VOLUME LXXVI, ISSUE 3, MARCH 2023

ISSN 0043-5147
E-ISSN 2719-342X

Wiadomości Lekarskie
Medical Advances

Official journal of Polish Medical Association has been published since 1928

INDEXED IN PUBMED/MEDLINE, SCOPUS, EMBASE, EBSCO, INDEX COPERNICUS,
POLISH MINISTRY OF EDUCATION AND SCIENCE, POLISH MEDICAL BIBLIOGRAPHY

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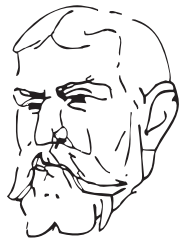

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The journal Wiadomości Lekarskie is cofinanced under Contract No.RCN/SN/0714/2021/1 by the funds of the Minister of Education and Science

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Medical Advances

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Publisher:
ALUNA Publishing House
ul. Przesmyckiego 29,
05-510 Konstancin – Jeziorna
www.wydawnictwo-aluna.pl
www.wiadomoscilekarskie.pl
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ORIGINAL ARTICLE

BILATERAL CRYPTORCHIDISM IN PEDIATRIC SURGEON'S PRACTICE: CURRENT TACTICS OF PATIENT MANAGEMENT

DOI: 10.36740/WLek202303111

Olga Gorbatyuk[1], Andrew Kovalenko[1], Mikita Veselyi[1], Mykola Gomon[2]
[1]SHUPYK NATIONAL HEALTHCARE UNIVERSITY OF UKRAINE, KYIV, UKRAINE
[2]NATIONAL PIROGOV MEMORIAL MEDICAL UNIVERSITY, VINNYTSIA, UKRAINE

ABSTRACT

The aim: To provide best practices of disease management to improve treatment outcomes for this group of patients.

Materials and methods: The paper is based on first-hand experience in observing and treating 117 children aged from 6 months to 13 years with bilateral congenital cryptorchidism during a ten-year follow-up period, who were referred for surgical treatment, and 3 newborn boys with undescended testicles and testicular torsion. A complex of clinical and laboratory, instrumental, endocrinological, and genetic research methods was used for the survey of all patients.

Results: Recognizing the action of a common causative factor for bilateral cryptorchidism, which is a consequence of primary endocrine disorders, makes it possible to predict bilateral identity of the location of testicles in this pathology, which we observed in 81 patients: bilateral inguinal cryptorchidism was registered in 49 (41.88%) children, bilateral abdominal cryptorchidism – in 32 (27.35%) children, a combination of inguinal and abdominal cryptorchidism – in 24 (20.51%) children. The following types of treatment were used in the studied group of children: 1 – primary surgical intervention – 4 children, representing 3.42%. 2 – observation and non-surgical treatment by an endocrinologist – 113 (96.58%) children. 3 – comprehensive treatment (surgical correction after hormone treatment) – 67 (59.29%) children.

According to the research, hormone therapy had a positive effect on descent of the testicles in 89 (78.76%) patients: the testicles descended into the scrotum – in 22 (24.72%) children; the testicles descended in the inguinal canal – in 32 (35.95%) children; the testicles descended to the level of the opening to the inguinal canal – in 35 (39.33%) children.

Conclusions: 1. All doctors, starting from the maternity hospital, polyclinic, children's unit, should identify children with bilateral cryptorchidism. All children diagnosed with bilateral cryptorchidism are referred to a surgeon or endocrinologist. The parents of a child with bilateral cryptorchidism should immediately consult a doctor. The study of the reasons for late admission of children to the surgical hospital revealed that 76.92% of patients sought medical advice late, after 1 year of life. 2. At the stage of diagnosis and determination of treatment tactics, an examination by an endocrinologist and a geneticist is necessary; ignoring them is considered an error in diagnostic and therapeutic tactics, since the process of descent of the testicles into the scrotum is hormone-dependent. 3. The indications for primary surgical treatment of a child with bilateral cryptorchidism involve a combination of cryptorchidism with inguinal hernia and pain syndrome, which might be caused by testicular torsion. 4. Hormone therapy provides better results of surgical intervention in bilateral cryptorchidism. The ineffectiveness of two courses of hormone therapy necessitates surgical treatment. 5. Comprehensive treatment of children with bilateral cryptorchidism (non-surgical hormone therapy and surgical correction) has led to good postoperative results in 71.64% of patients, satisfactory results – in 22.39% of children, recurrences – in 5.97% of patients. 7. A long-term follow-up observation should be carried out by a surgeon and endocrinologist until patients reach their reproductive years.

KEY WORDS: bilateral cryptorchidism, children, diagnostics, inverted testis

Wiad Lek. 2023;76(3):534-539

INTRODUCTION

Bilateral cryptorchidism (BC) is an urgent medical and social problem for the world and Ukraine. Periodic scientific discussions on the issue of cryptorchidism in children almost do not focus on bilateral cryptorchidism. However, the number of tactical diagnostic and treatment errors in this pathology remains high, despite the fact that patients with BC represent a large proportion of planned surgical corrections in childhood. Therefore, the issue of cryptorchidism in children remains relevant and outstanding today, despite a large number of publications on this topic, as there are still errors in diagnostic and treatment strategies of this pathology [1-3].

BC is a pathological condition defined as the failure of the testis to descend from the abdominal cavity into the scrotum in the antenatal period. It is one of the fairly common disorders of sexual development associated with the risk of infertility due to disorders of spermatogenic (reproductive) function. BC is a systemic disease, one of the symptoms of which is undescended testicles. Etiological factors of this pathology can involve de-

Table I. Number of pediatric patients with BC depending on the age and final diagnosis

Diagnosis/age	6 mths. - 1 yr.	1 yr. 1 mth. - 5 yrs.	5 yrs. 1 mth. - 10 yrs.	Over 10 yrs.	Total
Bilateral inguinal cryptorchidism	11	28	7	3	49 (41.88%)
Bilateral abdominal cryptorchidism	7	21	4	0	32 (27.35%)
Inguinal + abdominal	9	10	3	2	24 (20.51%)
Vanishing testes syndrome	0	9	3	0	12 (10.26%)
Total:	27(23.08%)	68 (58.12%)	17 (14.53%)	5 (4.27%)	117(100%)

creased production and impaired action of androgens, disorders of testicular organogenesis, 5α-reductase deficiency, androgen insensitivity syndrome, lack of gonadotropins, anti-Mullerian hormone, insulin-like factor 3, anatomical complications of testicular descent (inguinal canal obliteration, intra-abdominal adhesions, abnormal testicular fixation, inguinal hernia), dysplasia of connective tissue, which are found in more than 74% of patients with BC. The process of descent of the testicles into the scrotum is hormone-dependent. At present, most researchers consider hormonal disorders associated with dysregulation of the hypothalamic-pituitary-gonadal axis to be the main cause of BC.

The frequency of cryptorchidism among full-term children is 0.6-3.6%, among premature children – 30% or more. Clinical observations indicate that right sided cryptorchidism occurs in more than 50% of children, left sided – in 35-40% of cases, and bilateral – in 10-15% [4-7]. BC can be a component of many severe anomalies, such as congenital anomaly of the kidneys, hypospadias, prune belly syndrome, bladder exstrophy, gastroschisis and omphalocele, anogenital cleft, etc. Children with BC quite often have umbilical and inguinal hernia, congenital ophthalmocele, spinal curvature, broad nasal bridge, auricular dysplasia, abnormal occlusion, narrow palate, etc. Abnormal development of the central nervous system is registered in 83.3% of patients. Adiposis is significantly more common than in healthy boys. BC can be one of the manifestations of chromosomal pathology (Klinefelter's syndrome, gonosomic mosaicism, etc) [8-10].

The descent of the testicle depends on the interaction of hormonal and genetic factors that ensure the complex regulation of embryonic migration: insulin-like factor 3, differentiation of androgen producing Leydig cells and androgen receptor sensitivity, secretion of luteinizing hormone, the synthesis of which is carried out by the pituitary gland at 15-24 weeks of the fetal period. Testicles in boys are actively functioning, synthesizing anti-Mullerian hormone, which leads to regression of the Mullerian ducts, and testosterone. Testosterone and its active metabolite dihydrotestosterone are responsible for the formation of external and internal male genitalia. Low testosterone in boys at the 14th week of the fetal period will lead to violation of the process of fetal sex differentiation of varying degrees of severity (hypospadia, female structure of the external genitalia). Testosterone deficiency after the 14th week of intrauterine development will lead to underdevelopment of the external genitalia, often in combination with cryptorchidism [11, 12].

Nonpalpable testicles, according to Galvin D. et al. (2002), represent a unique problem both in terms of diagnosis and treatment. Until recently, the issues regarding management of children with BC have remained controversial [13]. Recommendations on this issue differ significantly depending on the position of the doctor and are not always sufficiently substantiated, and non-surgical, surgical and comprehensive treatment is used for correction without clearly defined indications. When the testicular tissue is damaged in cryptorchidism, the reproductive and hormonal function of the testicles suffers. Late diagnosis and treatment lead to infertility in 70% of patients, especially in BC [14, 15, 16].

The paper summarizes the data on first-hand experience in clinical observation of pediatric patients with BC.

THE AIM

Based on first-hand experience in observing and treating children with BC, to provide best practices of disease management to improve treatment outcomes for this group of patients.

MATERIALS AND METHODS

The paper is based on first-hand experience in observing and treating 117 children aged from 6 months to 13 years with bilateral congenital cryptorchidism during a ten-year follow-up period (Table I), who were referred for surgical treatment. The study was carried out on clinical sites of the Department of Pediatric Surgery of Shupyk National Healthcare University of Ukraine.

The largest number of children with BC in the study were aged 1-5 years (58.12%) and had bilateral inguinal cryptorchidism (41.88%). There were 27 boys under the age of 1 year, representing 23.08%.

In addition, 3 newborn boys with bilateral undescended testicles and testicular torsion were under observation. These children were premature; they were examined at the neonatal unit of the maternity hospital due to a sudden worsening of the condition (restlessness, food refusal, vomiting), which arose against the background of painful scrotal swelling and the presence of a bulge in the area of the inguinal canal. The children were examined by a pediatric surgeon within the first 3-4 hours from the onset of the disease. On the basis of clinical data, bilateral undescended testicles and testicular torsion were diagnosed, which was confirmed by Doppler ultrasonography.

Studying the reasons for the delay in seeking medical help (a total of 90 children older than 1 year, representing 76.92%) showed that 30% of parents considered their children to be healthy and did not consult a doctor (27 cases), 23 (25.55%) parents followed their pediatrician's advice to passively monitor their children until they reach an older age, 24 (26.67%) patients got advice from their surgeons to undergo surgical treatment at a later stage with an expectation of testicular descent with age, 16 (17.78%) patients followed their surgeon's advice to have surgical correction at an older age, considering it safer in terms of technical capabilities and general anesthesia, since the operation in young children is more complicated.

A complex of clinical and laboratory, instrumental, endocrinological, and genetic research methods was used for the survey of all patients.

Palpation of the inguinal region should be performed in the horizontal and vertical position of the child. If possible, the child is asked to strain or cough and the doctor tries to move the testicle into the inguinal canal, pressing on the lower abdomen from the top down.

The main diagnostic studies for BC are the following:

- visualization of the testicles by using ultrasound of the scrotum and inguinal canal to determine the location, size and structure of the testicle (CT without/with three-dimensional imaging and diagnostic laparoscopy are recommended as additional research methods) [17-20].

Doppler sonography is widely used to determine the state of vascularization. Laparoscopy, which is used in case of suspicion of an abdominal form of BC or vanishing testes syndrome, makes it possible to find the testicle, assess its condition, the condition of the internal inguinal ring, vessels and vas deferens.

- hormone testing (determining the level of luteinizing and follicle-stimulating hormones, prolactin, testosterone, estradiol, anti-Mullerian hormone, inhibin, etc);
- genetic testing (determination of sex chromatin, karyotyping, cytogenetic analysis of sex chromosomes in some cases).

Testing for human chorionic gonadotropin was performed when required. A positive test indicated the presence of testicles.

The compilation of best practices of pediatric surgeons, endocrinologists, and geneticists made it possible to develop recommendations for practical health care regarding management of patients with BC.

Statistical processing of research results was performed using standard methods with calculation of the relative value (absolute number of observations, percentage ratio).

RESULTS

Fifty-nine (50.43%) children in the study were overweight. Gynecomastia was registered in 7 (5.98%) boys, which was a consequence of endocrine disorders. Almost all children had hypoplastic (undeveloped) scrotum. Among the studied group of children, 28 (23.93%) had concomitant inguinal and/or umbilical hernias, 17 (14.53%) – hypospadia, 8 (6.84%) – abnormal occlusion, and 8 (6.84%) – neurological disorders.

Recognizing the action of a common causative factor for BC, which is a consequence of primary endocrine disorders, makes it possible to predict bilateral identity of the location of testicles in this pathology, which we observed in 81 patients, including 24 patients with a combination of different forms of cryptorchidism. Thus, among the studied group of 117 patients, bilateral inguinal cryptorchidism was registered in 49 (41.88%) children, bilateral abdominal cryptorchidism – in 32 (27.35%) children, vanishing testes syndrome – in 12 (10.26%) children, a combination of inguinal and abdominal cryptorchidism – in 24 (20.51%) children.

The following types of treatment were used in the studied group of children:

- primary surgical intervention – 4 children, representing 3.42%;
- observation and non-surgical treatment by an endocrinologist – 113 (96.58%) children;
- comprehensive treatment (surgical correction after hormone treatment) – 67 (59.29%) children.

Among 4 patients with BC who had indications for primary surgical treatment, 3 children had a combination of cryptorchidism with bilateral inguinal hernia and levels of gonadotropins within the age norm. One child with BC aged 13 years had complaints of pain in the undescended testicle, which arose after riding a bicycle and became an indication for surgical treatment. This child had a testicular torsion on the right side. Thus,

the indications for primary planned surgical intervention involved testicular retention in combination with inguinal hernias and BC, which was complicated by a testicular torsion. Newborns with a testicular torsion also underwent urgent surgery, namely detorsion and orchiopexy.

A low level of gonadotropins was registered in 98 (83.76%) children.

DISCUSSION

Until recently the issues regarding management of children with BC have remained controversial. The ratio between unilateral and bilateral cryptorchidism is 5:1, which was established by Odiorne W.B. and Simmons C.C. back in 1904 and is still relevant today [21]. In most children with BC, the level of luteinizing hormone was also low. It is luteinizing hormone deficiency that determines the effectiveness of hormone therapy for BC. Indeed, hormone therapy was effective in patients with low hormone levels. Therefore, children with a low level of gonadotropins first of all should consult an endocrinologist, who makes the decision on the need of hormone therapy. In the absence of effect, non-surgical hormone therapy is considered as preparation for surgical treatment. The ineffectiveness of two courses of hormone therapy necessitates surgical treatment.

Chorionic gonadotropin, pituitary gonadotropins, namely Prephyson, were used as a hormone therapy. There are reports of successful intranasal use of gonadotropin releasing hormone Kryptocur [14]. The hormone is usually prescribed twice a week for 4-5 weeks. Hormone therapy was ineffective in 24 (21.24%) children of the studied group.

In approximately 70% of cases BC is associated with reduced fertility [22].

According to the research, hormone therapy had a positive effect on descent of the testicles in 89 (78.76%) patients:

- the testicles descended into the scrotum – in 22 (24.72%) children;
- the testicles descended in the inguinal canal – in 32 (35.95%) children;
- the testicles descended to the level of the opening to the inguinal canal – in 35 (39.33%) children.

An increase in the size and testicular mobility in cryptorchidism occurred in most patients against the background of non-surgical hormone therapy.

Hormonal action provides certain guarantees of preserving fertility, improves the results of surgical treatment (reduction of postoperative recurrences); intraoperatively the testicles are easily separated from the surrounding tissues and descend into the scrotum without traction.

Comprehensive treatment of bilateral cryptorchidism was performed in 67 (59.29%) patients, namely surgical correction of the defect after two courses of hormone therapy. Among this group of patients, 32 boys had descent of the testicles in the inguinal canal, and 35 boys had descent of the testicles to a position near the internal inguinal ring against the background of non-surgical treatment.

Surgical treatment of BC involves sequential intervention first on one side. It is advisable to start the descent of the testicle from the side where the organ is relatively preserved. Our tactics of surgical treatment of children with BC involved moving and fixing undescended testicles sequentially. The surgery starts from the side where the testicle is located lower, is more mobile and more developed. If during surgery the testicle is absent in the inguinal canal and retroperitoneum, it is necessary to identify vas deferens, that will help find the testicle located high. Congenital testicular aplasia is diagnosed when vas deferens is identified as a blind ending. Thus, during the surgery for BC, it is necessary to find the testicle or any element of the spermatic cord. Operative exploration of these formations prevents diagnostic errors.

The following principal approaches should be followed when performing surgical intervention:

- mobilization of the elements of the spermatic cord not only in the inguinal canal, but also in the retroperitoneal space;
- with a high location of the testicle, the use of the technique of transposition of the vascular-nervous bundle and vas deferens by dissection of the deep inguinal ring, posterior wall of the inguinal canal and the intersection of the inferior epigastric vessels;
- preserving the distal portion of the processus vaginalis, which contributes to maintaining the optimal temperature regime, and also minimizes traumatization of the organ;
- less interruption of the inguinal canal structures to avoid additional plastics;
- testicular fixation without tension on the vascular bundle to preserve blood supply.

The results of surgical treatment of children with BC were evaluated as good, satisfactory and unsatisfactory. The results were considered as good when the testicles corresponded to the age norm in terms of size and consistency, or were larger than 50% of the age norm, were mobile, and were located in the scrotum. With satisfactory results, the testicles were smaller than 50% of the age norm, and were located in the upper third of the scrotum. The results were considered as unsatisfactory when the testicles were significantly reduced in size, traction to the root of the scrotum was observed.

Comprehensive treatment of children with BC has led to good postoperative results of surgical treatment in 48

(71.64%) patients, satisfactory results – in 15 (22.39%) children; 4 patients had recurrence of cryptorchidism, representing 5.97%.

CONCLUSIONS

1. All doctors, starting from the maternity hospital, polyclinic, children's unit, should identify children with BC. All children diagnosed with BC are referred to a surgeon or endocrinologist. The parents of a child with BC should immediately consult a doctor. The study of the reasons for late admission of children to the surgical hospital revealed that 76.92% of patients sought medical advice late, after 1 year of life.
2. At the stage of diagnosis of BC and determination of treatment tactics, an examination by an endocrinologist and a geneticist is necessary; ignoring them is considered an error in diagnostic and therapeutic tactics, since the process of descent of the testicles into the scrotum is hormone-dependent.
3. The indications for primary surgical treatment of a child with BC involve a combination of cryptorchidism with inguinal hernia and pain syndrome, which might be caused by testicular torsion.
4. Hormone therapy provides better results of surgical intervention in BC. The ineffectiveness of two courses of hormone therapy necessitates surgical treatment.
5. Comprehensive treatment of children with BC (non-surgical hormone therapy and surgical correction) has led to good postoperative results in 71.64% of patients, satisfactory results – in 22.39% of children. Four children had recurrences, representing 5.97% of the total.
6. A long-term follow-up observation should be carried out by a surgeon and endocrinologist until patients reach their reproductive years.

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ORCID and contributionship:
Olga Gorbatyuk: 0000-0003-3970-8797 [A-C]
Andrew Kovalenko: 0000-0003-0326-6421 [D,E]
Mikita Veselyi: 0000-0002-4340-4924 [E,F]
Mykola Gomon: 0000-0002-3557-2928 [E,F]

Conflict of interest:
The Authors declare no conflict of interest.

CORRESPONDING AUTHOR

Olga Gorbatyuk
Shupyk National Healthcare University of Ukraine
9 Dorogoshitska st., 04112 Kyiv, Ukraine
tel: +380503820641
e-mail: ol.gorbatyuk@gmail.com

Received: 27.08.2022
Accepted: 14.02.2023

A – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article

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