OPEN APPROACH VERSUS MINIMALLY APPROACH FOR THE TREATMENT OF VARICOCELE IN CHILDREN - AN EPIDEMIOLOGICAL STUDY

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OPEN APPROACH VERSUS MINIMALLY APPROACH FOR THE TREATMENT OF VARICOCELE IN CHILDREN-AN EPIDEMIOLOGICAL STUDY (Abstract). **Aim:** The therapeutic indication of varicocele and the best method of treatment in children are still subjects of extensive debate in the literature. The purpose of the present study is to compare two of the most frequently used methods of treatment, both in terms of patient evolution and in economic terms. **Material and methods:** The observation charts of 69 patients with varicocele, who were hospitalized in the Pediatric Surgery Clinic of the “Saint Mary” Children’s Emergency Hospital, have retrospectively been analyzed for a period of approximately 4 years. Three groups of patients have been created depending on the method of treatment - 25 cases operated by laparoscopic approach, 28 cases where the classical approach was used and 12 cases where surgery was denied or delayed. The demographic data, the duration of the surgery, the duration and the cost of hospitalization, the complications and the relapse rate have been compared statistically. **Results and discussion:** Patients mainly came from rural areas (73.8%), with an average age of approximately 14.5 years. The difference in weight of 54.7 / 53.5 kg between the group treated classically and the group treated laparoscopically was insignificant (p=0.76). The total duration of hospitalization and the postoperative duration of hospitalization were slightly higher in the group treated laparoscopically (5.24 / 4.28 days and 2.08 / 1.82, respectively), but the differences were not statistically significant (p=0.13 and 0.29, respectively); yet, the duration of the surgery was significantly higher (p=0.002) in the group treated laparoscopically (73.0 / 57.32 minutes). In terms of relapse, the postoperative progress was comparatively similar - only one patient in both groups relapsed and then was addressed by the other technique. However, regarding the rate of the postoperative occurrence of the hydrocele - a well-known complication following the surgical treatment of varicocele - it has not occurred in any patient treated classically, but it occurred in four patients treated laparoscopically (16%). Both the overall hospitalization costs (1,818/1,999 RON - classical / laparoscopic approach) and the costs divided on medication, sanitary materials used and medical tests were similar. **Conclusions:** The treatment of varicocele by laparoscopic approach began to be practiced in our clinic about four years ago, and although it is still being perfected (long duration of surgery and long duration of hospitalization), the results are encouraging. **Keywords:** CHILD, VARICOCELE, LAPAROSCOPY, CLASSICAL APPROACH.
A varicocele is the most frequent prepubertal andrological pathology which can cause infertility. This condition has been known since the first century, when it was described by Cornelius Celsus as follows: “when the disease has spread over the testicle and its cord, the testicle sinks a little lower, and becomes smaller than its fellow, in as much as its nutrition has become defective” (1). In 1550, Ambroise Pare described varicocele as “a pack of blood vessels well filled with melancholic blood” and, in 1885, Barwell described its surgical treatment, which is the subcutaneous ligation of the spermatic vessels (2). In 1948, Palomo described the retroperitoneal approach for the ligation of the spermatic veins at the inguinal canal exit, with the preservation of the spermatic artery (3). The incidence of varicocele is less than 1% in prepubertal boys, 15-30% in children of 12-18 years of age (4) and approximately 15% in the adult male population. A varicocele may be primitive (idiopathic, essential), as it is usually the one on the left side, which appears after puberty (13-30 years) without a determined cause, and secondary, which occurs due to a condition that produces a barrier to blood flow in the spermatic veins (e.g. right renal carcinoma). Another cause of secondary varicocele is the “nutcracker” syndrome, which is the left renal vein compression by the superior mesenteric artery, and the venous drainage obstruction and stasis at the pampiniform plexus (5). Varicocele may be bilateral in up to 2.5% of cases in adolescents and in up to 10% of cases in adults after the age of 35 - 40 (6). In 95-98% of cases, the condition occurs on the left side in adolescents and, if left untreated, it is the one that causes male infertility in 15-40% of infertile adults (6). Primitive varicocele is favored by several existing anatomical features on the left side, namely: the left spermatic vein is 8-10 cm longer than the right one; the blood flow angle of the left spermatic vein into the left renal vein is a right angle (90 degrees), which favors venous stasis; the colon compresses the left spermatic vein; the left spermatic artery spirals around the vein. The risk factors are: prolonged standing, poor quality of the venous wall, absence of valves inside the veins, hereditary constitutional predisposition and a genetic component, increased abdominal pressure. The pathophysiologic mechanism responsible for the infertility associated with varicocele is not fully elucidated; in addition to certain genetic and molecular causes, many other causes can be mentioned: testicular hypo perfusion and associated hypoxia, oxidative stress, increased temperature, reflux of certain toxic metabolites in the adrenal gland or in the kidneys, hormonal imbalance and toxic exogenous factors (7). Regarding the therapeutic indication of varicocele or the best surgical approach, there are still many controversies in the literature when it comes to children and adolescents. The purpose of the present study is to compare two of the most common methods of treatment, both in terms of patient outcome and in economic terms.

MATERIAL AND METHODS

We conducted a retrospective analytical study on 69 children hospitalized and treated in the Pediatric Surgery Department of the “Sf. Maria” Emergency Children’s Hospital of Iași, between January 2013 and September 2016. The patients were identified per the disease code entered in the hospital’s computerized database, and then the patients’ records were extracted from
the hospital archives. 4 patients were excluded from the study for missing data. Demographics, associated disorders, investigations, duration of surgery, duration and cost of hospitalization, complications and relapse rate were statistically compared. Three groups of patients have been created depending on the method of treatment - 25 cases (38.4%) operated by laparoscopic approach, 28 cases (43.0%) where the classical approach was used and 12 cases (18.4%) where surgery was denied or delayed. The data were processed by using the specialized Microsoft Excel data analysis and processing module.

RESULTS

Patients mainly came from rural areas (73.8%), with an average age of approximately 14.5 years (between 8 and 19 years of age). The reason why they went to the doctor was the appearance of a swelling in the scrotum, accompanied by local sensation of heaviness; in 40% of cases, persistent pain was the main symptom. The surgical indication was established on the following criteria: at least clinical second grade varicocele, smaller ipsilateral testis with ultrasound-measured volume and / or persistence of symptoms for more than three months. The decision to intervene surgically and the method of treatment (classically or by using a minimally invasive approach) depended on the doctor’s option and experience. For surgeons who are familiar with both methods of treatment, the patient’s weight was the one that mattered in the choice of surgical approach. Thus, 18.5% of patients were treated conservatively, 43% were operated on classically and 38.5% of patients were treated by laparoscopic approach.

The difference in weight of 54.7 / 53.5 kg between the group treated classically and the group treated laparoscopically was insignificant (p=0.76). Of the 65 patients, 4 patients (6.1%) had a varicocele on the right, 1 patient (1.5%) had a bilateral varicocele and the rest had a varicocele on the left. 27 children (41.5%) had other associated diseases, which were not related to the disease studied. In terms of imaging tests, 22 of the 28 cases (78.5%) of varicocele treated classically were confirmed by scrotal ultrasound - this investigation highlighted the smaller size of the left testicle as compared to the right one in 11 cases (50.0%); in 19 patients (67.8%), the abdominal ultrasound was also used - this was normal in all cases except for one patient for whom the investigation revealed the presence of bladder stones. For one patient, CT was used due to significant weight loss over the past six months; however, it did not reveal associated abdominal pathology. In the group of patients who were treated laparoscopically, 23 of the 25 patients (92.0%) were also diagnosed by scrotal ultrasound; in 7 patients (30.4%), the affected testicle was smaller than the contralateral one. Of the 25 patients, 23 (92.0%) also underwent abdominal ultrasound, which was normal; one patient with grade III left hydronephrosis and enuresis underwent abdominal CT and one patient with a history of right varicocele and right orchepididymitis also underwent abdominal MRI.

Of the 12 patients (18.4%) who were not approached surgically, only one patient had grade III varicocele and he refused the surgery; 8 patients were diagnosed with grade I varicocele, and two of them were scheduled for surgery; three patients with subclinical varicocele and six patients with grade I varicocele were proposed long-term
follow-up care. All the patients in this group underwent abdominal ultrasound, which turned out to be normal, and scrotal ultrasound, which showed that one testicle, the affected one, was smaller in 3 patients (25%): one patient who refused the surgery and two patients who were scheduled for surgery.

The total duration of hospitalization (including controls) and the postoperative duration of hospitalization were slightly higher in the group treated laparoscopically (5.2 / 4.3 days and 2.1 / 1.8, respectively), but the differences were not statistically significant (p=0.13 and 0.29, respectively); yet, the duration of the surgery was significantly higher (p=0.002) in the group treated laparoscopically (73.0 / 57.3 minutes). In terms of relapse, the postoperative progress was comparatively similar - only one patient in each group relapsed (4% and 3.5%, respectively) and then was addressed by the other technique. One patient in each group showed postoperative signs of orhiepididymitis in the affected testicle; the patient treated classically was subsequently diagnosed with varicocele recurrence. However, regarding the rate of postoperative occurrence of the hydrocele - a well-known complication following the surgical treatment of varicocele - it appeared on average at 6 months postoperatively in only one patient treated classically (3.5%) and in four of the patients treated laparoscopically (16%) - overall, the postoperative hydrocele rate is 9.4%. In two patients (one in the group treated laparoscopically and one in the group treated classically), the small size of hydrocele was the indication for conservative treatment. One patient was treated by puncture aspiration of hydrocele with favorable results; the other two patients, in whose case the fluid reappeared after having been aspirated, required surgical intervention, i.e. Jaboulay-type hydrocelectomy. Of the 25 patients (38.4%) who were approached laparoscopically, three also received concomitant treatment for other associated diseases - i.e. umbilical hernia in one patient and inguinal hernia in two other patients.

From an economic point of view, both the overall hospitalization costs (1,818/1,999 RON, p=0.49 - classical / laparoscopic approach) and the costs divided on medication, sanitary materials used and medical tests were similar. Thus, for the group treated classically, the money was spent as follows: approximately 92 RON on medication, 89 RON on sanitary materials and 62 RON on medical tests, compared to 111 RON (p=0.57), 135 RON (p=0.23) and 86 RON (p=0.32), respectively, in the group treated by minimally invasive approach.

**DISCUSSION**

A varicocele is a condition that most often (95-98%) occurs on the left side in adolescents; it can be bilateral in up 2.5% of cases in adolescents and in up to 10% of cases in adults (6). In our group of adolescents, the condition was identified on the left side in 93.9% of cases and was bilateral in 1.5% of patients. Varicocele symptoms can be discreet, such as: heaviness in the scrotum, testicular discomfort to continuous pain, difference in size between the two testicles, psychosexual disorders if the pain is persistent. All the patients in our study sought medical attention for swelling with or without heaviness in the scrotum, and almost half of them complained of persistent pain. Quite often, varicocele is asymptomatic and is discovered during routine ultrasounds or during investigations.
for infertility in adult couples. Physical effort, exposure to heat and prolonged standing favor the onset of varicocele and can explain the prevalence of the disease in patients from rural areas (73.8%), where children and adolescents are much more physically active and sometimes start work at an early age. The objective physical examination of the patient highlights the increased size of the hemiscrotum; the affected spermatic veins can be visibly dilated, making a specific pattern in the thin scrotal skin. On palpation, this conglomeration of veins is painless and feels soft, mobile, like a “bag of worms”. Three clinical grades of varicocele are described by Dubin and Amelar (8): Grade 1 - the varicocele is palpable only during special maneuvers that increase abdominal pressure (Valsalva maneuver); Grade 2 - it is palpable in dorsal decubitus, without other maneuvers; Grade 3 - this type of varicocele is both palpable and visible (the veins are dilated more than 4 mm) and it can be identified by the patient (this degree, but not only this one, is associated with patient’s impaired fertility).

Of the radio-imagistic investigations, the scrotal Doppler ultrasound is commonly used to record the spontaneous blood flow speed in the spermatic veins, which usually indicates stagnation of blood in the varicocele, dilated veins. Normally, the size of the veins of the pampiniform plexus range from 0.5 to 1.5 mm in diameter; if the dilation of these veins is greater than 2 mm, it suggests the diagnosis of varicocele (9). Testicular ultrasound can also confirm the gonadal hypotrophy, as it happened in 50% and, respectively, 30.4% of our cases; it can also confirm the subclinical varicocele, which is the dilatation of spermatic veins that can be detected only by ultrasound, and cannot be clinically evidenced, not even through the Valsalva maneuver; it is estimated that approximately 25% of patients with varicocele on one side and which can be detected during a clinical examination have subclinical varicocele on the other side (10). Retrograde spermatic phlebography (venography) can be considered the “gold standard” for the diagnosis of varicocele, but just like scintigraphy, it has limited indications due to invasiveness and is used primarily for relapses (11); contact thermography is of historical interest; investigations such as CT or MRI are indicated in the diagnosis of recurrent or secondary varicocele; the spermiogram - a predictive test for an adult patient’s ability of fertilization, will be performed before and after the surgery; the spermiogram is usually affected: lower sperm count, with poor mobility. Since our group was made up only of patients of pediatric age, the spermiogram was not carried out for ethical reasons.

The evolution of varicocele is extremely slow. The condition causes discomfort locally and may lead to complications in adults, such as changes in spermatogenesis and infertility because, due to the blood that stagnates in the testicular veins, the local temperature increases and spermatogenesis is affected (both the quality and the quantity of sperm decrease). Therefore, if left untreated, a varicocele can lead to the atrophy of the affected testicle, to lower testosterone levels and, eventually, to infertility (9,10). But since not all adults with varicocele are infertile, the decision to treat a child or an adolescent suffering from varicocele only to prevent possible subsequent infertility is controversial. Unfortunately, in the case of children, there is no agreement on the therapeutic indication of
varicocele and neither on the best surgical approach; the goal of the treatment is the prevention of the testicular function degradation and the gonadal atrophy, as well as the prevention of infertility, but with a low rate of recurrence and appearance of a secondary hydrocele, of nerve injuries or of other complications. The American Society for Reproductive Medicine recommends the treatment of varicocele in adults when it is palpable and at least one of the sperm analysis parameters is abnormal, in case of infertile couples where the woman is normal. In adolescents, the same organization considers that only the patients with varicocele and hypotrophy of the affected testicle should be eligible for surgery (11). Other therapeutic indications in adolescents are: clinical grade 2 or 3 varicocele, testicular discomfort, abnormal semen analysis and venous reflux detected by ultrasound; however, these indications are not universally accepted (4, 8). In our case, the criteria for recommendation of surgical treatment were: at least clinical grade 2 varicocele, smaller ipsilateral testicle measured by ultrasound and / or persistence of symptoms for more than three months (40% of children came in with persistent scrotal pain). There are studies demonstrating the beneficial effect of varicocelectomy in adolescents on the testicular growth, on the normalization of testosterone levels as well as on the improvement of sperm quality. Therefore, the decision to intervene surgically in a teenager with varicocele is left at the discretion of the physician (5,7).

Despite the well-known natural history of varicocele, the optimal method of treatment is still a controversial subject in the literature. There are two main types of treatment for varicocele: varicose vein ligation and sectioning by using a classical or a laparoscopic approach and selective trans venous embolization or varicose vein sclerotization by means of interventional radiology procedures (5); in case of recurrence after one method, the alternative technique may be used. The sectioning of the spermatic veins can be done classically by retroperitoneal surgical approach (Palomo technique), inguinal (Ivanissevich technique), microsurgical (inguinal or subinguinal) (6) or by laparoscopic approach. There are studies that show that the lowest rate of recurrence and complications can be obtained through the microsurgical subinguinal approach, but the technique is more difficult (7). Over the last 20 years, the embolization or the sclerotizing of testicular veins by percutaneous inguinal approach under local anesthesia has had results in terms of fertility that are like the advantage of minimal invasiveness and a low risk of developing postoperative hydrocele (8). Techniques such as NOTES (natural orifice transluminal endoscopic surgical procedures) and LESS (laparoscopic single-site), as well as the robotic-assisted inguinal approach are also attractive, but their role in the treatment of varicocele must be validated through randomized studies, on large groups of patients.

A recent study analyzes the methods of diagnosis, the indications and the treatment alternatives of varicocele in children and adolescents, based on the responses of 131 pediatric urologists (4, 10,11). Comparing the results of this study with our results, we can say that: the decision of surgical treatment is based on the reduced size of the affected testicle (96% of cases), testicular pain (79%), abnormal parameters of the semen analysis (39%), while our decision was based on the clinical grade of varico-
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an epidemiological study

cel, the testicular shrinkage determined by ultrasound and / or the persistence of pain-
ful symptoms for more than three months (40% of cases); the average age at the time 
of surgery was 12.5 years compared to 14.5 years in our study; the preferred method of 
treatment was the laparoscopic approach (38% of surgeons), followed by the micro-
surgical sub inguinal approach (28%), the inguinal approach (14%) and the retroperi-
toneal approach (13%), compared to 38.5% - laparoscopic approach in our case and 
43% - retroperitoneal approach (note: the inguinal or the sub inguinal approach is not practiced in our clinic).

The laparoscopic Palomo technique has been the preferred technique for the treat-
ment of the varicocele in children in many pediatric surgery centers since 1988 (4, 9).
Laparoscopy has numerous advantages: the patient recovers fast, the surgeon can see 
the place very well during the surgery, the dilated veins can easily be located, the 
relapse rate is lower, and there is the possibility to incidentally diagnose and treat 
possible associated pathologies - three of our patients had their umbilical hernia and 
inguinal hernia treated during the same surgery. Surgery usually takes less than one 
hour and the patient requires hospitalization for 24-48 hours postoperatively; these 
aspects have been confirmed by our study. Thus, in the study presented, the average 
duration of the surgery was less than one hour for the classical approach and just 
over one hour for the laparoscopic approach; the latter was calculated by also 
taking into consideration the three cases that involved complementary surgical pro-
cedures for the treatment of associated diseases, which increased the duration of 
the surgery. Besides the duration of the laparoscopic approach, which was longer, 
the two surgical techniques proved to be similar in terms of efficacy and cost; here, 
one must consider the fact that the laparoscopic approach was introduced in our 
clinic only about four years ago, which means that our pediatric surgeons are still 
learning in this regard. We expect the future duration of the laparoscopic approach 
to decrease gradually, as well as the length of postoperative hospitalization (from two 
days to one day), which will translate into lower hospitalization costs. Thus, the lapa-
roscopic approach will become option number one in our clinic.

Some surgeons perform the mass ligature and sectioning of the spermatic artery and 
veins as part of the classical approach as well as the laparoscopic approach. There is 
no evidence that this technique adversely influences further development, since the 
testicle will still receive arterial blood from the collaterals of the deferential artery. Al-
though the topic is controversial, a comparative study conducted on 122 adolescents 
who were operated on laparoscopically, with and without protection of the spermatic 
artery during varicocelectomy, showed significant improvement in semen quality in 
patients who had their spermatic artery protected (4). Moreover, the protection of ly-
mphatic vessels during varicocelectomy could decrease the rate of postoperative hydrocele 
(2, 10). The effect of the surgery (the reduc-
tion of testicular varicose veins and the improvement of the spermiogram) is visible 
after two or three months. The relapse rate can reach 20%. In our study, the mass liga-
ture and sectioning of the spermatic artery and veins was performed, regardless of the 
chosen method of treatment; only one pa-
tient in each group relapsed (3.5% and 4%), but this figures can also be the result of an 
error due to patients’ follow-up for a short
period - in the long term, more relapses may occur - or to the fact that patients with a relapse addressed other centers of pediatric surgery. Other possible postoperative complications are: occurrence of testicular hydrocele, permatic artery injury with subsequent testicular atrophy, bleeding and infection. In our study, postoperative hydrocele occurrence rate was 3.5% for the classical approach and 16% for the laparoscopic approach, compared with the rates reported by other studies: 13% and 20%, respectively (2, 11). The reason for the hydrocele occurrence was probably the mass ligature of veins with lymphatic vessels, both in the classical approach and in the laparoscopic one.

**CONCLUSIONS**

This study found that, since not all adults with varicocele are infertile, it is obvious that not all adolescents with this condition must be operated on. Yet, the criteria regarding *which, when and how* adolescents with varicocele should be treated have not been clearly defined yet. For children, especially, further studies are needed to formulate clear treatment protocols for this condition. The treatment of varicocele through laparoscopic approach has been practiced in our clinic for about four years, and although it is still being perfected (long duration of surgery and long duration of hospitalization), the results are encouraging.

**REFERENCES**