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Prospective follow up of fertility after adolescent laparoscopic varicocelectomy

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Abstract. – BACKGROUND: Varicocele associated with infertility has been recognized for years. Referential literature provides few papers, even meta-analyses which did not confirm the success of surgery related to the increasing of the semen quality.

AIM: The purpose of the presented paper is referred in arising the quantum of knowledge related to usefulness of surgery in varicocele treatment.

PATIENTS AND METHODS: The varococele incidence was established in premature age (7-18) in population of 969 boys. In those who suffered from varicocele, we estimated their semen analysis parameters before and three months after the surgery, and followed up the pregnancy rate in surgically treated subjects many years after the treatment.

RESULTS: A prevalence of 9.7% in premature age, significantly raising in the group aged 15-18 was showed. After the laparoscopic varicocelectomy, all of the semen parameters (left testicular volume, pH, sperm count, abnormal forms and viability) were improved, since the semen volume and the progressive motility not significantly. Since we observed adolescent varicocele, some of the semen parameters initialy have not been out of reference limits. Following the surgically treated subjects for next 12-17 years, the pregnancy rate is at least 75%, since not all of them have been married yet.

CONCLUSIONS: We recorded improvement of two out of three parameters of fertility after the operation in a group of 23 surgically treated patients. This fact encourages those who advocate surgical treatment of varicocele in adolescents, since the early therapy would prevent fertility disorders.

Key Words:
Varicocele, Adolescent, Laporoscopic varicocelectomy, Semen analysis, Pregnancy rate.

Introduction

Varicocele (enlargement of testicular veins) associated with infertility has been recognized for years. At the beginning of the first century A.D. Celsus described enlargement of testicular vein and noted atrophic testicle at the affected side. In 1885, Barvel was the first to report on improvement of quality of sperm after varicocele surgery, and he was followed by Benet in 1889, Macamber and Sanders in 1929. Rothman stated that initially the term varicocele referred to scrotal varices, while pampiniform varices were termed circocele. However, after establishment of anastomosis between the superficial scrotal and pampiniform veins, it has become clear that varicosity has the common cause. The success of varicocelectomy in patients with bilateral varicosities and azoospermia has been described and explained when they became fertile after surgery and their wives became pregnant. Many of the studies dealing with diagnosis and surgical treatment of varicocele followed from all over the world. Referential literature provides few reports on the incidence and tratement of varicocele in older children and adolescents[1]. Having in mind the adverse effect of varicocele on spermatogenesis, in last two decades, the influence of varicocele on adolescent function of the testicles has been investigated since varicocele rarely ocurs in children below 10 years of age. Few papers, even meta-analyses did not confirm the success of surgery related to the increasing of the semen quality[2-5]. The purpose of the presented paper is referred in arising the quantum of knowledge related to usefulness of surgery in varicocele treatment.

So, the aim of present study was:

- To establish the incidence of varicocele in older children (7-15 years) and adolescents (16-18 years),
- To estimate varicocele induced changes on their semen parameters an testicle size, and
- To estimate the short-term outcome of laparoscopic treatment of varicocele (after three moths) and long term effect related to pregnancies (12 to 17 years later).

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Patients and Methods

The study included 969 male subjects aged from 7 to 18 years. All subjects in the population were subjected to physical and ultrasonography examination to establish varicocele presence and testicle size. All varicocele positive subjects (when became older than 14) gave a semen sample. Related to the semen analysis outcome, 23 of them were proceeded to the surgery. The initial examination was performed in the period from 1992 to 1995, followed by varicocelectomy in the period from 1995 to 2000. If varicocele detected before puberty (mostly before 13-15 years old), we waited for puberty to perform semen analysis. In next 12 to 17 years, surgically treated subjects were followed up for the ability to fertilize a woman.

Varicocele Detection

Upon examination of subjects, extension of varicocele, i.e. pampiniform veins was determined by palpation and confirmed by ultrasonography (US) – color Doppler US. The examination was carried out in a room with optimum ambient temperature (22°C), in upright position and with Valsalva maneuver. Extension implied varicous enlargement and prolongation of pampiniform veins with transversal diameter expressed in centimeters. Normal findings is characterized with diameter of pampiniform veins of 0.5 cm – the veins without signs of varicous dilatation and naturally tortuous so that they can be palpated as a thin elastic cord. In cases of clinical manifested varicocele, upon contraction of abdominal musculature their diameter increased twofold. Initial extension of varicocele is characterized with varicous dilatation of pampiniform veins up to 1 cm in transversal diameter, medium extension between form 1 to 2 cm, and marked extension over 2 cm. Therefore, the degree of pampiniform veins extension was the criteria for varicocele grading, according to Guidelines on Male Infertility 2010, provided by the European Association of Urology[6].

Testicle Examination

A testicle examination was performed at the time just before surgery. The testicle of an adolescent boy has the shape of laterally flattened egg, sized 4 · 2.5 · 2 cm with volume of 10 mL (4 · 2.5 · 2 · 0.5; the testicle shape coefficient is 0.51), which can be defined as to no morphological aberrations. Clinical examination of the testicles includes estimation of all changes related to size, sensitivity, shape and consistence, i.e. morphological integrity. The testicle size was measured also by US. Since in cases of atrophy reduction of the testicle size is proportional in all three dimensions, the initial atrophy T1 corresponds from 4 · 2.5 · 2 cm (10 mL) to 3 · 2 · 2 cm (6 mL), the moderate atrophy T2 corresponds from 3 · 2 · 2 cm (6 mL) to 2.5 · 2 · 1 (2.5 mL), and severe atrophy T3 includes all values below 2.5 · 2 · 1 (2.5 mL).

Spermogram

All subjects with confirmed varicocele (some of them after reaching the puberty) were pleased to give a semen sample after 5 days of abstination. After liquefaction, which averaged 20 minutes, the samples were analyzed using a Sperm Quality Analyser SQA IIC-P (made by Medical Electronic Systems Ltd.), which determined spermatozoid concentration, their progressive motility, viability, and morphology (i.e. the percentage of abnormal forms). The reference values used were taken from the criteria given by the Guidelines on Male Infertility 2010, provided by the European Association of Urology[6]. The lower reference limit (with 5th centiles and their 95% confidence intervals) of progressive motility was 32% (31-34); viability at 58% (55-63); minimum sperm concentration was $15 \cdot 10^6$/mL (12-16); more than 4% (3-4) of the morphologically normal forms were out of the reference limits. pH above 7.22 was consider as normal finding but not above 8.00. Lower reference limit of semen fluid volume was 1.5 mL.

Surgical Intervention

Every subject with detected varicocele and decreased semen parameters (23 subjects) was proceeded to surgery. The laparoscopic varicocelectomy was procedure used, according to the techniques given by Miersch et al[7] In our population, all of the operated subjects had left sided varicocele. Three months after surgery, the semen analysis was conducted again, to estimate usefulness of the procedure. We had in mind that some changes in guidelines in last 20 years have been occurred, so we adapted the semen analysis criteria for surgery according to the new guidelines and excluded from statistical analysis those subjects who were classified as eligible for surgery according to the old guidelines.

Statistical Analysis

The prevalence of varicocele, size, grade and stage of severity of testicular changes are ex-

pressed in percentages for each of the studied group. Significant difference in the prevalence of varicocele was calculated using variance analysis for proportion (ANOVA for proportion). Evaluation of results after surgical treatment was based on Student *t*-test for coupled samples.

Results

The studies were conducted on a group of 969 children of school age. They were divided into three groups, regarding age: 7-10, 11-14 and 15-18.

The analysis revealed a significant rise in the prevalence of varicocele at the age of 15 to 18 (Table I). Out of 969 studied boys, 94 (9.7%) had varicocele. Regarding the subjects suffered from varicocele, 48 (51.06%) had grade I, 31 (32.98%) of subjects had grade II, and 15 (15.96%) had grade III. Table II shows subjects with changes in testicular volume at the affected (T) and opposite (contralateral) side (TC). The volume and consistence of the testicles were normal in 60 (63.83%) subjects, while contralateral side was not affected in 85.11%. There were no differences between testicle-size-groups, so we did not show the semen analysis outcomes for certain groups, but only cumulative.

Out of 94 subjects with varicocele, 23 of them were proceeded to surgery – laparoscopic varicocelectomy. These subjects had decreased semen parameters (3 or more parameters out of the reference limits), accompanied by discomfort feelings in scrotum, sometimes even pain. Table III shows outcomes before and after the procedure. Left testicular volume, pH, sperm count, abnormal forms and viability were significantly improved after surgery, while semen volume and progressive motility were improved but not significantly.

In following 12 to 17 years, out of 23 varicocelectomised subjects, 15 became married and 11 of them got babies. Two married men still use contraceptive methods to avoid pregnancies, while one still has fertility issues. Beside that, one single man also got a baby out of marriage. So, until now, the pregnancy rate in varicocelectomised group is at least 75% (12/16).

Table I. Age distribution of subjects and varicocele presence.

Age	Number of subjects	Varicocele	Percetage
7-10	168	15	5.60
11-14	436	39	8.94
15-18	265	40	15.09
Total	969	94	9.70

Table II. Testicle parameters in subjects with varicocele (T – ipsilateral testicle, TC – contralateral testicle, 0 – no changes, 1-3 – smaller testicle).

Findings	Number of subjects	Percetage
T_0-TC_0	60	63.83
T_{1-3}-TC_0	20	21.28
T_{1-3}-TC_{1-3}	14	14.89
Total	94	100%

Discussion

Although idiopathic varicocele was described in ancient times, modern ways of treatment was initiated in 1952 when Tulloch8 reported a case in whom preoperative azoospermia in a patient improved after surgical treatment of varicocele to $27 \cdot 10^6$/mL and that a year after the surgery his wife became pregnant. Ever since, varicocele has been recognized as a possible cause of male

Table III. Semen parameters before and after surgery in 23 operated subjects (NS – no significance).

Parameter	Before surgery	After surgery	Significance
Left testicular volume (mL)	8.348 ± 2.994	11.870 ± 2.546	$p < 0.01$
Semen volume (mL)	2.4 ± 0.52	2.41 ± 0.44	NS
pH	7.90 ± 0.22	7.35 ± 0.12	$p < 0.05$
Sperm count ($\times 10^6$/mL)	45.565 ± 21.043	78.478 ± 35.100	$p < 0.01$
Progressive motility (%)	40.652 ± 20.369	45.217 ± 10.604	NS
Abnormal forms (%)	45.87 ± 15.44	32.70 ± 10.32	$p < 0.05$
Viability (%)	35.93 ± 16.55	58.22 ± 18.33	$p < 0.01$

infertility. The appearance of varicocele in healthy men ranges between 6 and 15%. The study presented here showed that prevalence raised between the ages of 11 and 14 to reach the average maximum of 15% at the ages over 15. Lipshultz and Corriere[9] studied testicular atrophy in adolescents with varicocele. They recommended surgical treatment of adolescents for prevention of progressive testicular atrophy and impaired fertility.

Our study undoubtedly confirmed positive outcome of surgically treated varicocele, which is in accordance with Agrawal et al[10]. In 23 patients with varicocele, semen analysis before the procedure showed 3 or more semen parameters out of the reference limits. After the procedure, looking individually, two of three parameters were improved in every single subject. Cumulatively, all parameters were improved, since semen volume and progressive motility not significantly, but with a notice that semen volume in almost all subjects was not primary affected parameter at all. Prospective follow up of surgically treated subjects in further years shows the pregnancy rate of at least 75% (maybe more, since some of the subjects have not been married yet). These data are not in accordance with Cochrane meta-analysis by Evers et al[11].

Some of Authors opposing the surgery support their attitude by the fact that on the average one of three men with varicocele is expected to have fertility problems. On the contrary, surgical therapy is advocated by the fact that atrophy at the side of varicocele predisposes to infertility[12,13]. Modern urban life influences postpones parenthood towards the fourth decade of life, which additionally prolongs adverse effect of varicocele.

We recorded improvement of two out of three parameters of fertility after the operation in a group of 23 surgically treated patients. This fact encourages those who advocate surgical treatment of varicocele in adolescents. Since varicocele occurs in 16 to 30% as a cause of infertility, which is three to four times higher than in general population, early therapy would prevent fertility disorders.

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