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Diagnosis and Treatment Strategies of Cryptorchidism

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Abstract: Cryptorchidism, characterized by the failure of one or both testes to descend into the scrotum, is one of the most common congenital urological conditions in male infants. It can lead to a range of complications, including infertility, testicular cancer, and psychological effects if not appropriately managed. Early diagnosis and timely intervention are crucial in reducing long-term risks associated with this condition. This article explores the current approaches to diagnosing cryptorchidism, including clinical examination and imaging techniques such as ultrasound and laparoscopy. It also reviews the latest treatment strategies, ranging from hormonal therapy to surgical options, with an emphasis on the optimal timing of intervention to ensure the best outcomes. Additionally, the article discusses the controversies surrounding the management of non-palpable and bilateral cryptorchidism and highlights the importance of individualized treatment plans based on the patient's specific clinical scenario. By providing a comprehensive overview of both diagnostic and therapeutic modalities, this article aims to guide clinicians in making informed decisions to optimize the care of patients with cryptorchidism.

Key words: cryptorchidism; violation of the position of the testicle; bringing the testicle down.

The first attempts at treating cryptorchidism in children were made by J. Rosenmerkel and M. von Chelius in the 1820s. However, it was not until 1877 that T. Annandale successfully performed a testicular descent operation on a 3-year-old patient.

The optimal age to start treatment (either conservative or surgical) is 6 months, and the process should be completed by the child's 2nd year of life. In some cases, hormonal therapy is used, prescribed by both a pediatric surgeon and an endocrinologist. Chorionic gonadotropin (hCG) is commonly used, and gonadotropin-releasing hormone (GnRH) is used less frequently. However, the effectiveness of this therapy does not exceed 15% and depends on the height at which the testis is located in the inguinal canal. The more distal the testis is in the canal, the more effective the therapy. Higher success rates are typically seen in patients with retractile testicles that are more responsive to treatment.

hCG is recommended at a dose of 3000–10000 IU, with one injection per week for a month. If treatment is ineffective, the course can be repeated after 3 months. GnRH is applied as a nasal spray at a dose of 1.2 mg/day for 1 month. If conservative treatment fails, surgical intervention is indicated.

There are about 250 methods of surgical treatment for cryptorchidism, including modifications. Over time, surgical techniques have evolved significantly, with less traumatic methods replacing more invasive ones. It is widely accepted that the main stage of surgical treatment involves various methods of gonadal fixation. However, traction on the spermatic cord elements during orchidopexy is not acceptable, as it leads to reflex spasm of the arteries and veins of the organ, causing irreversible changes in the germinal epithelium.

Vol. 3 No. 5 (2025)
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The testicular descent operation should be performed by a qualified pediatric urologist or pediatric surgeon. The choice of surgical method depends on the form of cryptorchidism. For inguinal forms, the Petriwalsky–Shoemaker operation, developed in 1932, is indicated. For abdominal forms, the preference is given to one-stage or two-stage laparoscopic descent, such as the Fowler–Stephens method.

The Petriwalsky–Shoemaker operation for inguinal cryptorchidism is performed through an oblique transverse incision along the inguinal fold, up to 3 cm in length. The vaginal process of the peritoneum is isolated in the inguinal canal, and the testis and spermatic cord are mobilized. A careful orchido-funiculo-lysis is performed to free the spermatic cord elements from the cremaster muscle fibers and adhesions along its entire length up to the internal inguinal ring. A tunnel is formed in the scrotum using the index finger, and the testis is fixed at the edge of the tunica albuginea to the tunica dartos. The scrotal wound is sutured with individual knot stitches, and a cosmetic stitch is applied in the inguinal area using absorbable material. The effectiveness of the Petriwalsky–Shoemaker operation reaches 90%.

A one-stage transscrotal testicular descent approach was proposed by A. Bianchi and B.R. Squire in 1989. The short length of the inguinal canal and the high elasticity of the surrounding tissues allow the non-obliterated vaginal process of the peritoneum to be ligated and excised through an oblique transverse approach at the boundary between the scrotum and the inguinal area. Failures of this method are related to the short vascular bundle of the testis, which does not allow adequate descent of the testis into the scrotum, leading to acute ischemic disorders and testicular atrophy in 30–70% of cases.

As an alternative to this one-stage procedure for abdominal cryptorchidism, some authors suggest microsurgical autotransplantation of the testis on the vascular pedicle. This method has not gained wide use due to its complexity, and the results from early cases are unsatisfactory.

In 1976, N. Cortesi and colleagues first described the use of laparoscopic access for treating abdominal forms of cryptorchidism. This method allows precise localization of the "non-palpable" testis and assessment of the condition and length of the testicular arteries and veins.

In 2007, F. El-Anany and colleagues proposed a five-stage diagnostic classification for testicular localization based on diagnostic laparoscopy and developed an algorithm for selecting the treatment approach in children with non-palpable testis syndrome.

The laparoscopic two-stage Fowler–Stephens operation is known to be performed in cases of bilateral cryptorchidism with abdominal forms of retention and insufficient vessel length. During the first stage, the main vascular bundle of the testis is crossed, and the organ is left to receive blood supply through the deferent duct and its collateral vessels, as well as the cremasteric artery, for 4–6 months. In the second stage, laparoscopic testicular descent is performed.

During the second stage, the parietal peritoneum and the vas deferens are excised as a single triangular flap on a wide pedicle, which allows the deferent duct to be covered and additional collaterals to form. A new channel for testicular descent is created between the medial and midline umbilical folds, lateral to the bladder. A transscrotal incision is made, and the testis is lowered. The testicular condition is monitored using ultrasound on days 1, 3, and 7 after the operation.

Some authors use a one-stage laparoscopic method for testicular descent and fixation in abdominal cryptorchidism, with proven advantages shown by favorable outcomes.

For suturing the peritoneal defect at the internal inguinal ring in abdominal cryptorchidism, a device is proposed under video control to reduce the duration and trauma of the final stage of the operation.

After laparoscopic surgery, patients are discharged on the 3rd–5th day. The wounds are treated with antiseptic solutions, and bathing in a bathtub is prohibited for 7 days. Physical activities are restricted

Vol. 3 No. 5 (2025)
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for 30 days. A follow-up consultation with a pediatric urologist-andrologist and endocrinologist is mandatory one month after discharge.

Ultrasound monitoring of the testis is performed on an outpatient basis at 1 and 3 months after surgery. All patients are advised to have annual ultrasound screening of the genital organs, with mandatory assessment of blood flow, and to monitor their hormonal profile during prepubertal and pubertal periods.

In comparative studies of the immediate and long-term results of treatment in children with abdominal cryptorchidism, positive outcomes were observed in patients who underwent one-stage laparoscopic orchidopexy. In this cohort, no testicular hypoplasia was noted 12 months after surgery, and the testis volume, resistance index, peak systolic velocity, and final diastolic velocity were within the normal range.

Other authors suggest that the two-stage laparoscopic Fowler–Stephens procedure for treating cryptorchidism in children leads to more effective restoration of testicular arterial blood flow compared to the one-stage approach. Doppler sonographic examination of the testicular arteries in patients after cryptorchidism surgery proved to be a highly informative method for evaluating treatment quality.

A working classification of the severity of testicular hypoplasia based on sonographic criteria has been proposed:

Stage 1: The longitudinal size of the testis is smaller than the age norm, but not less than 10 mm. The echogenicity of the tissue is average or moderately reduced. Blood flow is represented by multiple echo signals, and the histogram shows more than 80% of the average gray scale value (SGS).

Stage 2: The longitudinal size of the testis is between 5 and 10 mm. The testis appears as an echonegative, heterogeneous structure. Blood flow is represented by multiple echo signals, and the histogram shows a range from 60 to 80 SGS.

Stage 3: The testis is not identifiable, and the structure at the expected site of the gonad consists of linear echopositive structures, sharply ending in the scrotum or inguinal canal. The size is less than 5 mm, and blood flow is identified only in the rudimentary spermatic cord as single echo signals. The histogram shows less than 60 SGS.

An intraoperative and sonographic protocol for evaluating the testis in cryptorchidism shows that hypoplasia is found in 51.4% of cases in children aged 0 to 3 years. Fertility in stage 3 hypoplasia is questionable.

Predicting infertility in adolescents after testicular descent and orchiopexy requires ongoing monitoring of gonadal development, as data from one- and five-year follow-ups show persistent abnormality in the organ.

Surgical complications in cryptorchidism are divided into early complications, which occur intraoperatively or in the early postoperative period, and delayed complications, identified during postoperative examinations. Testicular atrophy and malposition, which require further surgery, are traditionally used as the main criteria for evaluating the effectiveness of surgical treatment of the condition.

A diagnostic test for patients with recurrent cryptorchidism involves measuring metabolites of connective tissue (free, total hydroxyproline, glycosaminoglycans), which are significantly elevated in biological fluids compared to healthy children.

Androgen deficiency in cryptorchidism, including reduced testosterone concentration in the blood and increased adrenal steroid excretion, is observed in patients from the age of 3 years. The "pubertal surge" of androgens in cryptorchidism appears only at 13-14 years old and does not reach the levels found in healthy children.

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From the age of 5 years, undescended testis is associated with the development of a characteristic body composition, with a rapid increase in weight, height, shin length, thigh circumference, skin fold thickness, inter-sternal distance, and a relative decrease in shoulder width.

Delayed development of the sexual organs (scrotum, penis, both testes) is noted in newborns with cryptorchidism, and the appearance of secondary sexual characteristics is delayed by 2-3 years compared to healthy children. The pituitary response to disrupted testicular migration manifests as an increase in follicle-stimulating hormone secretion, and at certain periods, luteinizing hormone levels are also elevated.

In men who underwent orchiopexy in childhood, the volume of the descended testis and its epididymis is 2 times smaller than the contralateral side. Diffuse changes in the organ parenchyma and areas of sclerosis are found in 47% of cases after orchiopexy. In addition to pathological changes in the testes, boys with unilateral cryptorchidism show a reduction in prostate size compared to healthy children.

In cases of absent secondary sexual characteristics in boys older than 14.5 years, a stimulation test with 0.1 mg of triptorelin (Differelin) is performed for differential diagnosis of delayed puberty.

In cases of agenesis (aplasia), and considering the patient's and parents' desires, testicular prosthesis is performed to eliminate psychological and cosmetic defects. Silicone implants, which are most similar in physical properties to the tissue of the gonad, are used. The surgery involves forming a new tunnel in the corresponding half of the scrotum from an incision in the inguinal region, creating a bed for the prosthesis, and subsequently fixing it to the dartos muscle.

At the age of 18 and older, boys who have undergone surgery for cryptorchidism should undergo an evaluation of their fertility function through spermogram analysis.

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