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Testicular descent and fixation through a scrotal stria incision for the treatment of palpable cryptorchidism in children aged <3 years: 10-year experience with 1034 cases

Liu Chen, Wen-Hua Huang, Yun-Jin Wang, Qi-Liang Zhang, Chao-Ming Zhou, Xu Cui, Jian-Qin Zhang

This study was performed to summarize our clinical experience with testicular descent and fixation through a scrotal stria incision for the treatment of palpable cryptorchidism in children. This study included 1034 children with palpable cryptorchidism from March 2009 to March 2019. A scrotal stria incision was used to perform testicular descent and fixation. Overall, 1020 children successfully underwent surgical testicular descent and fixation through a scrotal stria incision, and 14 patients underwent conversion to inguinal incision surgery. All patients were discharged 1–2 days after the operation. During hospitalization and follow-up, 55 patients developed complications, including 10 patients with testicular retraction, 7 with poor healing of the incision, and 38 with a scrotal hematoma. No patients developed testicular atrophy, an indirect inguinal hernia, or a hydrocoele. Testicular descent and fixation through a scrotal stria incision for the treatment of palpable cryptorchidism in children is safe and feasible in well-selected cases. This method has the advantages of no scarring and a good cosmetic effect.

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INTRODUCTION

Cryptorchidism is one of the most common malformations of the urinary system in children, and surgery is the main method of treatment.[1,2] Cryptorchidism can be divided into palpable and nonpalpable types according to the location of the testicles, and approximately 80% of patients with cryptorchidism have the palpable type.[3,4] The treatment of cryptorchidism includes endocrine therapy and surgical treatment; however, the effects of endocrine therapy are not precise and are associated with adverse effects. Therefore, surgery is still the preferred treatment for cryptorchidism.[5] After Annandale[6] performed the first successful orchidopexy in 1879, inguinal approach is the current gold standard for palpable cryptorchidism. However, this method involves trauma and leaves obvious surgical scars that affect the patients' appearance.[6,7] Testicular descent and fixation through a scrotal incision for palpable cryptorchidism in children has the advantages of minimal trauma, a simple operation, and no postoperative scar. The procedure has been used worldwide in recent years and has produced good clinical results.[8,9]

PATIENTS AND METHODS

This study was approved by the Ethics Committee of Fujian Maternity and Child Health Hospital, Affiliated Hospital of Fujian Medical University, Fuzhou, China (number of Ethical Examination and Approval for Scientific Research Projects: 2019 and ethical approval No. 2004), and strictly adhered to the tenets of the Declaration of Helsinki. All of the patients' guardians provided written informed consent before the operation.

Patients

We retrospectively analyzed the clinical data of 1034 patients with palpable cryptorchidism in Fujian Maternity and Child Health Hospital, Affiliated Hospital of Fujian Medical University from March 2009 to March 2019, including preoperative, intraoperative, postoperative, and follow-up data. The inclusion criterion for this study was palpable cryptorchidism including the ectopic testes. The exclusion criteria were nonpalpable cryptorchidism; other congenital deformities, such as indirect hernia, hydrocoele, or hypospadias; age of >3 years; retracted testis; and refusal to provide written informed consent for surgery or refusal to comply with the follow-up schedule.

All patients (1034 patients with 1168 undescended testis) were diagnosed with palpable cryptorchidism based on their clinical manifestations, physical examination findings, and scrotal and inguinal color Doppler ultrasound findings. Among all cases of cryptorchidism, 321 occurred on the left side, 579 occurred on the right side, and 134 were bilateral; and 402 occurred at the upper pole of the scrotum, 534 occurred in the groin, and 98 involved a sliding testis. The patients' median age and weight were 16 (range: 7–36) months and 9.8 (range: 6.5–17.7) kg, respectively (**Table 1**).

Department of Pediatric Surgery, Fujian Maternity and Child Health Hospital, Affiliated Hospital of Fujian Medical University, Fuzhou 350001, China.
Correspondence: Dr. CM Zhou (sfyzhouchaoming@163.com)
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Table 1: Clinical data of the patients

Characteristics	*Value*
Patients (*n*)	1034
Age (month), median (range)	16 (7–36)
Weight (kg), median (range)	9.8 (6.5–17.7)
Left side/right side/bilateral (*n*)	321/579/134
Upper pole of scrotum type/groin type/sliding testis (*n*)	402/534/98
Operation time (min), median (range)	
Unilateral	22.8 (15.2–30.4)
Bilateral	43.5 (26.8–62.7)
Hospital stay (day), median (range)	1 (1–2)
Follow-up (month), median (range)	67 (1–121)
Incision length (cm), median (range)	1.7 (1.5–2.0)

Surgical procedure

After induction of anesthesia, the patient was placed in the supine position with the waist slightly raised using a cushion. We routinely disinfected and draped the surgical area. A 2.0-cm stria incision was made in the middle part of the scrotum (**Figure 1**). The skin and subcutaneous tissue were cut layer by layer. We fully exposed the external ring using a small retractor pulled upward through the incision after bluntly separating the space between the external oblique and Scarpa's fascia (**Figure 2**). The aponeurosis of the external abdominal oblique muscle was cut 1.0 cm to 1.5 cm through the external ring, and the middle and lower segments of the groin were thus fully exposed. After pushing the testicle to the area near the outer ring and clamping and cutting the processus vaginalis, the testicle was visible. The tissue between the spermatic cord and processus vaginalis was bluntly and sharply separated until the testicle could be descended to the bottom of the scrotum without tension. We transected the processus vaginalis in a high position (**Figure 3**) and reconstructed the outer ring orifice by suturing the aponeurosis of the external abdominal oblique muscle to ensure the integrity of the inguinal canal. The testicle was sutured in an interrupted manner to the dartos fascia of the scrotum with no torsion. We then closed the scrotal incision using 5-0 absorbable interrupted sutures.

If the testicle could not drop to the bottom of the scrotum after sufficient free release of the spermatic cord, or if obvious tension was present in the testicular fixation, we performed testicular descent and fixation through an inguinal incision. A groin incision was added and the inguinal canal was opened to free the spermatic cord more fully at a higher position until the testicle could be fixed at the bottom of the scrotum without tension.

All operations were performed by two associated chief physicians (LC and XC) and one chief physician (CMZ) of our hospital, all of whom followed the above-described procedural protocol.

RESULTS

In total, 1020 children (1154 undescended testes) successfully underwent surgery for testicular descent and fixation through a scrotal stria incision. Fourteen patients underwent conversion to inguinal incision surgery. The reason for failure of the operation was that the testicular position was high, located in the upper segment of the inguinal canal near the inner ring. After the spermatic cord was fully loosened via the scrotal incision, the testes of five patients could not drop to the bottom of the scrotum and nine patients had obvious tension at the fixation site; therefore, one inguinal incision was added and a traditional operation was performed. The median operation time for patients with unilateral and bilateral cryptorchidism was 22.8 (range: 15.2–30.4) min and 43.5 (range: 26.8–62.7) min, respectively.

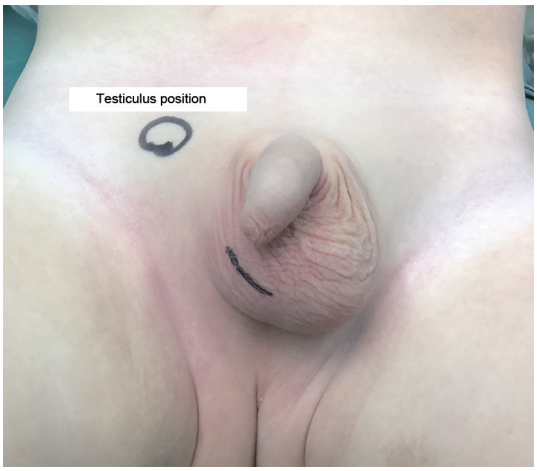

Figure 1: Position of testiculus and incision.

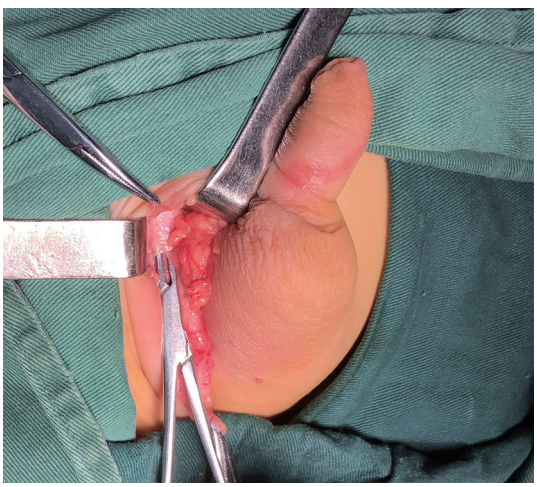

Figure 2: Exposing the external ring.

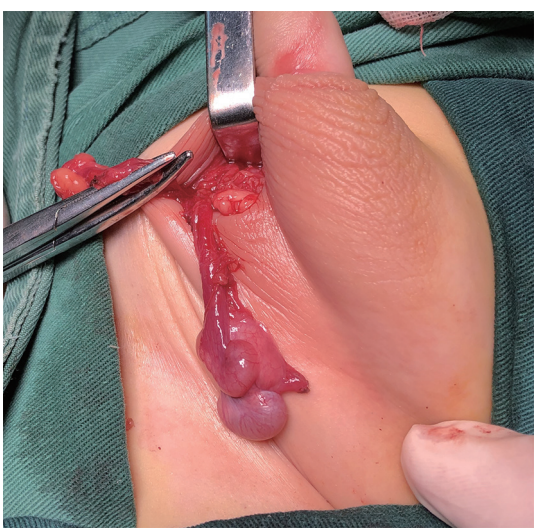

Figure 3: Transecting the processus vaginalis in a high position, and the testicle could be descended to the bottom of the scrotum without tension.

The average operation time of inguinal surgery for patients with unilateral and bilateral in ours was 30.1 min and 53.4 min, respectively, and there was no significance differences of the operation time between inguinal surgery and the scrotal incision surgery (the data have not been published). All patients were discharged 1–2 days after the operation (**Table 1**).

During hospitalization and follow-up, testicular retraction occurred in 10 cases. Among them, five cases (four in the upper inguinal segment and one in the middle segment) were caused by insufficient spermatic cord freedom and too little tension at the time of fixation. In two cases, the gap between the dartos fascia of the scrotum and the external fascia of the spermatic cord was too large during the process of freeing the spermatic cord. In two cases, the spermatic cord was short, and there was little tension when fixed. Finally, one patient with poor scrotal development could not completely accommodate the testes. All cases of testicular retraction were cured after testicular descent and fixation through an inguinal incision, and no patients developed recurrence. Seven of all patients had poor healing of the incision, which resolved after 1–2 weeks of dressing changes. Scrotal hematomas occurred in 38 patients and disappeared without treatment after 1–2 weeks. No patients developed testicular atrophy, an indirect inguinal hernia, or a hydrocoele.

The follow-up period ranged from 2 months to 10.1 years (median: 5.6 years). Follow-up examinations were performed at 1 week, 1 month, 6 months, and every 1–2 years after the operation. All patients were followed up at 1 week, 1 month, and 6 months after the operation; 99.6%, 97.0%, 92.0%, 89.0%, 85.0%, 78.0%, 70.0%, 65.0%, 53.0%, and 47.0% patients were followed up at 1 year, 2 years, 3 years, 4 years, 5 years, 6 years, 7 years, 8 years, 9 years, and 10 years, respectively. Before 6 months postoperatively, the follow-up visits involved examination of the wound healing and testicular position. One year after the operation, color Doppler ultrasound was performed at each re-examination to check the testicular development and any complications such as testicular retraction, testicular atrophy, indirect hernia, or hydrocoele.

DISCUSSION

Cryptorchidism is the most common congenital malformation of the urinary system and can affect reproductive function or increase the probability of testicular tumor occurrence. Cryptorchidism is also a predisposing factor for testicular torsion; therefore, early active treatment is needed.[10,11] In patients with palpable cryptorchidism, the classic treatment technique for testicular descent and fixation is via the groin approach. This procedure is technically mature and effective. However, the groin area contains an obvious scar after the operation.[6] With the increasing emphasis of the postoperative appearance by children and their families, pediatric surgeons should not only strive to achieve surgical effectiveness but also perform minimal incisions with fewer scars.[12] There was no scar since the incision of the operation of testicular descent and fixation through a scrotum was located in the scrotal wrinkle.

The distance between the outer ring and the upper scrotum in children is short, the skin is loose, and the length of the processus vaginalis is shorter in most children with than without cryptorchidism.[13] The length of the inguinal canal increases in most children by the age of 1–3 years. The length of the inguinal canal is 1.4 cm in 1-year-old children, 1.9 cm in 2-year-old children, and 2.7 cm in 3-year-old children.[14] Therefore, the outer ring of the inguinal canal can be exposed through a scrotal incision, and high ligation of the processus vaginalis can be performed. The external and internal fascia of the spermatic cord can be completely transected to ensure that the spermatic cord can be adequately loosened and that the testicles can be placed into the scrotum without tension; this allows for testicular descent and fixation through a scrotal stria incision. However, it is relatively difficult to perform surgical repair of cryptorchidism in the middle and upper segments of the inguinal canal because of the limitations of the visual field and operating space. In our experience of treating this type of cryptorchidism in the present study, one assistant used two retractors to pull along the inguinal direction and the inside direction of the inguinal canal, respectively (**Figure 2**); the outer ring could then be fully exposed. The other assistant helped the chief surgeon to cut the aponeurosis of the external oblique muscle 1.0–1.5 cm through the external ring, allowing for further exposure of the middle and upper segments of the groin. Thus, we could fully release the spermatic cord, transverse the processus vaginalis in a high position, and completely break the outer fascia of the spermatic cord to ensure that it was fully loosened before placing the testicle into the scrotum without tension. The external ring was then reconstructed to ensure the integrity of the inguinal canal. In this study, 232 cases of cryptorchidism were repaired with this method, all achieving full release of the spermatic cord, high traversing of the processus vaginalis, and complete testicular descent and fixation.

Regardless of the surgical method used, testicular retraction is a serious postoperative complication.[15,16] Feng *et al*.[17] performed a systematic review and meta-analysis summarizing 697 cases of testicular descent and fixation via the scrotum, and the rate of testicular retraction was 1.6%. Arena *et al*.[18] performed the same operation in 197 cases with no postoperative testicular retraction. Chen and Wu[19] performed a similar study, and the incidence of testicular retraction was 2.1% (5/236). In the present study, the rate of testicular retraction was 0.98% (10/1020), which is equivalent to the above-mentioned studies. Testicular retraction can occur for several reasons.[20,21] First, if the spermatic cord is not fully dissociated, the tension is great when the testis is fixed. Second, some older children have longer inguinal tubes, shorter spermatic cords, and poor development of the scrotum, which cannot fully accommodate the testis. Third, local scar contraction after the operation may cause testicular retraction. Fourth, the gap between the dartos fascia of the scrotum and the external fascia of the spermatic cord may be too large in the process of freeing the spermatic cord. Therefore, when testicular descent and fixation is performed via a scrotal stria incision, the tension of the spermatic cord should be fully evaluated and the spermatic cord should be fully relieved, especially in patients with cryptorchidism in the middle and upper inguinal segments. The operative technique should be carefully selected. Although the middle and upper segments of the inguinal canal can be fully exposed, the length of the free spermatic cord can be increased by cutting the aponeurosis of the external oblique muscle 1.0–1.5 cm through the external ring. If tension is still present after full release of the spermatic cord, another operation should be considered to avoid the occurrence of testicular retraction or testicular atrophy caused by the influence of a forced operation on the blood flow of the spermatic cord and vas deferens.[22]

Scrotal hematomas are the most common complications after testicular descent and fixation via a scrotal incision; they were also the most common complications in our study, accounting for 69.1% (38/55) of all complications. Scrotal hemorrhage is more likely to occur after the operation because the scrotal incision is larger than those in other surgical methods, the time of the operation involving the scrotum is longer, and the traction on the scrotum is more severe. Incomplete hemostasis of the scrotal wound during the operation is also an important cause of postoperative scrotal hematomas. Therefore,

use of a gentle technique during the operation, careful hemostasis, and slight pressure bandaging after the operation are effective measures to prevent scrotal hematomas. Although scrotal hematomas are common, they are usually not serious and generally need no special treatment. The scrotal hematomas of the 38 cases in the present study disappeared by 1–2 weeks after the operation without treatment.

In some studies of traditional testicular descent and fixation, high ligation of the processus vaginalis was not performed for a high traversing processus vaginalis, and this procedure did not increase the risk of an indirect inguinal hernia or hydrocoele.[23-26] Other studies have shown that the absence of ligatures or sutures of the inner ring orifice during laparoscopic testicular descent and fixation also did not increase in the risk of an indirect hernia or hydrocoele.[27,28] It should be emphasized that the processus vaginalis must be traversed at a high position, which is similar to cutting the peritoneum at the inner ring orifice during the laparoscopic operation; this can promote self-closure of the processus vaginalis at the inner ring orifice after the operation.[29] All operations in the present study were performed according to this method, and no indirect hernia or hydrocoele occurred during follow-up.

This study had several limitations. First, this was a single-center study. Second, this study was retrospective in design. Third, the study lacked comparable controls.

CONCLUSION

Testicular descent and fixation through a scrotal stria incision for the treatment of palpable cryptorchidism in children is safe and feasible in well-selected cases. The cosmetic results are impressive, and the follow-up results are promising.

AUTHOR CONTRIBUTIONS

LC and CMZ designed the study, collected the clinical data, performed the statistical analysis, participated in the operation, and drafted the manuscript. WHH, QLZ, YJW, XC, and JQZ participated in the operation and revised the article. All authors read and approved the final manuscript.

COMPETING INTERESTS

All authors declared no competing interests.

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