

Morphological Changes in the Testes in Cryptorchidism in Children

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Annotation: Cryptorchidism, the condition of undescended testes, remains one of the most common congenital anomalies in male infants, with a prevalence ranging from 1% to 8% at birth depending on the population. In many cases, the testes descend spontaneously within the first six months of life. However, about 1% of boys have testes that remain undescended and may require surgical correction (orchiopexy), ideally performed before the age of one to minimize long-term risks such as infertility and testicular cancer. Recent studies have noted variations in cryptorchidism prevalence by geographical and environmental factors.

Keywords: review; primary acquired cryptorchidism; children; undescended testis; ascending testis.

Prevalence of Primary Acquired Cryptorchidism. The exact prevalence of primary acquired cryptorchidism remains uncertain. J.D. Atwell et al. reported 10 cases of primary acquired cryptorchidism. J. Gracia et al. described 36 patients with "spontaneous" testicular ascent over a 20-year observation period. Another study reported 23 patients diagnosed with acquired cryptorchidism over 14 years. Dutch researchers highlighted 14 cases of testes normally positioned at birth that subsequently ascended into the inguinal canal. J.F. Robertson et al. documented 13 cases of primary acquired cryptorchidism. Additionally, 21 boys out of 103 children with undescended testes were found to have previously documented testicular descent into the scrotum. Other studies reported 83 boys who underwent surgery for primary acquired cryptorchidism over a five-year period.

A prospective cohort study revealed that primary acquired cryptorchidism occurred in 0.2% of boys at 3 months, 0.6% at 18 months, and 36 months of age. This type accounted for 58% of cases at 18 months, 71% at 36 months, and 69% in boys older than 36 months.

C.L. Acerini et al. presented intriguing epidemiological data. In a seven-year prospective study, trained nurses examined 742 boys at birth and at 3, 12, 18, and 24 months. The prevalence of

cryptorchidism was 5.9% at birth, decreasing to 2.4% by 3 months as expected. However, it rose to 6.7% at 12 months due to new cases and reached 7.0% by 24 months.

Age of Onset. Information on the age of onset of acquired cryptorchidism varies widely. Some studies suggest "secondary testicular ascent" may occur as early as 2 years of age, while others observed it between 1 and 14 years, with an average of 8.4 years, or between 5 and 14 years. There is a reported case of both testes ascending from the scrotum to the abdominal cavity on one side and the inguinal canal on the other in a 1-year-old child. This child had previously been examined twice by a pediatric urologist, with no abnormalities detected.

The interval between the last documented scrotal position of the testis and the diagnosis of "ascending testis" was approximately 2 years, 4.5 years, or 5.2 years.

Etiology and Pathogenesis. The etiology of primary acquired cryptorchidism remains controversial. Some authors attribute the condition to incomplete obliteration of the processus vaginalis, causing the testis to be "sucked" into the abdominal cavity due to negative intraperitoneal pressure during breathing. Other urologists observed fibrous bands of the obliterated processus vaginalis during surgery, which they believe hindered normal elongation of the spermatic cord, leading to testicular ascent as the child grew. T.D. Clarnette et al. supported this view, noting that testicular repositioning during surgery was only possible after cutting the fibrous bands.

Some authors identified adhesions surrounding the testis as a cause of acquired cryptorchidism, detected during surgery. In contrast, R. Rabinowitz et al. found no evidence of open processus vaginalis or adhesions, disputing these as etiological factors.

Others propose that ectopic attachment of the gubernaculum testis could explain testicular ascent. This hypothesis suggests that initially, the testis was only partially descended, and as the child grew, abnormal gubernacular positioning led to the testis leaving the scrotum.

An interesting observation involves acquired cryptorchidism in three brothers with Pelizaeus-Merzbacher syndrome (a rare X-linked leukodystrophy associated with spastic muscle conditions). Their testes ascended into the inguinal region due to increased m. cremaster tone following the onset of spasticity. Reduced early postnatal androgen activity may also contribute to testicular ascent. Y. Zhou et al. attributed the phenomenon to the postnatal failure of the spermatic cord to elongate proportionately with somatic growth.

Risk Factors. Identified risk factors include prematurity, intrauterine growth restriction, and a family history of undescended testes. A statistically significant association between acquired cryptorchidism and proximal hypospadias has been noted. A case of acquired cryptorchidism in a patient with disorders of sex development revealed the presence of ovotestis.

J.S. Barthold et al. found that discontinuation of breastfeeding and the use of soy-based formulas significantly increased the likelihood of developing acquired cryptorchidism. However, these factors did not affect congenital cryptorchidism, hydroceles, or inguinal hernias.

Incidence and Associations with Neurological Conditions. It has been established that the incidence of cryptorchidism in certain groups can reach up to 24%, with 20% of these cases documented as acquired. Some studies link testicular migration from the scrotum to the inguinal region with tetraplegia.

Relationship Between Pseudo-Cryptorchidism and Acquired Cryptorchidism. Many publications explore the relationship between pseudo-cryptorchidism and acquired cryptorchidism. Primary acquired cryptorchidism is often observed in older children with a history of an exaggerated cremasteric reflex. In some studies, up to 85% of boys with so-called "ascending testes" had indications of pseudo-cryptorchidism. The risk of pseudo-cryptorchidism progressing to acquired cryptorchidism varies widely among authors, ranging from 2% to 45%, 3.2%, 28% and up to 50%.

Clinical Presentation. Primary acquired cryptorchidism is typically unilateral (77%) . The testis is almost always palpable superficially in the inguinal region, outside the inguinal canal, near the external inguinal ring, and cannot be manually repositioned into the scrotum.

Pathohistological Findings. Histological studies have shown a consistent pattern across sources. The mean tubular fertility index was 40 (37%), and the histological appearance resembled that of congenital undescended testes . Some authors noted differences in the volume of testes located in the inguinal region compared to those in a normal position but did not specify the percentage or extent of these differences.

Biopsy studies of testes during orchidopexy in children aged 3–12 years revealed a significant reduction in germ cells and fertility factors, especially in boys older than 9 years. Median germ cell counts per tubule (GC/T) were 1.06 for boys <9 years and 0.60 for boys \geq 9 years. Similarly, the mean number of Ad-Sertoli cells per tubule (Ad-S/T) was 0.02 for boys <9 years and 0.01 for boys \geq 9 years. No developmental abnormalities or atypical cells were observed, and immunohistochemical staining was negative in all samples .

Comparative studies of germ cell counts in congenital and acquired cryptorchidism found no significant differences. Microlithiasis rates were also similar between the two groups. While microlithiasis has been associated with testicular cancer, one study concluded that men with a history of "ascending testes" did not have a confirmed diagnosis of testicular cancer.

Treatment. The treatment of children with acquired cryptorchidism remains controversial. For example, one report described three patients treated with hCG; one was successful, but the other two ultimately required surgery. A.B. Belman et al. treated seven boys (ages 4–10) with short courses of hCG, achieving temporary positive effects in four cases, but six eventually needed orchidopexy. Other studies reported no success with hCG treatment, with all patients undergoing surgery.

Hormonal therapy has not demonstrated proven efficacy. Today, most urologists agree that surgical intervention is indicated for acquired cryptorchidism.

Surgical Findings. Reports on intraoperative findings are inconsistent. A patent processus vaginalis was found in 98.8%, 78%, 50% and 43% of cases or in 10 out of 14 patients in other studies. Conversely, some authors reported that the processus vaginalis was closed in all observed cases.

In some cases, dense fibrous bands (scarred remnants of the processus vaginalis) were observed, obstructing the growth of the spermatic cord. Other reports described adhesions anchoring the testis in the inguinal region, preventing its descent into the scrotum. However, some studies rejected the presence of adhesions, attributing the condition to an abnormally positioned gubernaculum testis above the inguinal-scrotal junction, although this explanation has been disputed by other researchers.

When comparing intraoperative data in children with congenital and acquired cryptorchidism, the following conclusions were shown: compared to congenital undescended testes, acquired cases are more often located in the superficial inguinal pouch, have normal gubernaculum testis attachment, and a closed vaginal process.

Long-term outcomes: Reports in the literature describe long-term outcomes of treatment for acquired cryptorchidism. Over a follow-up period of 1.4 to 15.5 years (with an average observation period of 6.6 years) after orchidopexy for primary acquired cryptorchidism, the testicular volume was assessed in 155 patients aged 5.1 to 26.6 years. The average volume of operated testes in patients under 18 years old was 2.5 ± 2.9 ml, significantly less than the normative values for this age ($p < 0.001$). In the group of patients older than 18 years, the volume was 8.1 ± 3.7 ml, also significantly lower than the average of 13.4 ml ($p < 0.001$) [31]. Some authors evaluate the long-term outcomes of surgical treatment of acquired cryptorchidism as excellent.

An interesting case is that of a 22-year-old man with primary acquired cryptorchidism, whose testes were documented in the scrotum up to the age of 12. Histopathologically, there was complete atrophy of Sertoli cells. This fact shows that untreated acquired cryptorchidism can lead to testicular atrophy and, consequently, loss of its function.

Recommendations: The vast majority of urologists agree on the necessity of regular monitoring of testicular position in children. However, recommendations regarding the frequency and duration of monitoring vary significantly. Some publications simply state the need for observation without detailing the frequency and duration of follow-ups.

Due to the risk of acquired cryptorchidism in children with retractile testes (false cryptorchidism), it is recommended to monitor these children annually until the condition resolves or until puberty. Other studies recommend monitoring testicular position in all boys until the age of 3, until 7 years, until the onset of puberty, or until puberty is complete.

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