

Treatment of Varicocele: Randomized Prospective Study on Open Surgery Versus Tauber Antegrade Sclerotherapy

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ABSTRACT: The goal of this randomized prospective study in patients with varicocele was to evaluate the outcome following open surgery with inguinal approach versus antegrade sclerotherapy according to the Tauber procedure. From January 2002 to November 2003, we recruited 64 patients with left varicocele for this study. All patients were clinically examined, before surgery and again 8 months postsurgery, by objective examination, scrotal color Doppler ultrasound, and semen analysis. These patients were randomized in a balanced 4-block pattern: depending on randomization, the patients underwent open surgery (group A: 32 patients) or antegrade sclerotherapy according to the Tauber procedure (group B: 32 patients). At the current follow-up, it is possible to evaluate all the patients for whom we have preoperative and postoperative Doppler imaging and semen analysis. An analysis of seminal parameters shows a statistically significant improvement of the rate of fast progressive spermatozoa ($P < .05$) and reduction in immotile spermatozoa

($P < .01$) in those patients who underwent sclerotherapy compared to the patients who underwent open surgery. The outcomes of all other parameters (number and morphology) are fully comparable. Operating time is decidedly shorter for antegrade sclerotherapy ($P < .01$), but there are no significant differences in terms of early or late postoperative complications. It is widely known that varicocele is a condition found in 9% to 23% of the male population around the world; this percentage rises to 40% among infertile males. The treatment of this condition not only resolves clinical symptoms but also stops continuous damage to spermatogenesis, thereby potentially improving fertility. Our experience demonstrates that sclerotherapy (Tauber procedure) combines shorter surgical time and faster recovery of normal daily activities with significant improvement in sperm motility.

Key words: Tauber procedure, sperm motility.

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Varicocele is a condition of varicosity and tortuosity of the pampiniform plexus, caused mainly by retrograde blood flow through the internal spermatic vein. The percentage of clinically evidenced varicocele in young adult subjects varies from 9% to 23% (Segenreich et al, 1998; Onozawa et al, 2002), as reported by the most recent case studies. Furthermore, varicocele can be observed in over 40% of infertile males. In fact, many studies have been conducted to examine the etiology and pathophysiology of varicocele as well as the influence it can have on spermatogenesis. Nevertheless, it is very questionable today how much the varicocele really damages the reproductive system and the mechanisms through which this occurs, and it is not completely clear which are the most appropriate diagnostic techniques and the most effective surgical treatments.

The objective of our randomized prospective study was to evaluate the differences between surgical and semi-

nological results observed in two groups of patients with primary left varicocele who underwent, respectively, open surgery (inguinal approach) or Tauber antegrade sclerotherapy.

Materials and Methods

From January 2002 to November 2003 we evaluated 64 patients with left varicocele; exclusion criteria were recurrent varicocele, bilateral varicocele, and normal semen analysis without testicular volume reduction. All patients were clinically assessed by physical examination, color Doppler ultrasound (for scrotal imaging), and semen analysis, performed preoperatively and repeatedly (at least twice) 8 months postoperatively; we prefer to perform the first follow-up visit 8 months postoperatively because we think this is a reasonable period of time in which to resume a regular spermatogenesis, and we anticipate it represents a complete post-surgical recovery.

Semen samples were collected by masturbation, after 3 to 4 days of abstinence, and examined in the same lab; the examination evaluated total volume, sperm density, motility, and morphology. Basic requirements for semen analysis are standardized according to the World Health Organization (WHO) guidelines. Moreover, routine endocrinology tests were performed on all patients; we also measured follicle-stimulating hormone, luteinizing hormone, prolactin, testosterone, and estradiol. We do not

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routinely perform hormone stimulation tests preoperatively (GnRH test).

In all cases, we classified varicocele on physical examination according to the Dubin and Amelar classification (Dubin and Amelar, 1970). We performed scrotal color Doppler ultrasound on all patients while they were in the supine and upright position, using the same instrument, to obtain a more accurate varicocele grading. Our ethics committee approved this prospective study.

Based on randomization, and after informed consent was obtained, the patients were admitted for same-day surgery and underwent open surgery with inguinal approach (group A) or Tauber antegrade sclerotherapy (group B). The patients were assigned to different treatments according to a balanced randomized block design (blocks of 4 subjects).

All patients in both groups were discharged the same day of the procedure; at follow-up we asked them about the day after surgery on which they returned to normal activity.

Surgical Techniques

Open varicocelectomy was performed under local anesthesia (bupivacaine and lidocaine 1%), with a short (4- to 5-cm) oblique incision made over the internal inguinal ring. After incision of the muscular layer, the funiculus was carefully exposed. We identified the elements of the funiculus and spermatic veins using magnifying lenses (3.5×) to obtain magnification and to preserve the spermatic artery. The spermatic veins were closed and sectioned in the upper part of the funiculus, where they usually flow together in 2 to 3 major branches. At the end of these procedures we performed a careful inspection of the inguinal channel, looking for extrafunicular vessels.

Antegrade sclerotherapy (Tauber procedure) was also performed under local anesthesia (bupivacaine and lidocaine 1%) with a very short (2-cm) longitudinal incision at the base of the scrotum to catch funiculus. The most enlarged vein was isolated and suspended between 2 slack sutures; we performed a little incision of the vein to insert a 23-gauge needle. The right position of the needle was controlled by washing the vein with saline solution. We injected iodine contrast into the vein to perform a venogram (15 seconds x-ray exposure), and finally, during a Valsalva maneuver, we injected 3 mL of atoxysclerol 3% and 1 mL of air mixed together.

Statistical Analysis

Mann-Whitney, Kruskal-Wallis, and Wilcoxon signed ranks tests were used to compare unpaired and paired patient data in both surgical groups. The level of statistical significance was set at P less than .05. All calculations were carried out with SPSS (Release 10.0.1, SPSS Inc, Chicago, Ill).

Results

To date we have evaluated all 64 patients with complete Doppler imaging and semen analysis preoperatively, postoperatively, and at 8 months postoperatively. In preoperative data analysis, no significant differences were found among the variables of the two groups in the study.

As envisaged in our randomized prospective study, all patients presented primary idiopathic left varicocele; none of the patients presented bilateral varicocele. Routine endocrinological evaluation showed normal hormonal parameters in all patients.

In the group of patients who underwent open surgery (group A), mean age was 25.1 years (range: 16–44 years). Four patients presented grade I varicocele, 10 presented grade II, and 18 presented grade III. In this group, 18 patients presented asthenospermia, 12 presented oligoasthenospermia, and 2 were oligospermic.

The patients who underwent sclerotherapy (group B) had a mean age of 26.8 years (range: 16–45 years). Three patients presented grade I varicocele, 15 presented grade II, and 14 presented grade III. Nineteen patients in this group had asthenospermia and 11 had oligoasthenospermia, while 2 were oligospermic.

The Table shows the mean preoperative and postoperative values in sperm number, motility, and morphology in groups A and B. Concerning operating time, open surgery with inguinal approach procedure had an average time of 42 minutes (range: 36–60 minutes), whereas Tauber antegrade sclerotherapy required an average time of only 25 minutes (range: 17–30 minutes) ($P < .05$). There were no significant early or late complications: only 1 patient of the “Tauber” group presented moderate scrotal hematoma in the immediate postoperative period. We had no hydrocele either group. Most of the patients who underwent sclerotherapy returned to their normal activity the next day, while those patients who underwent open surgery did this after 3 to 4 days.

As far as recurrences are concerned, in group A we had 2 patients with clinical recurrence (6%) and 1 patient (3%) with subclinical recurrence, and in group B we had 3 patients with clinical recurrence (9%). Patients with recurrences in the open-surgery group subsequently underwent sclerotherapy, whereas recurrences in group B patients were treated with open surgery.

Semen data were analyzed 8 months after surgery and were compared with preoperative data. This comparison yielded 2 extremely interesting results: a significant reduction in the number of immotile spermatozoa only in the group of the patients who underwent the Tauber procedure ($P < .001$), and also an increase in the fast progressive spermatozoa, which was statistically significant in the group of patients who underwent sclerotherapy ($P < .05$) (Figure).

With regard to the other semen parameters (ie, number and morphology), no statistically significant changes were observed between the 2 groups (P was not significant). No significant association was found between the variables being studied and preoperative varicocele grade. Apart from treatment, we did obtain an improvement in seminal parameters in 40% of patients, considering, ob-

Mean pre- and postoperative values in sperm number and motility in the 2 groups (group A and group B were homogeneous according to preoperative parameters)

	Preoperative	Postoperative
Group A		
Number of spermatozoa (mil/mL)	median 38 (range: 2–100)	median 45 (range: 2–100)
Normospermic (pts. [%])	18 (56)	22 (68)
Oligospermic (pts. [%])	14 (44)	10 (32)
Motility		
Normal (pts. [%])	2 (7)	14 (43)
Asthenospermic (pts. [%])	30 (93)	18 (67)
Fast progressive	10.1 ± 1.5	17.8 ± 4.3
Slow progressive (%)	32.8 ± 2.1	34.7 ± 4.3
Immotile (%)	56.5 ± 2.7	47.4 ± 3.8
Morphology (abnormal forms, %)	59.3	37.5
Group B		
Number of spermatozoa (mil/mL)	Median 34 (range: 2–100)	Median 47 (range: 3–100)
Normospermic (pts. [%])	19 (59)	24 (75)
Oligospermic (pts. [%])	13 (41)	8 (25)
Motility		
Normal (pts. [%])	2 (7)	15 (46)
Asthenospermic (pts. [%])	30 (93)	17 (64)
Fast progressive (%)	12.8 ± 3.1	22.0 ± 4.2
Slow progressive (%)	28.1 ± 2.3	31.5 ± 1.6
Immotile (%)	59.6 ± 4.1	46.7 ± 3.9
Morphology (abnormal forms, %)	53.1	34.3

viously, the normalization of oligospermic and asthenospermic patterns.

Discussion

It is widely known that varicocele is a pathological condition present in a noteworthy percentage of the male

population worldwide and that this percentage increases significantly when infertile subjects are analyzed. Many reports—beginning with the first study conducted by MacLeod in 1965—have widely demonstrated the correlation between varicocele and infertility. Likewise, the literature published over the past 40 years has extensively shown that both sperm parameters and pregnancy rates improve in the patients affected by varicocele once this

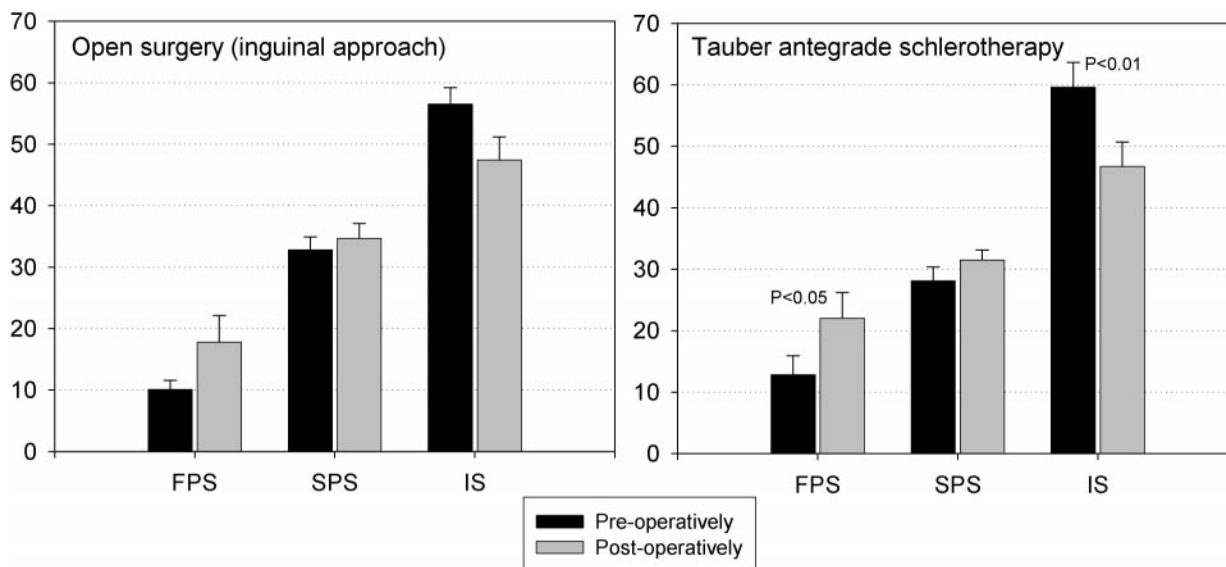


Figure 1. Pre- and postoperative sperm motility indexes subdivided according to different treatments (group A and group B). FPS indicates fast progressive spermatozoa (%); SPS, slow progressive spermatozoa (%); and IS, immotile spermatozoa (%).

pathology has been corrected (Schlesinger et al, 1994; Segenreich et al, 1997). Therefore, it is generally accepted that treatment of varicocele improves semen parameters, with recovery rates ranging between 60% and 80%. Schlesinger et al (1994) reviewed 16 studies that assessed the effect of varicolectomy on sperm density and reported that postoperative significant improvements were demonstrated in 12 studies and that sperm motility was noted in 5 of these (Mordel et al, 1990; Iaven et al, 1992; Schlesinger et al, 1994). Furthermore, although several studies report that a high grade of varicocele is associated with better recovery of semen parameters following treatment of varicocele (Steckel et al, 1993; Abdulmaaboud et al, 1998), we did not observe this.

The ideal treatment for primary varicocele is still discussed today: many procedures, such as open spermatic vein ligation and retrograde sclerotherapy (Porst et al, 1984; Lenz et al, 1996; Abdulmaaboud et al, 1998), and more recently, methods such as laparoscopy, microsurgery, and antegrade sclerotherapy, have been used. The antegrade scrotal sclerotherapy of spermatic vein was described for the first time in 1988 by Tauber, and it is an easy technique, rapid to perform, effective, and carries a low complication rate (Tauber and Johnsen, 1994; Tauber and Pfeiffer, 2003).

In the experience of Goldstein (1992) and Marmar and Kim (1994), the microsurgical approach decreases the incidence of hydrocele and recurrent varicocele resulting from venous collaterals, and to the small veins, immediately adjacent to the testicular artery, that are often not identified; furthermore, microdissection ensures preservation of the testicular artery, reducing the risk of testicular atrophy.

Each technique obviously presents advantages and disadvantages, and numerous studies have yielded contrasting results; however, in the case of every procedure used, the surgical exposure does not provide a rapid restoration of sperm vitality before a period of 8 to 12 months postoperatively. Many comparative studies, which evaluate results obtained with the different methods used to treat varicocele, have reported results with a low level of significance (Porst et al, 1984; Goldstein, 1992; Marmar and Kim, 1994; Tauber and Johnsen, 1994; Lenz et al, 1996; Mandressi et al, 1996; Abdulmaaboud et al, 1998; Tauber and Pfeiffer, 2003).

Our experience demonstrates that sclerotherapy promotes significant improvement of the seminological parameters in terms of sperm motility. In fact, if we closely analyze the statistical data, it becomes evident that in group A (open surgery), there is no significant change in all seminal parameters, such as for immotile (56.5% preoperative vs 47.4 postoperative, P is not significant). Instead, the statistically significant reduction in immotile spermatozoa (59.6% preoperative vs 46.7% postoperative,

$P < .001$) in group B is associated with a sensible increase in the group of fast progressive spermatozoa ($P < .05$)—presenting clear evidence of an early recovery of sperm motility.

A possible but as-yet theoretical explanation may be the lower invasiveness of the antegrade sclerotherapy procedure and faster recovery of testicular function following surgical exposure; instead, in retrograde sclerotherapy, only a single vein is selected and isolated to perform the procedure, thereby sparing all the structures near it. Moreover, sclerotherapy clearly shortens operating times, thus promoting faster recovery and a quicker return to normal everyday activities.

In the open-surgery group we had a 6% rate of clinical recurrence, which is likely due to the sparing of small venules surrounding the testicular artery (we did not use a microscope); we did prefer to correct recurrence in the patient with subclinical varicocele as well, because the seminal parameters did not improve. In the Tauber group, the recurrence rate was 9%, according to the literature, and this is probably due to some venous anatomical variation or to the venous spasm that could occur during the operation.

Conclusions

The question of which is the best surgical procedure for treating varicocele continues to be widely debated. However, treatment of this pathology cannot only solve the clinical symptoms that are sometimes associated with it, but it can also block ongoing damage in terms of spermatogenesis, potentially improving fertility. Antegrade sclerotherapy could be considered a valid alternative to other surgical techniques that are commonly used to correct varicocele.

Our randomized prospective study has undoubtedly confirmed what has recently been a common opinion, albeit one never supported by statistical data: antegrade sclerotherapy is a rapid, effective, and low-cost procedure characterized by its low invasiveness. Our experience also demonstrates that antegrade sclerotherapy is associated with shorter surgical time and an earlier return to normal daily activities, as well as significant improvement in semen parameters with regard to sperm motility.

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