

*Review***SURGICAL TREATMENT OF CRYPTORCHIDISM IN CHILDHOOD****D. Dinkov, Kr. Kalinova*, K. Georgiev, B. Brahomov, E. Kyazimova, Y. Dimcheva**

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ABSTRACT

Undescended testis (UDT) or cryptorchidism is the most common genital anomaly seen in boys and can be treated surgically by orchidopexy. Cryptorchidism is best diagnosed clinically, and treated by surgical orchidopexy at age 6-12 months, without a routine biopsy. Timing of orchidopexy must be optimized in order to improve long-term prognosis. Both primary care providers and parents should be educated regarding the advantages of early orchidopexy in UDT. Outcomes of orchidopexy include having a viable, palpable testis in the scrotum, fertility, as measured by paternity rates or semen analysis in adulthood and risk of testicular cancer. Multiple operative techniques have been described and are associated with various success rates. In the past decade, success of orchidopexy for inguinal testes has been >95%. For abdominal testes, success for orchidopexy has been >85-90% in most series with single stage orchidopexy or two stage Fowler-Stephens orchidopexy, both with open surgical or laparoscopic technique. Laparoscopy is the best way of diagnosing and managing intra-abdominal testes. However, having a palpable testis in the scrotum does not assure fertility, as there are iatrogenic factors that may adversely affect the outcome. The risk of testicular carcinoma is increased by a factor of 3.7 to 7.5 times.

Key words: cryptorchidism, children, surgery

Undescended testis is the commonest genital malformation in boys. Although the mechanism that regulates prenatal testicular descent is still partly obscure, there is persuasive evidence that endocrine, genetic, and environmental factors are involved (1).

The treatment of undescended testis should begin after six months and ideally are completed by the child's first birthday (2). In Germany, there is a general consensus about the need to raise awareness of the importance of timely management of undescended testis (3). Treatment comprises hormonal and/or surgical approaches. Men with untreated bilateral cryptorchidism suffer from impaired fertility (2). Early treatment can potentially minimize the risk of infertility, although treatment before the age of 13 doesn't appear to lessen the risk of malignancy (4). Scrotal positioning, however, allows easier examination of the testicle—usually by self-examination—which favors early detection of malignancy (5). The current S2 guidelines describe in detail a diligent follow up for up to one year postoperatively (2) Cryptorchidism,

or undescended testis, is defined as failure of a testis to descend into a scrotal position, because of the pathological process during embryonic organogenesis (**Figure 1A**). An undescended testis can be located anywhere between the abdominal cavity and the entrance of the scrotum.

Different forms of undescended testis

Undescended testis can be categorized on the basis of physical examinations (modified from (1, 2):

- Undescended testis. The testicle is located intra-abdominally or in the inguinal canal. It is located in the normal descent pathway and shows normal insertion of the gubernaculum.
- Cryptorchidism from the ancient Greek "kryptos" (hidden) and "orchis" (testicle). The testicle is not palpable and is located intra-abdominally (retentio testis abdominalis) or is not present (anorchia).
- Ektopia testis. The testicle is located beneath the skin superfascially, perineally, on the thigh or shaft of the penis. The testicle shows abnormal insertion of the gubernaculum.
- Inguinal testicle. The testicle is palpable in the groin (retentio testis inguinalis).
- Gliding testicle. The testicle is located at the scrotal entrance or above the scrotum. It

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can be drawn down into the scrotum, but immediately slides back into its initial position.

- Retractable (hypermobile) testes. The physiological retractile (hypermobile) testicle is usually present in the scrotum or can be effortlessly pushed down into the scrotum; it retracts on induction of the cremasteric reflex but returns spontaneously into the scrotum. Recognizing the retractile (hypermobile) testicle is particularly important because it does not require treatment. (5, 6, 7)

We can mark off mainly palpable and non-palpable testes. To describe the position of the palpable testis:

- “peeping” - sliding in and out of the internal inguinal ring.
- Canalicular - Retentio testis inguinalis – uncompleted descend of a testis, which is

located in different levels of canalis inguinalis. (Figures 1A, B, C) (3)

- extra-canalicular - superficial inguinal pouch.
- Suprapubic.
- ectopic - the testis get pass from the external inguinal ring, but it is located in unusual place – outside of the scrotum.

Non-palpable testes can be:

- intra-abdominal - Retentio testis abdominalis – the testis is located retroperitoneal before or on the internal inguinal ring;
- absent;
- Atrophic (that one suffers significant volume loss after prior inguinal or testicular surgery or due to prolonged location in an extrascrotal position or primary developmental failure), (2-4).

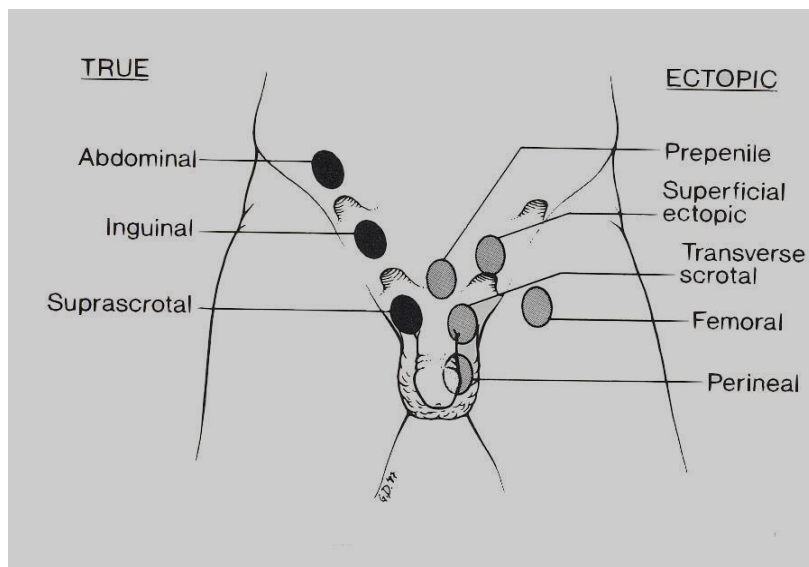


Figure 1A. Pathological process during embryonic organogenesis (3)

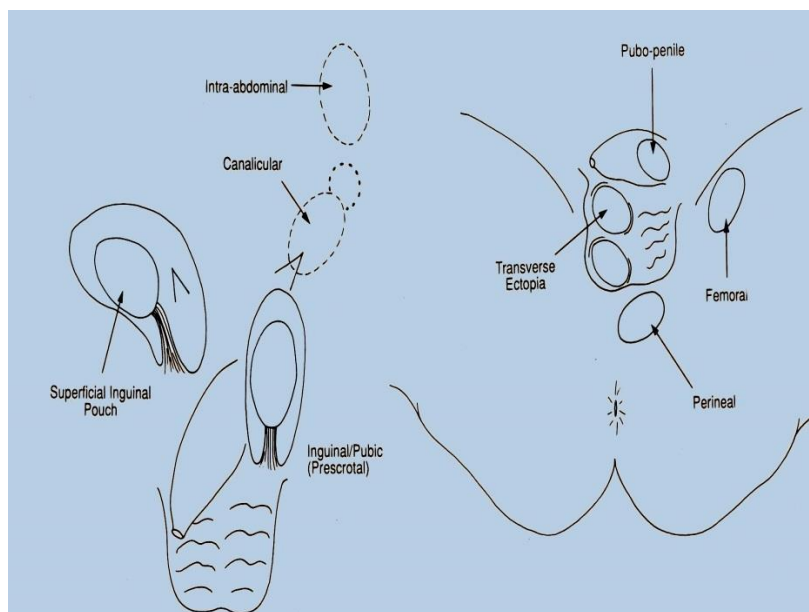


Figure 1B. Different levels of retention testis (3).

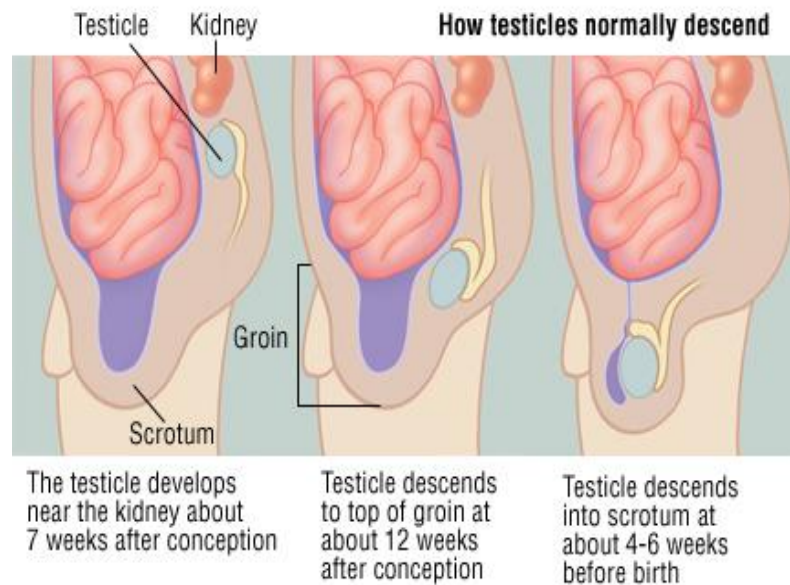


Figure 1C. Retentio testis inguinalis – uncompleted descend of a testis (3).

Epidemiology

In the neonatal period occurs in 2-4% of reserved for term infants and 33% of premature babies, but after 1 year of age only 1% of them have undescended testicles.

Etiology and pathogenesis

After the 5-th month (Figure 1C) (3) testicle begins to descend to the inguinal canal and passes through it with the processus vaginalis peritonei to 7 months. To the 9th month descent has already been completed, but in premature may be completed by the first year of birth. Descent is under the control of maternal gonadotropins violation in this balance leads to pathology. In etiopathogenesis allowed and influence factors by the fetus, congenital anatomical abnormalities gubernaculum, prematurity or fetal hypotrophics.

Detained in the inguinal canal is hypoplastic testicle (Figure 4) and abdominal undeveloped and atrophic, is impaired and the seminiferous its hormonal function. If left in an atypical position in an area with a higher body temperature (in the abdominal cavity body temperature is 2 °C higher than that in the scrotum), there is a danger of deepening the atrophy and degeneration of malignant, testicular torsion, and hydrocele. (4, 6)

Diagnosis

The physical examination is still the most important step in making the diagnosis of UDT and distinguishing it from a retractile testis. The most common challenge is to differentiate a retractile from a true undescended testis. The parent should be asked if they have ever seen the testis in the scrotum, for example when bathing the child. Retractable testes are often

bilateral and are caused by an overactive cremasteric reflex, which pulls the testis out of the scrotum towards the inguinal canal especially when the child is cold. This is a normal condition.(2)

In case of bilateral cryptorchidism level of testosterone and gonadotropine are decreased. Upon closer examination bimanualno testicle rolling palpable in the inguinal canal, but cannot be pushed into the scrotum. The testis is hypoplastic, with soft consistency. The external inguinal opening is very narrow or obliterans. Abdominal Located testicle diagnosed with Doppler ultrasonography or scintigraphy. More accurate diagnosis is the laparoscopic examination. Hormonal studies in bilateral criptohidismus show decreases in testosterone and serum gonadotropin.

Ultrasound is the most heavily used imaging modality to evaluate undescended testes. Ultrasound has variable ability to detect palpable testes and has an estimated sensitivity and specificity of 45% and 78%, respectively, to accurately localize nonpalpable testes. Given the poor ability to localize nonpalpable testes, ultrasound has no role in the routine evaluation of boys with cryptorchidism. Magnetic resonance imaging has greater sensitivity and specificity but is expensive, not universally available, and often requires sedation for effective studies of pediatric patients. Diagnostic laparoscopy has nearly 100% sensitivity and specificity for localizing nonpalpable testes and allows for concurrent surgical correction. (4-5)

There are 6 reasons supporting early intervention for UDT, which is now

recommended at 1-2 years of age. These are reduced fertility, risk of testicular malignancy, associated inguinal hernia, risk for testicular torsion or trauma, as well as psychological distress. (2, 3)

Treatment

Sir John Hunter, the British anatomist, reported this condition in 1786. In 1877, Annandale performed the first successful orchidopexy. In 1899, Bevan published the principles of testicular mobilization, separation of the processus vaginalis, and repositioning of the testis into the scrotum. Since then, testicular maldescent has been the subject of many clinical studies, but its embryology, effects on fertility, and ultimate clinical impact still remain topics of discussion and research. The treatment of cryptorchidism is hormonal, surgical, or a combination of both (4, 5, 7, 8). The success of treatment depends on the position of the testicle at diagnosis. The use of human chorionic gonadotropin (hCG) stimulates the Leydig cells of the testicle to produce testosterone. Gonadotropin releasing hormone (GnRH) stimulates the pituitary to secrete luteinizing hormone (LH) which in turn stimulates the Leydig cells of the testicle to produce testosterone and thereby initiate descent.

Orchidopexy is the standard operation for undescended testis (11). It should primarily be performed for testicular ectopy, simultaneous inguinal hernia, after previous inguinal surgery, for relapses, in older infants, or after unsuccessful hormone therapy. For the non-palpable testicle, the open operation/laparoscopy is simultaneously diagnostic and therapeutic. Cryptorchidism should be treated when the patient is aged approximately 6 months. This age recommendation has been pushed up over recent decades and is based on the rarity of spontaneous descent after age 6 months and the possible improvements in fertility that early intervention may confer. (6-8)

Hormonal therapy may be considered in bilateral cryptorchidism, to distinguish retractile/ascending testis from undescended testes, or to improve collateral testicular blood supply during redo orchidopexy. (9)

The main therapy is surgical one. It is indicated; when the testis is located in any site other than the scrotum, especially after unsuccessful hormonal treatment. If the testis can be palpated pre-operatively, a classical orchiolysis should always be carried out first, followed by orchiopey. If the testis is non-palpable, laparoscopy should be carried out to

determine whether a testicle can be located intra-abdominally. If orchiolysis and orchiopey would prove inadequate to achieve scrotal fixation due to shortness of vasa spermica, auto transplantation with microsurgical technique can be carried out. (7-10)

In Germany from 2003 to 2008, 78 % of the patients were not operated according to the medical guideline, namely, after their second year of life. After modification of the guideline recommendation 95 % of the orchidopexies were performed after the first year of life. This is in line with findings from a German university hospital, published 2012 by Höfling et al. as well as with data from an Austrian study from 2010 (10). Similarly, in the USA, only 18 % of the patients with UDT received orchidopexy before the age of 2 and 43 % were operated before reaching the age of 3 years between 1999 and 2008, as one study reported (11). An Australian study about orchidopexy in UDT in the state of Victoria from 1999 to 2006 demonstrated that while the overall orchidopexy rate declined by 26 %, the percentage of boys aged 0 to 2 years rose from 44 % to 58 % (10).

Surgery for the Palpable Testis

Palpable testes should be approached via inguinal exploration. The key steps of the operation are: 1. Mobilization of the testis and the spermatic cord to the level of the deep inguinal ring. 2. High ligation of the processus vaginalis. 3. Skeletonization of the cord by division of cremasteric and internal spermatic fascia. 4. Mobilization of the cord through the internal ring to obtain adequate length to bring the testis to the scrotum without tension. Division of the gubernaculum is optional. 5. Placement of the testis in a sub-dartos pouch in the scrotum. If used, fixation sutures should be placed through the tunica albuginea only, not the testicular parenchyma. (11).

Surgery for the Non-palpable Testis

If the testis is not palpable, laparoscopy should be carried out to determine whether a testis can be located intra-abdominally. If a testicle is indeed located intra-abdominally, preparations are made for microsurgical auto transplantation. First of all a classical orchiolysis is carried out with an attempt at orchiopey to achieve scrotal fixation (**Figure 2**). If this attempt is not successful plainly not feasible, the spermatic vessels are cut as high as possible and anastomosed to the epigastric vessels that has been dissected free. (9)

Technique by **Petrivalsky-Schoemacker-1931 (Figure 3)**.



Figure 2. Retentio testis dextra-6-month old boy (before operation).

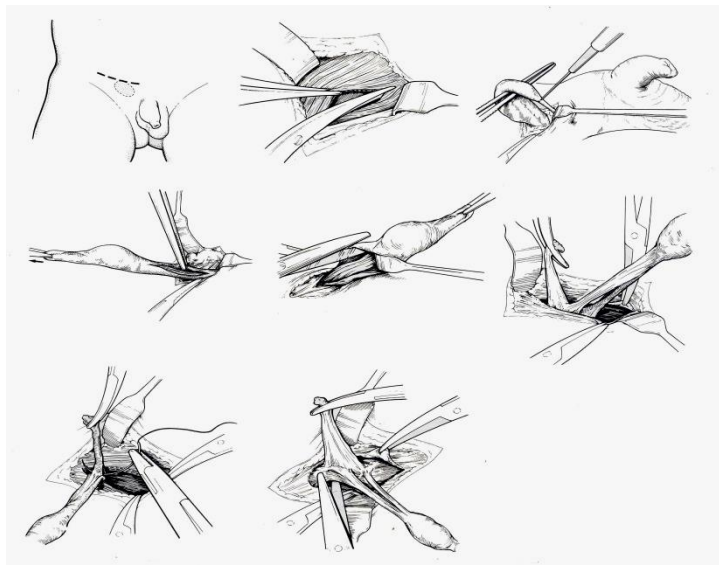


Figure 3. Technique by Petrivalsky-Schoemacker/1931/ (7).

After routine orchiolysis via an inguinal approach, scrotal pouch is created. Gubernakulum divided by acute way while taking care not to hurt the vas deferens, testis and spermatic cord with cremasteric fibers and hernial sac is available free of adhesions from the floor of the inguinal canal to vatr. Hernial bag is opened longitudinally to be back wall of the bag are separated deployed elements of the spermatic cord to the level of the internal iliac opening the bag is ligated. Furunkulolizis of the vas deferens through of the loose fibers which extends the course of the vascular access. With fine scissors the connective tissue between the tunica dartos and the scrotal skin is freely cut away, resulting in a pouch between the tunica dartos and the scrotal skin. (7) From the external inguinal

opening to the bottom of the scrotum is made a way to the tissues. After that testis is pulled and fixed.

Technique by Bianchi - Method Bianchi /1989/ - transscrotal access (Figure 4). The basis of the method of Bianchi standing belief, it is not mandatory undescended testes have a shorter than normal a.spermatica (13). In recent years, the method is preferred due to the rapid rehospitalization, low traumatical short operative time and good cosmetic results. Results published by different authors give the opinion about the excellent results which gives the method of Bianchi compared with Petrivalsky-Schoemaker at palpable testicules. All testes, which were treated by the method has been successfully fixed in the middle or

bottom of the scrotum: Missing inguinal hernia, hydrocele or testicular atrophy, as postoperative complications In retrospective studies conducted by the Department of Paediatric Urology, Royal Manchester Children's Hospital, Oxford Road, Manchester,

UK the results are similar, with a combined processing of data for a total of 1695 procedures for the 4.4 percent needed Redo surgery, 1.6% received immediate complications and overall relapse rate is 2.0% (6)



Figure 4. Method Bianchi /1989/ - transscrotal access. (13)

Mean operative time was significantly shorter in the method of Bianchi (45.2 min.) Compared to the inguinal orchidopexia (66.6 min). The mean follow-up duration of 39.1 months with all testicular; with the exception of 1 (97.7%) are in a good position within the scrotum and have good texture; 1 testis ascended postoperatively and requires inguinal orchidopexia (12, 13).

CONCLUSION

Cryptorchidismus is child pathology requiring surgery between 16-24 months to preserve maximum potential for fertility. Type of surgical access should be consistent with the type of retention for highest performance and minimal postoperative complications. Recent retrospective studies have shown that the method of Bianchi appears to be an excellent alternative to the standard inguinal orchidopexia when palpable testis located distal to the external inguinal ring with minimal post-operative complications.

Shoemaker method is the primary method for orchidopexia. The method of Bianchi seems to be an excellent alternative to standard inguinal orchidopexia at undescended palpable testicles located distal to the external inguinal ring.

REFERENCES

1. Virtanen H. E, Bjercknes R., Cortes D. et al. Cryptorchidism: classification, prevalence and long-term consequences. *Acta Paediatr.* 96:611-6, 2007.
2. Murphy F., Paran T. S., Puri P. Orchidopexy and its impact on fertility. *Pediatr Surg Int.* 23:625-32, 2007.
3. Hutson J. M., Hasthorpe S., Heyns C. F. Anatomical and functional aspects of testicular descent and cryptorchidism. *Endocr Rev.* 18:259-80, 1997.
4. Hutson J. M. Sponsored Fred McLoed Lecture. Undescended testis: the underlying mechanisms and the effects on germ cells that cause infertility and cancer. *J Pediatr Surg.* 48:903-8, 2013.
5. Kirsch A. J., Escala J., Duckett J. W. et al. Surgical management of the nonpalpable testis: the Children's Hospital of Philadelphia experience. *J Urol.*; 159:1340-3, 1998.
6. Kokorowski P. J., Routh J. C., Graham D. A. et al. Variations in timing of surgery among boys who underwent orchidopexy for cryptorchidism. *Pediatrics.* Sep; 126 (3): 2010.
7. Michael J. Mathers, Herbert Sperling, Herbert Rübber, Stephan Roth, The Undescended Testis: Diagnosis, Treatment

- and Long-Term Consequences, *Dutch Arztebl Int.*; 106: 527–532, 2009.
8. Hensel K. O., Caspers T., Jenke A. C. et al. Operative management of cryptorchidism: guidelines and reality--a 10-year observational analysis of 3587 cases. *BMC Pediatric*, 15:116, 2015.
 9. McCabe JE1, Kenny SE. Orchidopexy for undescended testis in England: is it evidence based? *J Pediatr Surg.*, 43:353-7, 2008.
 10. Aggarwal H., Rehfuss A., Hollowell J. G. Management of undescended testis may be improved with educational updates for referring providers, *J Pediatr Urol.*10:707-11, 2014.
 11. Dayanc M., Kibar Y., Irkilata H. C., Demir E., Tahmaz L., Peker A. F. Long-term outcome of scrotal incision orchiopexy for undescended testis. *Urology.*70 (4):786-8, 2007.
 12. Taran I., Elder J. S. Results of orchiopexy for the undescended testis. *World J Urol.*24 (3):231-9, 2006.