# A comparative study of transscrotal, transinguinal and laparoscopic orchidopexy for inguinal cryptorchidism

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## Abstract

# Background

A retrospective comparative study was performed on scrotal incision, inguinal incision and laparoscopic orchidopexy. The characteristics of the different surgical methods were analysed.

# Methods

Clinical data of 158 patients with inguinal cryptorchidism admitted to our hospital from January 2017 to January 2018 were retrospectively analysed.

# Results

The operation time in the scrotal incision group was significantly less than that in the inguinal incision group and laparoscopic group ($P < 0.05$). The length of the operative incision in the scrotal incision group and laparoscopic incision group was shorter than that in the inguinal incision group. There was no significant difference in the postoperative hospitalisation time or hospitalisation cost among the three groups ($P > 0.05$). The incidence of scrotal haematoma in the scrotal incision group was significantly higher than that in the inguinal incision group and laparoscopic group. There were no complications, such as testicular atrophy, testicular retraction, indirect inguinal hernia, or hydrocele.

# Conclusions

Transscrotal incision, transinguinal incision and laparoscopic orchidopexy are safe for the treatment of inguinal cryptorchidism. Satisfactory early clinical results can be achieved. Rational use of scrotal incision surgery and laparoscopic surgery for cryptorchidism may replace transinguinal surgery and can provide a good cosmetic effect for children.

## Background

Cryptorchidism is one of the most common genital malformations in the urinary system of children. Surgery is the most important method to treat cryptorchidism[1–2]. According to the position of the testis, cryptorchidism is generally classified into abdominal cryptorchidism, inguinal cryptorchidism and suprascrotal cryptorchidism[3]. After Annandale successfully performed orchidopexy in 1879[4], testicular descent fixation through an inguinal incision became a classic method for the treatment of inguinal cryptorchidism and suprascrotal cryptorchidism. However, there were obvious surgical scars in the groin after the operation, which affected the patients’ appearance. With the continuous improvement of people's requirements for surgery, minimally invasive surgery has become a developmental trend.

Laparoscopic exploration and testicular descent fixation have been the gold standard for the diagnosis and treatment of abdominal cryptorchidism and can also be used in the treatment of groin cryptorchidism[5–8]. The treatment of suprascrotal cryptorchidism with testicular descent fixation via a single scrotal incision has reached a basic consensus and can also be used in the treatment of groin type cryptorchidism[9–12]. However, there is no consensus on the most appropriate surgical method for inguinal cryptorchidism. Through retrospective comparative analysis of clinical data from patients with inguinal cryptorchidism treated by scrotal incision, inguinal incision and laparoscopic testicular descent fixation, this paper analysed the characteristics of different surgical methods to explore the most suitable surgical methods for inguinal cryptorchidism and provide a reference for the most optimal operative clinical choice.

## Methods

# Patients

We retrospectively analysed the clinical data of 158 patients with inguinal cryptorchidism in our hospital from January 2017 to January 2018. According to the operation methods, the patients were divided into three groups: the transscrotal incision (group A, n = 54 cases), inguinal incision (group B, n = 58 cases) and laparoscopic group (group C, n = 46 cases). All patients were diagnosed with inguinal cryptorchidism by a physical examination and scrotal ultrasonography. The preoperative clinical data of all children are shown in Table 1. There were no significant differences in age, weight, size of affected testis and unilateral or bilateral testis. The inclusion criteria were inguinal cryptorchidism diagnosed by a physical examination and scrotal ultrasonography. Patients were excluded from this study if they had other types of cryptorchidism; other complications requiring a simultaneous surgical treatment, such as hernia, hydrocele, hypospadias, etc.; refused to sign the consent form for surgery; or refused to comply with the follow-up schedule.

Table 1
Comparison of preoperative,intraoperative and postoperative data among three groups of patients

| Item | Group A | Group B | Group C | Value P |
|---|---|---|---|---|
| Number | 54 | 58 | 46 | |
| Age(year) | 1.53 ± 1.29 | 1.87 ± 1.65 | 1.79 ± 1.46 | 0.436 |
| Weight(kg) | 11.01 ± 2.20 | 13.59 ± 2.53 | 12.43 ± 2.56 | 0.510 |
| Affected testis size(cm) | 0.81 ± 0.21 | 0.76 ± 0.26 | 0.73 ± 0.23 | 0.891 |
| Unilateral/Bilateral | 42/12 | 43/15 | 36/10 | 0.859 |
| Operative time(min) | | | | |
| Unilateral | 20.43 ± 5.22 | 34.66 ± 6.34* | 36.87 ± 8.15* | 0.036 |
| Bilateral | 38.94 ± 7.81 | 60.58 ± 10.65* | 67.46 ± 12.88* | 0.023 |
| The incision length(cm) | 1.68 ± 0.53 | 3.36 ± 0.84* | 1.86 ± 0.75# | 0.046 |
| Postoperative hospital stay(d) | 1.34 ± 0.52 | 1.45 ± 0.63 | 1.48 ± 0.78 | 0.914 |
| Hospital costs(1000RMB ) | 6.72 ± 1.23 | 6.94 ± 1.45 | 7.83 ± 1.61 | 0.602 |
| * indicates that compared with group A, P < 0.05, # indicates P < 0.05 compared with group B. | | | | |

# Transverse Scrotal Incision For Testicular Descent Fixation

A transverse incision was made in the scrotum of the affected side. The scrotal skin and sarcolemma were incised layer by layer. The sarcolemma and subcutaneous space were bluntly separated. We pushed the testis through the skin to the vicinity of the outer circumferential orifice, the sheath process was clamped, and the testis was incised. A small amount of sheath process was incised to the proximal end, the free spermatic cord to the testis was pulled to the bottom of the scrotum without tension, and the unclosed sheath process was transected. The testis was examined to ensure there was no torsion. The testis and sarcolemma were fixed by intermittent 5 − 0 absorbable sutures. Finally, we sutured the scrotal incision layer by layer with intermittent 5 − 0 absorbable sutures.

# Transinguinal Testicular Descent Fixation

An inguinal dermatoglyphic incision on the affected side was made, which was approximately 2.5 cm long. The inguinal skin, superficial subcutaneous fascia, deep fascia and abdominal oblique aponeurosis were successively incised. Testicles on the affected side were found at the inguinal site. The proximal testicular process was incised, and the testicles were rolled out. The posterior wall of the sheath process was transected after the distal testicular lead band was cut off, and the interstitial tissue between the

spermatic cord and sheath process was bluntly separated until the testis could reach the bottom of the scrotum without tension. The proximal end of the sheath process was ligated and sewed together with No. 1 thread at the inner ring. The sheath process was severed approximately 0.5 cm from the distal end of the ligation. High ligation of the sheath process was performed. A tunnel was bluntly separated along the direction of the subcutaneous ring to the bottom of the scrotum. All incisions were made at the bottom of the scrotum of approximately 1 cm. We separated the sac of the sarcolemma between the skin and the sarcolemma under the incision. The affected testis was reduced to the sac of the sarcolemma without torsion or tension. The testis and sarcolemma were sutured and fixed intermittently with 5 – 0 absorbable thread. The abdominal oblique aponeurosis was sutured intermittently, and the external inguinal ring was reconstructed. Finally, we sutured the inguinal incision and bottom of the scrotum layer by layer.

# Laparoscopic Testicular Descent Fixation

A right umbilical skin fold incision was made, and a 5 mm trocar was placed directly into the abdomen to establish the pneumoperitoneum (6–10 mmHg); a 5 mm trocar was implanted bilaterally in the lower abdomen. Laparoscopy was performed to explore whether the left and right inner ring orifices were closed, the location of the testicle and the development of the deferent duct and spermatic cord vessels. We cut the inner peritoneum of the spermatic cord at the inner ring, lifted the peritoneum bluntly to separate the distal perispermatic cord tissue, broke the testicular lead by an electric hook, lifted the testis, freed the perispermatic tissue around the affected side of the deferent duct to the bottom of the bladder, and freed the peritoneal tissue near the spermatic cord until the testis of the affected side could move to the inner ring of the affected side without tension. We used the separating forceps to separate in the direction of the scrotum. A tunnel was bluntly separated through the groin to the bottom of the scrotum. All incisions were made at the bottom of the scrotum of approximately 1 cm. Then, we separated the sac between the skin and sarcolemma under the incision. The vessel forceps entered the abdominal cavity through the tunnel under the guidance of the separating forceps. We held the testicular lead band to reduce the testis of the affected side to the sac without torsion or tension. We used 5 – 0 absorbable thread to suture the spermatic cord fascia and scrotal floor subcutaneously, fixed the testicles in the sac of the sarcolemma, and sutured the incision at the bottom of the scrotum. We also used 5 – 0 absorbable thread to close the posterior peritoneal annulus and inguinal annulus, examined the abdominal cavity for bleeding, discharged the abdominal cavity gas, and closed the abdominal wall incision.

# Statistical analysis

Using SPSS 19.0 statistical software, continuous data are presented as the mean ± standard deviation and range. The mean values of the three groups of samples were compared by variance analysis. The S-N-K (S) method was used for two-way comparisons, and the $\chi 2$ test was used for categorical variables. A p value of $< 0.05$ was defined as statistical significance.

# Results

All patients underwent successful surgery, none of whom were converted to conventional operations. Regardless of unilateral or bilateral cryptorchidism, the operation time of group A was significantly shorter than that of group B and group C ($P < 0.05$), but there was no difference between group B and group C. The incision length of group B was significantly longer than that of group A and group C ($P < 0.05$), but there was no difference between group A and group C. There was no significant differences in hospitalisation time and hospitalisation expenses between the three groups ($P > 0.05$) ( Table 1).

There were no complications, such as testicular atrophy, testicular retraction, inguinal hernia or hydrocele, in the three groups. There was no significant difference in the incidence of poor wound healing among the three groups ($P > 0.05$). The incidence of scrotal haematoma in group A was significantly higher than that in group B and group C ($P < 0.05$), but there was no difference between group B and group C (Table 2).

Table 2
Comparison of postoperative complications among three groups

| Item | Group A | Group B | Group C | Value P |
|---|---|---|---|---|
| Testicular atrophy | 0 | 0 | 0 | |
| Testicular retraction | 0 | 0 | 0 | |
| Indirect inguinal hernia, | 0 | 0 | 0 | |
| Hydrocele | 0 | 0 | 0 | |
| Poor wound healing | 2 | 4 | 3 | 0.736 |
| Scrotal haematoma | 8 | 2* | 1* | 0.016 |
| * indicates that compared with group A, P < 0.05, # indicates P < 0.05 compared with group B | | | | |

All patients were followed up for more than 12 months, with a median follow-up time of 14 months. The follow-up times were one week, three months, half a year and one year after the operation. The content of the follow-up included the symptoms and signs of the children, which were followed up via outpatient visits. Scrotal colour Doppler ultrasonography was performed six months and one year after the operation. No complications such as testicular atrophy, testicular retraction, inguinal hernia or hydrocele occurred during the follow-up period. One year after the operation, the size of the affected testicles in the three groups were 1.31 ± 0.29 cm in group A, 1.26 ± 0.31 cm in group B and 1.28 ± 0.22 cm in group C, which were improved to some extent compared with those before the operation, but there was no significant difference between the three groups ($P = 0.938$).

# Discussion

The incidence of cryptorchidism is higher in the neonatal period, but with the growth of the child, the incidence of the disease decreases, but the incidence of cryptorchid still remains 1% at approximately 1 years old[1, 13]. Cryptorchidism can affect reproductive function, cause a decrease of fertility or even infertility, and increase the probability of testicular tumours. Cryptorchidism is also one of the predisposing factors for testicular torsion. Therefore, early active treatment is needed[14–15]. The testes of children with cryptorchidism may continue to descend after birth, but the chance of self-descent after 6 months is obviously reduced. Therefore, children require evaluation for the possibility of a medical intervention after 6 months[16–19].

The treatment of cryptorchidism includes endocrine therapy and surgical treatment, but the effect of endocrine therapy is not accurate. There are some side effects with endocrine therapy, so surgery is still the preferred treatment for cryptorchidism[20]. At present, the main surgical methods for the treatment of cryptorchidism are laparoscopic surgery, inguinal incision surgery and scrotal incision surgery. The choice of surgical technique is made according to the location of the testis, a physical examination and whether the testicle can be explored by ultrasound. Laparoscopic exploration and simultaneous treatment of celiac cryptorchidism is a consensus[6–8].Lower scrotum high position cryptorchidism and sliding testis are basically operated on through a scrotal incision[9–10]; however, there is no consensus on the most appropriate surgical method for inguinal cryptorchidism.

For inguinal cryptorchidism, the traditional operation adopts the transinguinal approach and makes an oblique incision, transverse incision, or scrotal double incision to find the testis; frees the spermatic cord; transverse or ligated sheath process; fully releases the spermatic cord and vas deferens; and fixes the testis in the middle or lower part of scrotum without tension. This surgical procedure is clearly exposed, technically mature and effective. However, this operation must incise the aponeurosis of the external oblique abdominal muscle and destroys the normal anatomical structure and nerve of the inguinal canal, causing great trauma and leaving obvious scars in the inguinal area after the operation that will affect the aesthetic appearance. With the increasing demands of children and their families regarding the aesthetics after surgery, paediatric surgeons need to consider not only achieving the effect of surgery but also achieving an aesthetically pleasing and scarless result.

Because of the short distance between the outer ring orifice and the upper scrotum, the skin is loose and the length of the sheath process in most children with cryptorchidism is shorter than that in normal children[9]. The length of the inguinal canal increases most between the ages of 1 and 3. The length of the inguinal canal in a 1-year-old child is 1.4 cm, is 1.9 cm at the age of 2 and is 2.7 cm at the age of 3[21]. Therefore, an operation through scrotal incision can expose the external ring of inguinal canal, reach high transection or ligation of the sheath process, and completely transect the extraspermatic fascia and intraspermatic fascia to ensure sufficient release of the spermatic cord. Then, the testis can be placed in the scrotum without tension. The operation only needs a single scrotal incision, which does not need to destroy the inguinal structure like the traditional operation. The operation leads to less trauma, less postoperative pain, is simple, and the incision is located in the scrotal fold. There is basically no scar

after the operation, and the cosmetic effect is good. In this study, the operation time and incision length of this method were significantly shorter than those of inguinal incision ($P < 0.05$). However, it took a long time and required traction. The incidence of scrotal swelling after the scrotal incision operation was higher than that after the inguinal incision operation and laparoscopic operation ($P < 0.05$). Therefore, the operation should be gentle and pay attention to haemostasis, and the scrotum should be slightly compressed after the operation. The scrotal incision has a low location, small incision and relatively small field of vision. The difficulty of the operation lies in fully releasing the spermatic cord vessels and the high ligation or transection of the sheath process. For cases with a high testicular position or older age, the operation is more difficult[22]. In such cases, we can cut the outer ring mouth at 0.5-1.0 cm, which meet the needs of loosening the spermatic cord and ligating the sheath process. In this group, 5 sides of the outer ring mouth were cut, and good results were achieved. However, due to the differences in surgical experience, if it is difficult to release the spermatic cord vessels during the operation (sometimes even if the outer ring mouth is cut 0.5-1.0 cm), a tension-free testicular descent will not be guaranteed. Laparoscopy can be used to further free the spermatic cord or inguinal incision to free the spermatic cord. Therefore, although testicular descent fixation through scrotal incision has the advantages of a short operation time, less trauma and good cosmetic effect, its indications should be understood grasped before the operation.

Laparoscopic testicular descent fixation also has no inguinal incision, no inguinal canal incision, less trauma, less pain, and a good cosmetic effect; additionally, the scope of laparoscopic exploration is large and clear, which can determine whether there is a testis and its location (especially high cryptorchidism) and can fully free the spermatic vessels to the inferior pole of the kidney. It can be carried out under direct vision, thus reducing the damage to the testicular blood supply and ensuring tension-free testicular descent into the scrotum. Although laparoscopic surgery has complications, such as intestinal injury, bladder injury and subcutaneous emphysema caused by $CO_2$ pneumoperitoneum, their incidence is low and can be avoided as long as care is taken during the operation[23–24].

The incidence and severity of postoperative complications are important indicators for judging the safety of surgical procedures. There were no complications, such as testicular atrophy, testicular retraction, inguinal hernia or hydrocele, in the three groups during the perioperative period and at the 1 year follow-up after the operation, and the size of the affected testis was improved to varying degrees. There was no significant difference between the three groups, indicating that scrotal incision, inguinal incision and laparoscopic testicular descent fixation have a good early curative effect for inguinal cryptorchidism and that their curative effect is similar. However, this study is a single-centre retrospective study with a small sample size and short follow-up time. Multi-centre, large sample, medium- and long-term follow-up studies need to be completed to determine the clinical outcomes of these procedures more objectively.

# Conclusion

Transscrotal incision, inguinal incision and laparoscopic testicular descent fixation are safe for the treatment of inguinal cryptorchidism, and satisfactory early clinical results can be achieved. Rational use

of transscrotal incision surgery and laparoscopic surgery may replace inguinal surgery and can provide a good cosmetic effect for children, with the latter being a better choice for children seeking a better cosmetic effect. However, the indications should be strictly controlled.

# Declarations


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### Authors'contributions

WYJ and ZZM designed the study, collected theclinical data, performed the statistical analysis, participated in the operation,and drafted the manuscript. ZQL,CL,CX,ZCM and ZQ participated in the operation and revised the article. All authors read and approved the final manuscript.


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### Availability of data and materials

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

### Ethics approval and consent to participate

This study was approved by the ethics committee of our hospital and strictly adhered to the tenets of the Declaration of Helsinki (Code of Ethical approval for scientific research project:2019 Ethical Scientific Research Approval No. 2004).In addition,all patients were minors,and their guardians signed an informed consent form before the operation.

### Consent for publication

Written informed consent was obtained from patients' guardians for publication of clinical datas.

### Competing interests

The authors declare that they have no competing interests.

# References


1. Berkowitz GS,Lapinski RH,Dolgin SE.Prevalence andnatural history of cryptorchidism.Pediatrics.1993;92 (1):44–49.

2. Murphy F. Paran TS,Puri P.Orchidopexy and its impact onfertility. Pediatr Surg Int. 2007;23(7):625–32.
3. Zhang YB, Zhang M, Du ZJ, et al. Minimally invasive treatment of different types of cryptorchidism in children. Chinese Endoscopic Urology. 2017;11(3):174–7.
4. Annandale T.Case in which a testicle congenitally displaced into the perinaeum was successfully transferred to the scrotum.Br Med J.1879;1(940):7.
5. Ang CW. Forrest J.Diagnostic laparoscopy and management of the impalpable testis-a review of 10 years' practice at a non-paediatric specialist centre. J Pediatric Urol. 2008;4(3):214–7.
6. He D, Lin T, Wei G, et al. Laparoseopic orchiopexy for treating inguinal canalicular palpable undescended testis. J Endourelogy. 2008;22(8):1745–50.
7. Riquelme M. Aranda A,Rodriguez C,et a1.Laparoscopie or chiopexy for palpable undeseended testes:a five-year experience. J Laparoendoscopic Adv Surg Tech A. 2006;16(3):321–4.
8. Denes FT, Saito FJ,Silva FA,et al. Laparoseopic diagnosis and treatment of nonpalpable testis.International. Braz J Urol. 2008;34(3):329–35.
9. Bianchi A. Squire B.Transscrotal orchidopexy:orchidopexy revised. Pediatr Surg Int. 1989;4:189–92.
10. Takahashi M, Kurokawa Y, Nakanishi R,et al. Low transscrotal orchidopexy is a safe and effective approach for undeseended testes distal to the external inguinal ring. Urol Int. 2009;82(1):92–6.
11. Dayanc M, Kibar Y, Irkilata HC,et al.Long-term outcome of scrotal incision orchiopexy for undescended testis.Urology.2007;70(4):786–788.
12. Callewaert PR, Rahnama'i MS,Biallosterski BT,et al.Scrotal approach to both palpable and impalpable undescended testes:should it become our first choice? Urology.2010;76(1):73–76.
13. Gurney JK. McGlynn KA,Stanley J.Risk factors for cryptorchidism. Nat Rev Urol. 2017;14(9):534–48.
14. Hutson JM,Balic A, Nation T,et al. ryptorchidismSemin Pediar Surg. 2010;19(3):215–24.
15. Lip SZ, Murchison LE, Cullis PS,et al. A meta-analysis of the risk of boys with isolated cryptorchidism developing testicular cancer in later life. Arch Dis Child. 2013;98(1):20–6.
16. Ritzén EM. Bergh A,Bjerknes R,et al.Nordic consensus on treatment of undeseended testes. Acta Paediatr. 2007;96(5):638–43.
17. Bao X. Zhang W.Diagnostic criteria and treatment of cryptorchidism in children. Journal of Practical Pediatrics Clinical. 2012;27(23):1847–8.
18. Niedzielski JK, Oszukowska E, Stowikowska-Hilczer J. Undescended testis·current uends and guidelines:a review of the literature. Arch Med Sci. 2016;12(3):667–77.
19. Gapany C, Frey P, Cachat F,et al. Management of cryptorchidism in children:guidelines. Swiss Med Wkly. 2008;138(33–34):492–8.
20. Zhao HT. He R,Sun J.A randomized controlled study of chorionic gonadotropin in the treatment of infantile cryptorchidism. Chinese Journal of Pediatric Surgery. 2010;31(10):797–9.
21. Xu T. Zhu DL,Zhong J.Anatomical and clinical features of indirect inguinal hernia in boys. Journal of Practical Pediatrics Clinical. 2003;18(4):314–5.

22. Al-Mandil M, Khoury AE, El-Hout Y,et al. Potential complications with the prescrotal approach for the palpable undescended testis? A comparison of single prescrotal incision to the traditional inguinal approach. J Urol. 2008;180(2):686–9.
23. Pelizzo G, Bernardi L, Carlini V,et al. Laparoscopy in children and its impact on brain oxygenation during routine inguinal hernia repair. J Minim Access Surg. 2017;13(1):51–6.
24. Hsieh MH. Bayne A,Cisek LJ,et al.Bladder injuries during laparoscopie orehiopexy:incidence and lessons learned. J Urol. 2009;182(1):280–4.