THE ACUTE SCROTUM IN CHILDREN

Elena Ţarcă, Geanina Irina Crişcov*, B. Savu, S.G. Aprodu
University of Medicine and Pharmacy, “Grigore T. Popa”-Iaşi
Faculty of Medicine
Department of Mother and Child Medicine
*Corresponding author. E-mail: irinacriscov@yahoo.com

THE ACUTE SCROTUM IN CHILDREN (Abstract): The acute scrotum syndrome is a medical-surgical emergency and the recognition of this condition by both healthcare professionals and the general population may result into the patients’ coming in earlier for medical examination and into the preservation of the gonad in case of torsion. The purpose of this retrospective analytical research is to point out specific epidemiological aspects in pediatric patients suffering from acute scrotum, and to review the existing diagnosis and treatment options. The study included 208 patients, of whom 16 with vanishing testis and 192 with acute scrotum (torsion of testis 25.5%, torsion of the hydatid of Morgagni 68.2%, epididymoorchitis 5.2%). The torsion of the hydatid of Morgagni occurs in boys with a mean age of 10 years and it involves both testes equally, whereas the torsion of testis usually occurs around the age of 13 and is twice more common in the left gonad. Another significant difference between the two conditions is the inflammatory syndrome, which occurs in 45.4% of the children with torsion of testis versus only 18.2% in the torsion of hydatid. Only one out of six testes torted during the neonatal period could be saved (16.6%); the gonad preservation rate was as high as 68.2% in the group of patients with testis torsion occurring outside the neonatal period. These alarming data are accounted for by the non-recognition of the severity of the condition and by the delayed surgical therapy, which occurs on the average 20 hours after the testis torsion has set in. If the asepsis and antisepsis standards are observed, patients with torsion of the hydatid of Morgagni or torsion of testis require neither fluid sampling from the tunica vaginalis for culture, nor antibiotic therapy. Keywords: ACUTE SCROTUM, TESTICULAR TORSION, TESTICULAR APPENDAGE, EPIDIDYMO-ORCHITIS.

The acute scrotum syndrome refers to the sudden onset of pain, swelling and other inflammatory phenomena in a hemiscrotum, which may be caused by conditions such as orchiepididymitis, torsion of testis or appendix testis, testicular hematoma due to local injury or hematocoele due to adrenal hemorrhage during the perinatal period, testicular tumor, strangulated inguinal or scrotal hernia, acute scrotal edema, Henoch-Schönlein purpura. Strangulated inguinal hernia and testis torsion are surgical emergencies, whereas orchiepididymitis may only require medical therapy. Scrotal injury with hematoma or incarcerated hernia may be diagnosed according to anamnesis, whereas Doppler ultrasound scanning may differentiate the inflammatory phenomena due to orchiepididymitis from the absence of blood flow due to testis torsion (1). A detailed history, through physical examination of the genitalia and
medical imaging examinations such as Doppler ultrasound scanning, and sometimes scintigraphy or IRM, usually allow a preoperative differential diagnosis. Nevertheless, even the slightest diagnosis doubt requires surgical examination designed to rule out testis torsion as the cause of the acute scrotum and to save the gonad (2,3,4). The purpose of this research is to emphasize specific epidemiological aspects in pediatric patients suffering from acute hemiscrotum syndrome, and to review the existing diagnosis and treatment options in a regional Romanian center.

**MATERIAL AND METHODS**

We have conducted a retrospective analytical study on 257 patients hospitalized and treated in the Pediatric Surgery Clinic of the “Sfânta Maria” Children’s Hospital of Iași over a period of about 3 years (January 2012 – February 2015). Our hospital is the only tertiary hospital in the Moldova area, which treats pediatric patients coming from 7 counties. The patient data were retrieved from the hospital’s computerized database, after entering the disease code N44, which stands for “Torsion of Testis”. The system generated 257 patients encoded with this diagnosis, from a total number of 4816 diagnoses. Only 208 of them were eligible for our research, the remaining 49 being excluded as their diagnoses did not correspond to the aim of our study. We carried out an analysis and statistical processing of the patients’ demographic data, diagnosis on hospital discharge, age on the first hospitalization, number of hospitalization days, personal history, paraclinical tests and examinations, treatment method, operating technique, subsequent evolution, pathology findings. All patients were seen by at least one specialist doctor, routine complete blood counts, inflammatory tests (ESR, Fibrinogen) and urinalysis were performed. Sometimes, additional examinations were conducted, i.e. abdominal and scrotal ultrasound scanning, Doppler ultrasound scanning and even CT in uncertain cases. The best course of care adopted in our clinic recommends a surgical procedure in all the acute hemiscrotum syndrome cases, in whom suspected testis torsion cannot be ruled out by clinical and paraclinical means, or in whom the painful symptoms due to torsion of the hydatid of Morgagni do not subside within a few hours from hospitalization. The statistical analysis was conducted using SPSS for Windows and Microsoft Excel. The data were reported as means ± standard deviations. The differences between groups were analyzed using the t Student test, and the level of statistical significance was p≤0.05.

**RESULTS**

131 of the 208 patients included in the study were finally diagnosed with torsion of the hydatid of Morgagni, 65 with torsion of testis, 10 with acute orchiepididymitis and 2 with post-traumatic scrotal hematoma. Excluding the 16 patients who came in for congenital undescended testicle, which postoperatively proved to be vanishing testis, among the acute scrotum group the testis torsion rate was 25.5%, the rate of torsion of the hydatid of Morgagni was 68.2% and orchiepididymitis 5.2%.

After group analysis, we noted that most of the patients came from urban areas (1.33 ratio). The overall mean age of the patients was 9.66±4.47 years (Fig. 1). 44 of the 65 children finally diagnosed with testis torsion came in for acute scrotum syndrome at a mean age of 13.01±3.93 years, 5 came in immediately after birth and were diagnosed with neonatal testis torsion and 16 patients came in for congenital undes-
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...cended testicle at the mean age of 3.10±3.00 years; their postoperative diagnosis was vanishing testis. As concerns the mean age on consultation for acute hemiscrotum syndrome, a comparison between the 131 patients with torsion of the hydatid of Morgagni (9.82 years) and the 49 with torsion of testis (11.68 years), reveals a difference of about 2 years, which is statistically significant (p=0.001). The difference increases if we exclude from the second group the five patients who came in during the neonatal period, i.e. 9.82 versus 13.01 years. The torsion of the hydatid of Morgagni occurred on the left side in 67 patients, on the right side in 61 patients and on both sides in 3 patients, whereas the torsion of testis impaired 21 patients in the right side, 42 patients on the left side and 2 patients on both sides.

Fig. 1. Distribution of patients by age

The analysis of the personal history of the 131 patients with torsion of the hydatid of Morgagni revealed a prior injury in 7 of them and an intercurrent respiratory condition in 5 other children. Associated conditions were detected in 28 children, 14 of whom suffered from uro-genital conditions. The mean period of time elapsed between symptom occurrence and the patients’ seeking medical assistance was 21 hours (between one hour and 7 days). In 44 of the patients the symptoms were edifying, and the doctor on call did not request medical imaging tests, whereas in the other 87 children an abdominal and scrotal ultrasonography was performed. The lab tests revealed an inflammatory syndrome (high leukocytosis, ESR and Fibrinogen levels) in 24 children (18.2%) and nutritional anemia in 9 of them (6.8%). Only three patients were prescribed conservative treatment consisting of bed rest, non-steroidal anti-inflammatory drugs and cold compressions on the aching spot, and they were fully recovered. The other patients underwent surgery under general anesthesia, which consisted of hemiscrotum exploration, removal of the torted hydatid of Morgagni (Fig. 2).

A biopsy of the tunica vaginalis was performed in 9 patients, and fluid was sampled in 55 other patients for culture and antimicrobial susceptibility testing. The culture was negative in all the 55 cases. After the surgery, 59 patients were given antibiotic therapy, namely cephalosporins...
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or beta-lactams. The postoperative evolution of four patients was marked by the occurrence of a scrotal hematoma, three of whom underwent a second surgery to remove it. Another patient needed a second surgery for postoperative scrotal abscess. The other patients recovered rapidly, and they were discharged, on the average, 2.6 days after the surgery. No pathology tests could be conducted on the removed hydatid of two of the patients due to the fact that the removed mass was too small. In all the other patients, the microscopic examination revealed signs of stasis, inflammation, hemorrhage, hemorrhagic necrosis (Fig. 3).

Fig. 2. Torsion of the hydatid of Morgagni – intraoperative aspect

Fig. 3. Hydatid of Morgagni – haemorrhagic necrosis and leukocytic exudate – HEx100

Three of the 44 patients with torsion of the testis who came in for acute hemiscrotum syndrome outside the neonatal period had suffered prior injury. Associated conditions were detected in 8 children, as 6 of them were also suffering from uro-genital diseases. The mean period of time elapsed between symptom occurrence and the patients’ seeking medical assistance was 20 hours (between one hour and 11 days). The lab tests revealed an inflammatory syndrome in 20 children (45.4%) and nutritional anemia in 3 of them (6.8%). Surgery was performed without preoperative imaging tests in only 6 patients, whereas an abdominal and scrotal ultrasonography was performed in the other 38 patients. Since it is not readily available in our hospital, Doppler ultrasonography was conducted preoperatively only in 6 patients, and postoperatively in 10 patients. A pelvic CT scan was performed in an adolescent suspected of testis tumor, but the postoperative pathological examination set the diagnosis of old testis torsion, with total glandular necrosis (Fig. 4). The testis was surgically approached through the scrotum in all the patients, the testis was detorted (between 180° and 1080°), the spermatic cord was injected with xylocaine and, depending on the recoloring degree, the surgeon decided to keep or to ablate the gonad (Fig. 5). Orchiectomy was performed in 7 patients due to the clearly necrotic gonad (the mean period of time before going to see a doctor was 4.4 days for these patients), whereas in other two patients orchiectomy was carried out after 48 hours (on second look). In the other 35 patients, the doctors decided to keep the gonad on condition of its regular ultrasonographic follow-up, and the diseased progressed (one and three-month follow-up) in other 5 patients. As concerns the 14 patients in whom the dis-
ease progressed (31.8%), 7 of the group of 21 were living in rural areas and 7 of the group of 23 were living in an urban environment. Thus, there were no significant differences as concerns the patients’ living environment. Overall, after detorting, the three-month follow-up revealed that 30 patients (68.2%) recovered. Orchidopexy was performed on the impaired side in the patients in whom the gonad was preserved, and contralateral orchidopexy was preferred for 7 patients. Two patients required a second surgery, one for the excision of a postoperative hematoma and the other for pus draining. The mean hospitalization duration was 3.7 days for the first surgery.

Two of the 5 patients with neonatal testis torsion, who came in immediately after birth for acute scrotum suffered from torsion on the right side, two on the left side and one on both sides; orchiectomy was performed in 2 children on the first surgical procedure as there were no doubts about the ischemic necrosis diagnosis, whereas in a patient the gonad was initially preserved but it was finally removed two days later (on second look). Contralateral orchidopexy was also performed in all these patients. The right testis of the child with bilateral torsion was removed on account of the advanced necrosis, whereas his left testis was detorted and fixed, but it later progressed to testicular atrophy. In another patient the testis was detorted and the spermatic cord was injected with xylocaine. The testis was preserved and the 3-month follow-up ultrasonography revealed the patient’s recovery. Thus, only one out of six testes could be saved (16.6%).

Fluid was sampled from the testicular vaginal tunic of 29 of all the 49 patients with acute hemiscrotum syndrome due to testis torsion, and the culture was positive in 3 children younger than 6 months; 34 children were administered broad-spectrum antibiotics.

Ten patients, with a mean age of 9.97 years (two newborns, one 5 month infant and 7 children older than 10 years), with acute scrotum syndrome were diagnosed with acute orchiepididymitis intraoperatively. Fluid from the tunica vaginalis was sampled and the result was positive in five of them. All the patients were administered antibiotic therapy. The patients were examined for genitourinary tract abnormalities, detected in 3 of them, and urinary infections, present in two patients. The evolution was poor in a single child with cicatricial phimosis, recurrent urinary in-

Fig. 4. Testicular torsion - haemorrhagic necrosis – Hex40

Fig. 5. Testicular torsion – intraoperative aspect
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Infections and postoperative scrotal abscess, who required orchiectomy.

Two boys exhibited right vanishing testis, one suffered from bilateral torsion and 13 suffered from left testis torsion. The congenital undescended testicle was examined by inguinal approach in 9 children and by laparoscopic approach in 7; biopsy of the blind-ending deferent duct was performed in 12 patients (Fig. 6).

Fig. 6. Vanishing testis – connective-vascular tissue – HEx100

DISCUSSIONS

The medical technological breakthroughs achieved lately have led to the decrease of the number of surgical procedures performed in patients with acute scrotum syndrome. Different studies have proven that only 14-38% of the patients with acute scrotum suffered from testis torsion, despite the physical examination and their personal history that would indicate surgery (5). Our research revealed a 25.5% testis torsion incidence rate, a 68.2% Morgagni hydatid torsion incidence rate and a 5.2% orchiepididymitis incidence rate.

Torsion of appendix testis, more precisely of the hydatid of Morgagni and more rarely of the appendix epididymis, is the most common cause of acute scrotum syndrome in children. The hydatid of Morgagni is an embryonic remnant originating in the Müllerian duct, attached to the upper testis pole and occurring in about 90% of the patients. The symptoms evoke an acute scrotum syndrome, the pain sets in progressively, unlike in torsion of testis, and is less sharp, and is sometimes located only in the upper testis pole, where the torted hydatid may be palpated and viewed (blue dot sign). In order to avoid about two thirds of the surgical procedures that are not absolutely necessary each patient should undergo medical imaging tests, more precisely Doppler ultrasound scanning. Ultrasonography sometimes reveals the hydatid as a hypoechogenic mass, which is highly vascularized due to inflammation, and a reaction hydrocele may also occur. The Doppler ultrasound scan may reveal and quantify the blood flow in the testis and the scrotum, and may provide information about the structural integrity of the gonad. The treatment may be conservative and consist of rest, ice packs, scrotum lifting, anti-inflammatory and analgesics. If the diagnosis is uncertain, the pain very sharp or does not subside further to treatment, surgery is recommended for the removal of the necrotic hydatid (6). Unfortunately, since Doppler ultrasound scans could not be performed on the patients hospitalized in our clinic and since there were no well established therapeutic protocols, far too few children could benefit from this examination method and therefore only three of the patients with torsion of the hydatid of Morgagni received conservative treatment, which considerably increased the surgical procedure rate. Nevertheless, this is not a bad approach, since most authors recommend immediate surgery if there is even the slightest doubt.
Torsion of testis is a surgical emergency that may occur at any age and, if improperly treated, may lead to infertility and psychological impairment. The annual incidence rate of this condition is 1/4000, and about 61% of all the patients are younger than 25 years, and exhibit bimodal age distribution, namely during the neonatal period and around the age of 13 years (7). Our research supports these data, as all the patients younger than 1 year suffered from testis torsion. When comparing the mean age at which the patients came in for acute scrotum, we noted a significant difference of about 3 years between the two groups, namely the 131 patients with torsion of the hydatid of Morgagni (9.82 years) and the 44 patients with torsion of testis (13.01 years). Similar studies have also reported older age of patients with torsion of testis than of patients with torsion of the hydatid of Morgagni (8).

In children, testicular torsion usually occurs in the absence of any predisposing factor, since a prior scrotal injury or intense physical effort was only reported in 4-8% of the cases (9). In our case, a prior injury was reported only in 5.3% of the children with torsion of the hydatid of Morgagni and in 6.8% of the children with testis torsion. Other possible triggering factors are the sudden testis volume increase during puberty, congenital undescended testicle, testicular tumors, low temperatures associated with an exaggerated cremasteric reflex, presence of a long intrascrotal spermatic cord (9). Whereas appendix testis torsion seems to affect both sides equally (27 left versus 21 right), left side impairment by torsion of testis was twice more common than right side impairment, which was also reported by other literature studies (8). Another significant difference between the two conditions is the occurrence of the inflammatory syndrome in 45.4% of the children with torsion of testis versus 18.2% in those with torsion of hydatid. Other studies also suggested that leukocytosis and the NLR (neutrophil to lymphocyte ratio) are predictive of inflammatory processes and also torsion of testis (10,11).

Detorting during the first 6 hours is associated with over 90% chances of saving the testis, whereas the same procedure applied more than 24 hours from the event only saves less than 10% of the testes (12). Surgery is sometimes delayed due to lack of medical education, to children living in disadvantaged families who do not seek medical assistance, to long distances to the nearest hospital or sometimes to the failure of the first doctor who examines the child to recognize the condition. In our research, the mean period of time elapsed between symptom occurrence and the patients’ seeking medical assistance was 21 hours for children with torsion of the hydatid of Morgagni and 20 hours (between one hour and 11 days) for those with torsion of testis, which explains the testicular preservation rate of only 68.2%. In our research, the patients’ living environment did not influence in any way their postoperative evolution. The surgeons usually decides whether to preserve or remove the gonad during the surgical procedure, depending on the time elapsed from symptom occurrence, on the degree of torsion, on the color of the testis after detorsion, and possibly after the spermatic cord has been injected with xylocaine. If the black-purplish color persists, this indicates irreversible glandular necro-
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sis and recommends removal, whereas if the testis becomes pink again, it should be preserved and orchidopexy should be done. The torted testis preservation rate varies between 58 and 75.7% in various studies (13,14). Most authors recommend bilateral orchidopexy after detorsion, in order to prevent any reoccurrence (15), but in the absence of therapeutic protocols this was not complied with throughout our study. Orchidopexy is done by fastening the testis against the scrotal wall using two or three suture points with nonabsorbable stitches crossing the tunica albuginea. Although it has been argued that this technique may trigger the production of antispermatic antibodies, this has not been accurately proven and, at any rate, the torsion reoccurrence risk seems higher (16).

Originally described by Taylor in England, in 1897, and then 50 years later by Campbell in North America (17,18), perinatal testicular torsion is rare yet controversial event as to its etiology, clinical form, management and long-term sequelae. Perinatal testicular torsion includes antenatal torsion and torsion occurring during the first 30 days after birth, and it makes up about 12% of testis torsions in children (10.2% in our research). The possible etiopathogenic theories include difficult delivery, breech presentation, multiparity, high birth weight and exaggerated cremasteric reflex (19). Prenatal torsion has minimum clinical symptoms and no discomfort, whereas postnatal torsion has significant clinical symptoms, such as pain and acute inflammatory phenomena in a previously healthy testis. Since antenatal ultrasonography does not have high sensitivity to this abnormality, antenatal torsion is usually detected on the routine newborn checkup and it is usually too late to save the gonad. Therefore, the management of this condition is highly controversial. Some authors only recommend clinical and ultrasound monitoring and avoidance of surgical procedures, whereas others suggest immediate scrotal or inguinal exploration and contralateral orchidopexy (20). According to other authors, if the torsion occurs much before the birth (the inflammatory signs on the hemiscrotum are discrete), surgery can wait and the patient may receive conservative treatment or elective orchiectomy and contralateral orchidopexy will be done; if the torsion occurs at birth or after birth, surgery is a major emergency and is to be done even in the absence of any medical imaging tests (21). The advocates of conservative treatment rely on the low incidence of contralateral torsion and support the avoidance of any anesthetic and surgical risks during the neonatal period. Moreover, if the parents are correctly informed, they will bring the child to the emergency room on the first signs and symptoms of torsion of testis, which means that surgery may be done on time. In a study conducted on 48 cases of bilateral perinatal testicular torsion, despite the prompt surgical intervention in 46 of these patients, only 3 testes exhibited a blood flow on postoperative Doppler ultrasonography (20). In our research, only one patient exhibited signed of recovery at the three-month follow-up, and the gonad had to be removed due to advanced necrosis in all the other cases.

If the asepsis and antisepsis standards are observed, patients with torsion of the hydatid of Morgagni or torsion of testis confirmed and surgically treated require neither fluid sampling from the testicular vaginal tunic for culture, nor antibiotic therapy. Nevertheless, fluid was sampled from the tunica vaginalis of 55 patients with torsion of the hydatid of Morgagni, for culture purposes, and the results were
negative in all these cases; furthermore, 59 patients were administered intravenous antibiotic therapy. Only one patient living in a disadvantaged social environment and who did not observe the postoperative hygiene requirements developed a scrotal abscess 5 days after the surgery and required a second surgical procedure. As for the patients with torsion of testis, only 3 of the 30 samples collected were positive, all three in infants under the age of 6 months; on the other hand, 34 patients were administered broad-spectrum antibiotic therapy. In our opinion, according to these data, fluid sampling from the testicular vaginal tunica is only necessary for patients with orchiepididymitis or strong inflammatory phenomena. Prophylactic antibiotic therapy is recommended only to infants with acute scrotum who underwent surgery.

Orchiepididymitis is the most common cause of acute scrotum syndrome after puberty, with an incidence peak at the age of 40-50 years, but it may also occur in babies. In our research, the incidence rate of this condition was 5.2% versus 9% or 16% in other studies, which also included patients older than 18 years (8,22), and the disease affected two categories of patients, namely neonates and adolescents. Surgery was performed in all the patients, who were administered antibiotic therapy. The evolution was positive in 9 out of 10 cases. The most common etiology is urinary tract infection related to possible associated malformations, hematogenous infection or scrotal injury. The treatment is conservative if we are absolutely certain about the diagnosis and it consists of analgesics, anti-inflammatory drugs, ice pack and antibiotic therapy, under ultrasound scanning and biological monitoring. Nevertheless, if there is even the slightest doubt surgery is to be done in order to rule out testis torsion as a cause of acute scrotum.

CONCLUSIONS
Torsion of the hydatid of Morgagni occurs in boys at the approximate age of 10 years and it affects both testes equally, whereas torsion of testis usually occurs at the age of 13 and affects twice more often the left gonad. Another significant difference is the inflammatory syndrome, which occurs in 45.4% of the children with torsion of testis versus only 18.2% of those with torsion of hydatid. Only one out of six tortured testes could be saved in the neonates (16.6%), whereas in the group of patients with torsion of testis that were not neonates, the gonad preservation rate was 68.2%. These data are accounted for by the non-recognition of the severity of the condition and by the delayed surgical therapy. Patients with torsion of the hydatid of Morgagni or torsion of testis require neither fluid sampling from the tunica vaginalis for culture, nor antibiotic therapy.

REFERENCES
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