the diameter of internal ring between 2-3 cm, the efficacy of high hernia sac ligation was controversial, these patients can be considered laparoscopic posterior wall suture repair or open muscle repair. In our study, 97% of adolescent indirect hernia patients with an internal ring diameter ≤ 2 cm, these patients were treated with high hernia sac ligation, the recurrence was 0. Therefore, we believe that the ligation of high hernia sac in adolescents with an internal ring diameter ≤ 2 cm is effective. But we should also note that in our study, the number of cases was small; no comparative study was done; the follow-up time of some patients was short; patients with recent surgery must be followed for a longer period of time to observe the true recurrence rate.

The main complication after inguinal hernia repair is seroma, the high ligation of the hernia sac does not require the separation of the preperitoneal space and hernia sac, the incidence of seroma is low. No seroma occurred in this study. One case of incision infection occurred in this study, the patient underwent
laparoscopy converted to laparotomy because of irreducible hernia, 6 months after the operation, the wound was infected due to the non-absorbable suture knot which was removed by a second operation. 4 patients (4/71, 5.63%) had complaints of intermittent pain around the ligation incision site mostly during exercise. This was similar to previous research [7, 23]. the patient’s pain degree was mild, so no treatment was needed. No hydrocele occurred after surgery.

In summary, high hernia sac ligation in the treatment of adolescent indirect hernias with the diameter of internal ring \( \leq 2 \text{ cm} \) is effective, The rate of recurrence and complications is low. Therefore, this study suggests that high hernia sac ligation is effective enough for the treatment of adolescent indirect hernias with the diameter of internal ring \( \leq 2 \text{ cm} \) and no need to worry about the adverse effects of using the mesh. However, this study is a retrospective study with a small number of participants. Further prospective comparative study is required.

Declarations

Ethics approval and consent to participate

Subjects and their legal guardians have given their written informed consent and the First People’s Hospital of Foshan institutional review board has approved the study protocol. All methods were carried out in accordance with relevant guidelines and regulations or Declaration of Helsinki.

Consent to publish

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors’ contributions

GYF made substantial contributions to the conception of the study and the design of the work, acquisition and interpretation of data and drafted the manuscript. GY made substantial contributions to the conception of the study, acquisition and interpretation of data and revisions of the manuscript. All
authors have read and approved the manuscript.

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Not applicable

References


**Figures**
**Figure 1**

The size of the hernia diameter was measured

**Figure 2**

The sled needle with a 2-0 non-absorbable suture was puncture into the abdominal cavity
Figure 3

The suture was hooked and took out of the body surface by the crochet
Figure 4

The high ligation of the hernia sac was complete

Supplementary Files

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