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A GENTLE METHOD OF TREATING AN ACUTE SPERMATIC CORD CYST IN CHILDREN

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ЩАДЯЩИЙ МЕТОД ЛЕЧЕНИЯ ОСТРО ВОЗНИКШЕЙ КИСТЫ СЕМЕННОГО КАНАТИКА У ДЕТЕЙ

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We examined 355 children with acute spermatic cord cysts (ASCC) aged from 18 days to 1 year. All patients were divided into two groups according to the type of surgical treatment performed. The reference group consisted of 160 children receiving traditional treatment. The primary group included 195 boys with ASCC, who underwent a gentle treatment method for this pathology developed at the clinic. Analysis of the results showed that, in comparison with traditional treatment methods of ASCC in children, the author's method showed advantages in the form of less invasiveness and the number of complications, as well as faster recovery of patients.

Keywords: acute, spermatic cord cyst, puncture-sparing method, treatment, children

Обследовано 355 детей с остро возникшей кистой семенного канатика (ОВКСК) в возрасте от 18 дней до 1 года. Все больные по виду проведенного хирургического лечения были разделены на две группы. Референтную группу составили 160 детей, получавших традиционное лечение. В основную группу вошли 195 мальчиков с ОВКСК, которым проводилось разработанное в клинике щадящее лечение данной патологии. Анализ результатов показал, что в сравнении с традиционными методами лечения ОВКСК у детей авторский метод имел преимущества в виде меньшей инвазивности и количестве осложнений, а также в более быстром восстановлении пациентов.

Ключевые слова: остро возникшая киста семенного канатика, пункционный щадящий метод, лечение, дети

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ASCC – acute spermatic cord cyst
PG – primary group

RG – reference group

There is no consensus among pediatric surgeons regarding the therapeutic tactics for acute spermatic cord cysts (ASCC) in children [1]. There are adherents of radical treatment of this pathology. At the same time, many specialists favor the puncture method of treatment. Proponents of radical correction explain their choice by the fact that surgery allows one-stage elimination of the disease [2]. However, there are no recommendations on how to deal with patients with contraindications to anesthesia [3].

In pediatric surgery, methods and approaches that improve patients' quality of life are highly relevant. Reducing the traumatic nature of procedures and surgeries plays an important role. Modern technologies make it possible to achieve a more precise and less

invasive intervention, which is especially important in operations on the genitourinary organs in pediatric patients [4].

The choice of approach should be based not only on the immediate results of treatment and the number of possible complications but also on the recurrence rate of ASCC in the distant period. The long-term results and recurrence rate of minimally invasive techniques have not yet been sufficiently described in the literature [5, 6].

Material and Methods. This study was based on the treatment results of 355 children with ASCC between 18 days and one year of age. All patients were treated at the Specialized Pediatric Surgical Clinic of SamSMU over 28 years (from 1994 to 2021).

Depending on the tactics and treatment method, all patients with ASCC were divided into two groups. The

reference group (RG) consisted of 160 (45.1 %) children treated in the clinic from 1994 to 2007 and received conventional treatment. The main group (PG) consisted of 195 (54.9 %) boys with ASCC who were treated according to the technique developed in the clinic. PG patients were treated at the clinic from 2008 to 2021. There were significantly ($p < 0.05$) more rural residents, 225 (63.4 %), than urban residents, 130 (36.6 %).

The distribution of children in the groups by age was equivalent (Table 1). Under one month of age, the pathology was reported less frequently (2.5 %) than in other ages. ASCC occurred most frequently in boys in the 1–2 and 2–3-month age groups (48.7 % and 26.5 % respectively).

Table 1

Distribution of patients by age in the compared groups

Age, months	Groups		Total
	RG	PG	
Under 1	3 (1.9 %)	6 (3.1 %)	9 (2.5 %)
1–2	73 (45.6 %)	100 (51.3 %)	173 (48.7 %)
2–3	51 (31.8 %)	43 (22.1 %)	94 (26.5 %)
3–4	18 (11.3 %)	17 (8.7 %)	35 (9.8 %)
5–12	15 (9.4 %)	29 (14.8 %)	44 (12.4 %)
Total	160 (100 %)	195 (100 %)	355 (100 %)

The central part of patients – 235 (66.2 %) were admitted to the clinic in the first 24 hours from the disease onset. The reason for the parents' early appeal to the hospital was the pronounced restlessness and crying of the child, which are characteristic manifestations of ASCC. At the same time, children were admitted later, from 1 to 3 days (24.8 %) and from 4 to 5 days (9 %).

The examination complex included complaints and anamnesis, examination, palpation, clinical and laboratory examination, and ultrasound with Doppler ultrasonography (USG).

The following criteria were determined to compare the traditional method of puncture treatment of ASCC in RG with the proposed method in PG: recurrence of cystic fluid accumulation, erythrocyte content in aspirated cystic fluid, and the appearance of swelling at the puncture site.

Statistical data processing was performed using the Statistica 7.0 program (StatSoft, USA). Nonparametric and parametric statistical methods were used to assess the reliability of differences between the indicators with confirmation of normal distribution. The level of statistical significance was taken as $p < 0.05$.

Results and Discussion. In RG 107 (66.9 %), out of 160 children who were treated by puncture method, 17 (10.6 %) were treated due to the lack of effect from punctures in the planned procedure, and surgical cyst excision was performed. A total of 124 (77.5 %) children underwent puncture treatment. The reason for the use of puncture treatment was the presence of medical contraindications to anesthesia in patients. Parents of 93 (58.1 %) children refused operative treatment. 36 (22.5 %) patients were operated on soon after admission, and the puncture method of ASCC treatment was not applied to them. Of these, 22 (13.8 %) children were operated on as emergencies. The indication for emergency intervention was the diagnosis of a pinched hernia. 19 (11.9 %) patients were admitted to the clinic from family polyclinics with the diagnosis of a pinched hernia, and 3 (1.9 %) patients had this diagnosis established in the clinic (it was impossible to exclude a

pinched hernia). In these patients, the diagnosis of ASCC was established intraoperatively.

ASCC puncture in RG was performed using a disposable syringe with a needle, in compliance with all the requirements of asepsis and antisepsis, under local anesthesia.

During ASCC puncture, complications were observed in 91 (73.4 %) children out of 124. Small vessels were damaged in 13 (10.5 %), and small hematomas were noted in 19 (15.3 %) children. Recurrence of the disease after RG puncture was reported in 59 (47.6 %) children; in these cases, we performed repeated punctures for the second and third time. 72 (58.1 %) patients were cured after single puncture emptying of ASCC. In some cases, double and triple punctures were performed to achieve a positive treatment effect (32 (25.8 %) and 3 (2.4 %), respectively). In 17 (13.7 %) cases, the puncture method was ineffective. Even after twofold 7 (5.7 %) and threefold 4 (3.2 %) punctures, there was a recurrence of the disease, which was the reason for surgical excision of the cyst (Table 2).

Table 2

Frequency and number of punctures performed on RG patients

Criteria	Frequency and number of punctures			Total
	1 time	2 times	3 times	
Patients were treated by:				
– puncture	78 (62.9 %)	39 (31.5)	7 (5.6 %)	124 (100 %)
– operated	72 (58.1 %)	32 (25.8 %)	3 (2.4 %)	107 (86.3 %)
	6 (4.8 %)	7 (5.7 %)	4 (3.2 %)	17 (13.7 %)
Punctures:	78 (44.1 %)	78 (44.1 %)	21 (11.8 %)	177 (100 %)
– effective	72 (40.7 %)	64 (36.2 %)	9 (5.1 %)	145 (82.0 %)
– ineffective	6 (3.4 %)	14 (7.9 %)	12 (6.7 %)	32 (18.0 %)

Analysis of the results of ASCC treatment in patient RG revealed the dependence of puncture efficacy on the patient's age. In children three months and older, puncture had no therapeutic effect. At the same time, the puncture treatment method was effective in children under three months of age. Out of 114 children under three months of age who were treated with the puncture method, only 7 (6.1 %), patients punctures were ineffective. These patients underwent surgical excision of the cyst.

The studies above showed us that puncture treatment of ASCC is highly effective in children under three months of life. At the same time, the ASCC puncture method in RG needed modernization. The use of a standard disposable injection needle with cutting edges during ASCC puncture in RG led to such complications as blood vessel damage and penetrating cyst puncture. The lack of hardware visual inspection forced the surgeon to rely only on palpatory sensation. This could not give reliable information about the complete emptying of the cyst. Repeated punctures further reduced the reliability of palpation due to soft tissue edema and contraction of the cyst walls.

A method was proposed for puncture treatment of ASCC in PG patients, characterized by minimal traumatization of soft tissues, excluding damage to blood vessels during aspiration of the liquid contents of the cyst.

Minimal traumatization of soft tissues during puncture was achieved by using a disposable angiocatheter, which has thin, elastic walls and is equipped with a needle with a particular laser sharpening, which provides an atraumatic and painless introduction. The cyst's complete and qualitative emptying was controlled by real-time ultrasound examination.

As a result of comparative analysis of the traditional method of puncture treatment of ASCC in RG and the sparing method of puncture treatment developed in the clinic in PG, it was found that the incidence of soft tissue edema as a consequence of puncture treatment of ASCC was significantly reduced ($p < 0.01$) from 19 (15.3 %) in RG to 2 (1.3 %) in PG (Table 3). Macroscopic signs of blood in the puncture fluid of RG patients were visualized in 13 (10.5 %) cases, whereas in PG, this criterion was not recorded in any case 0 % ($p < 0.05$).

Table 3

Comparison of the efficacy of puncture treatment of ASCC in the groups

Criteria	Groups	
	RG	PG
Local soft tissue edema	19 (15.3 %)	2 (1.3 %)##
Presence of signs of blood in the puncture (macroscopically)	13 (10.5 %) #	–
Average content of erythrocytes in the punctate sediment, in the field of view	14.23±1.31	1.98±0.31##
Repeated accumulation of cystic fluid*	42 (36.8 %)	9 (6.0 %)##

Note: * – percentage of complications in relation to all children treated by puncture method in groups up to 3 months of age; # – $p < 0.05$; ## – $p < 0.01$.

The content of erythrocytes in the cyst fluid sediment can judge the level of traumatization of the compared puncture methods. The mean erythrocyte content in the punctate sediment decreased significantly ($p < 0.01$) from 14.23±1.31 in RG to 1.98±0.31 in PG. At the same time, due to the use of the gentle ASCC puncture treatment method, the incidence of recurrent cyst fluid accumulation was significantly ($p < 0.01$) reduced from 42 (36.8 %) in RG to 9 (6.0 %) in PG from 42 (36.8 %).

In RG 107 (66.9 %), children under three months of age were treated by traditional puncture, surgery was performed in 7 (4.4 %) patients at this age after an ineffective puncture, and surgery was performed

immediately in 13 (8.1 %) due to the difficulty of differential diagnosis with an impingement hernia. In contrast to RG in PG children under three months of age, 148 (76.0 %) of 148 (76.0 %) had effective puncture-sparing ASCC. In 1 (0.5 %) case, due to the parents' refusal, the second puncture was not performed, and surgical excision of the cyst was performed at the parents' insistence. It should be noted that five children in PG, whose age was older than three months, underwent puncture before surgical excision of the cyst. These boys underwent puncture as a palliative method because the children had temporary contraindications to general anesthesia. No diagnostic surgery was performed in PG children under three months of age. To achieve a therapeutic effect in some cases, repeated punctures were also performed in children with ASCC in PG. In RG, the number of patients who recovered from the puncture method alone was 107 children; in PG, the number of patients who recovered from the puncture method was 148. To achieve a curative effect, 32 (29.9 %) patients in RG underwent double punctures, and 3 (2.8 %) underwent three punctures. As a result of the new sparing method of puncture treatment, the efficiency of a single puncture increased from 67.3 % in RG to 94.6 % in PG. It should be noted that the number of punctures required to recover children from ASCC in PG decreased by 30.0 % compared to RG.

Proponents of the puncture method of ASCC treatment explain their choice by the fact that open surgical intervention is appropriate only in case of unsatisfactory results of the puncture method. The choice of this tactic is justified by the properties of the vaginal outgrowth of the peritoneum in young children to obliteration [6, 7]. At the same time, the possibility of repeated punctures is allowed. At the same time, the minimally invasive puncture method of ASCC treatment is considered the most attractive. With the right tactical approach, the presence of hardware visual control in real-time, and the safest possible methods of ASCC puncture, this method, with several advantages, can be a full-fledged alternative to the surgical method [8].

It is important to note that the development of various complications may accompany surgical interventions. Scarring and adhesions, impaired blood flow, and patency of the vas deferens are complications that may develop after surgical intervention [9, 10].

Conclusion. Thus, the developed method of sparing ASCC treatment, including real-time ultrasound monitoring and atraumatic needles, is safe at any age and does not require special skills from the surgeon. Compared to traditional methods of treating ASCC in children, the sparing method has shown advantages in less invasiveness, fewer complications, and faster patient recovery.

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NETOSIS AS A PROCESS INVOLVED IN THE CONSOLIDATION OF ANEURYSMAL BONE CYSTS IN CHILDREN USING HEMOSTATIC AGENTS

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НЕТОЗ КАК ПРОЦЕСС, УЧАСТВУЮЩИЙ В ЗАЖИВЛЕНИИ АНЕВРИЗМАЛЬНОЙ КОСТНОЙ КИСТЫ У ДЕТЕЙ ПРИ ПРИМЕНЕНИИ ГЕМОСТАТИЧЕСКОГО ПРЕПАРАТА

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The study investigating the excessive formation of neutrophil extracellular traps (NETs) in neutrophils culture obtained while treatment of aneurysmal bone cysts using «Haemoblock», a hemostatic agent (Pul-Sar, Istra, Russian Federation), as a stimulator has been conducted. One hundred twenty-eight children with aneurysmal bone cysts (ABC) aged 6 to 15 years were included in the study. Sixty-three of the patients a clinical comparison group, underwent intralesional resection followed by alloplasty. Sixty-five of the patients made up a main clinical group who underwent minimally invasive surgery; 35 patients (A) and 30 children were treated by puncturing and administered a hemostatic agent (B).

Ex vivo excessive NET generation was evaluated in neutrophil culture isolated from blood obtained during cyst puncturing and from peripheral venous blood in all children of the main clinical group. Neutrophils isolated from cysts had a statistically significantly increased ability to form extracellular traps compared to neutrophils from peripheral venous blood in response to stimulation by «Haemoblock», a hemostatic agent. Neutrophils in these patients formed mainly filamentous NETs.

Thus, a modulating NETs formation plays a main role in providing intercellular interaction and proliferation of cells, including fibroblasts, leading to the closure of the cavity of aneurysmal bone cysts in children.

Keywords: aneurysmal bone cyst, netosis, neutrophil extracellular traps, hemostatic agent, children

Проведено исследование выраженности образования нейтрофильных внеклеточных ловушек (НВЛ) в культуре нейтрофилов, полученной при лечении аневризмальных костных кист при использовании в качестве стимулятора гемостатического раствора «Гемоблок» (Пуль-Сар, Истра, Российская Федерация). Всего в исследование