The effect of physical activity on varicocele pain and resolution of this pain by different varicocelectomy techniques

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Introduction: *To evaluate the effect of physical activity on varicocele pain and how different varicocelectomy techniques relieve this pain.*

Materials and methods: *Between November 2012 and January 2015, a total of 64 patients with left groin pain and clinical varicocele were enrolled in this study. A visual analogue scale (VAS) classifying the pain in ten scores was used to assess the severity of pain before and after beginning continuous physical activity, and after operations. Patients were randomly divided into three groups. Group 1 had open sub-inguinal varicocelectomy, Group 2 had loupe-assisted sub-inguinal varicocelectomy and Group 3 had microscope-assisted sub-inguinal varicocelectomy.*

Results: *The mean VAS score of patients before and after beginning continuous physical activity was 3.10 ± 0.9, and 7.65 ± 0.93, respectively (p = 0.001). These values were 3.36 ± 0.9, and 7.45 ± 0.82 in Group 1 (p = 0.001), 2.90 ± 0.83, and 7.54 ± 1.29 in Group 2 and 3.06 ± 1.06, and 7.87 ± 0.71 in Group 3 (p = 0.001). After the operations, the mean VAS score decreased to 1.90 ± 1.13 in Group 1 (p = 0.002), 1.63 ± 1.32 in Group 2 (p = 0.003), and 0.81 ± 0.71 in Group 3 (p = 0.001). Comparing the postoperative results among the groups, there was no statistical significance between Groups 1 and 2 (p = 0.190), and Groups 2 and 3 (p = 0.378), but a statistically significant difference was determined between Groups 1 and 3 (p = 0.011).*

Conclusions: *Physical activity has a significant worsening effect on varicocele pain. Microscopic sub-inguinal varicocelectomy offers the best results for pain resolution.*

Key Words: varicocele, pain, sport, physical activity, varicocelectomy

Introduction

Varicocele is defined as abnormal tortuous veins of the pampiniform plexus in the spermatic cord with retrograde blood flow due to incompetent valves.[1] It was first described by Celcius concomitant to testicular atrophy in the first century. It is also associated with testicular pain, progressive testicular dysfunction, impaired testosterone production, and non-obstructive azoospermia.[2] Varicocele is usually an asymptomatic condition occurring in 15% of males, 50% of primary infertile males, and 69% of secondary infertile males.[3] However, 2%-10% of patients experience scrotal pain and discomfort. Most patients describe the varicocele pain as a dull and throbbing ache, scrotal heaviness, and heat sensation especially worsened by standing, and alleviated by lying down.[4,5] Treatment indications of varicocele include infertility, pain, testicular hypotrophy, and cosmetic reasons.[6] In most literature, varicocele is defined as a progressive disease. In patients with grade 1 varicocele, 40% have been reported to have testicular hypotrophy, and 28% of

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adolescents with subclinical varicocele develop clinical varicocele over time.[7,8] The incidence of varicocele has been reported as 75% in the 8th decade of life, increasing by approximately 10% for each decade.[9] There is current ongoing debate as to the definitive time for varicocele surgery.

To date it has not been fully explained how varicocele causes scrotal pain, abnormality in semen quality, or infertility. The possible mechanisms are compression of nerve fibers by dilated veins, increase of scrotal temperature, which must be 2°C-3°C lower than the body temperature, and tissue ischemia due to blood stasis.[9] If infertility or testicular hypotrophy is not the main concern, many urologists start varicocele treatment with conservative methods including scrotal support, anti-inflammatory medication, limitation of activity and rest.[10] The length of conventional treatment for pain is not clear. Scrotal pain of more than 3 months is evaluated as chronic, and it is reasonable to decide on varicocele surgery if the patient has chronic scrotal pain due to varicocele. In a previous study, the duration of the pain was noted to be a predictive factor of pain recovery after varicocele surgery.[11]

Many researchers have studied the effect of varicocelectomy on infertility, pain, and testicular hypotrophy. Increased fertility rates, significant pain recovery, and catch up of the testicular volume have been recorded in all types of varicocelectomies.[12] Atar et al reported that the diameter of the left spermatic vein measured during the Valsalva maneuver and the duration of the reflux increased significantly after the exercise test compared with the baseline.[13]

To the best of our knowledge, although the role of physical activity of varicocele has been investigated on many subjects, the effect of physical activity on varicocele pain and the effects of different varicocelectomy techniques for the resolution of this pain have not yet been evaluated. In this research, it was aimed to draw attention to the effects of different varicocelectomy techniques in sportive men unresponsive to conventional treatments.

Materials and methods

This study was approved by the Ethics Committee of our institution and followed the Institution's Review Board of Human Subject Guidelines.

This prospective randomized study included a total of 64 patients with left groin pain and clinical varicocele between November 2012 and January 2015. Informed consent was obtained from all patients. The evaluation of the patients started with the history taking including the pain, the effect of sport on this pain, previous scrotal surgeries, any infectious pathology affecting the testis or epididymis, and any other urological abnormalities. All patients underwent a complete physical examination including especially a palpation of scrotum, testis, and epididymis. Tenderness during palpation of these structures, any signs of orchitis or epididymitis, and grade of varicocele were noted. Clinical varicocele was graded according to the World Health Organization (WHO) classification: grade 1 was palpable varicocele during the Valsalva maneuver; grade 2 was palpable at rest, but not visible; and grade 3 was visible and palpable at rest. After the physical examination, all patients were evaluated by urinalysis, urine culture, complete blood count (CBC), and scrotal color doppler ultrasonography (S-CD_USG). Any abnormality of urinalysis, urine culture, CBC was noted to exclude any other pathology that could cause the groin pain. S-CD_USG with 12 MHz transducer showed the vein diameter under Valsalva maneuver, duration of reflux classified as interrupted or continuous, testicle volume according to the formula length x width x height x 0.53 and classified as < 10 cc or > 10 cc,[14] and other pathologies of testis or epididymis. After verification of the diagnosis of varicocele by physical examination and laboratory tests, patients were also evaluated by semen analyses. At least three semen samples were collected by masturbation after 3 days of abstinence. Semen volume, sperm concentration, sperm motility (category a. rapid progressive motility, category b. slow or sluggish progressive motility, category c. non-progressive motility, category d. immotility) and sperm morphology were noted.

A visual analogue scale (VAS) classifying the pain in ten scores by 10 cm horizontal lines showing no pain at 0 cm and the worst pain at 10 cm was used to assess the severity of pain before and after beginning continuous physical activity.[15] Continuous physical activity was defined as doing a sporting activity more than 3 days a week, such as running, playing football, basketball, tennis, volleyball, or any physical activity lasting more than 1 hour.

Sub-inguinal varicocelectomy was planned for the patients who were unresponsive to conventional treatments. Patients were randomly divided into three groups. Group 1 patients had open sub-inguinal varicocelectomy (OSV), Group 2 had loupe-assisted sub-inguinal varicocelectomy (LASV) and Group 3 had microscope-assisted sub-inguinal varicocelectomy (MASV). Early postoperative complications were noted as defined by Dindo and Clavien.[16] One year postoperatively, pain was evaluated using the same

VAS, and S-CD_USG control using the same parameters. Pain resolution was defined as complete or partial when there was a decrease of > 70% in symptoms. A control semen analysis was applied only for patients with preoperative abnormal semen parameters. All changes in preoperative and postoperative parameters were recorded.

Loupe with ×3.5 magnification (Heine Binocular Loupe, Germany) and surgical microscope with × 40 magnification (Karl-Zeiss Surgical Miscoscope OPMI Vario 000000-1026-701, Germany) were used in the varicocelectomy surgeries.

Statistical analysis

Statistical analysis was applied using SPSS v. 20 for MAC software (Statistical Package for Social Sciences). Descriptive statistics were stated as mean, frequency and percentiles. Skewness, Kurtosis and Shapiro Wilk tests were used to assess the normality of distribution of the variables. The Wilcoxon test was used to compare related samples and the Mann-Whitney U Test to compare independent samples. A value of $p < 0.05$ was accepted as statistically significant.

Results

A total of 64 males with left side clinical varicocele and groin pain started continuous physical activity. Group 1 comprised 25 patients, Group 2, 19 patients and Group 3, 20 patients. The average age was 23.82 ± 2.84 years (range, 20-36 years). No patient had any history of previous scrotal surgery, orchitis or epididymitis, or other urological abnormality. Tenderness on palpation of the scrotum was positive in 20 (31%) patients. Grade 1 varicocele was determined in 11 (17%) patients, grade 2 in 31 (52%) and grade 3 in 22 (33%) on physical examination. Urinalysis, urine culture, and CBC were normal. The average vein diameter was 4.67 mm ± 1.12 mm (range 2-8) in the S-CD_USG examination. Under the Valsalva maneuver, interrupted venous reflux was determined in 12 (18%) while 50 (82%) had continuous venous reflux. Testicular volume < 10 cc was determined in 7 (11%) patients and > 10 cc testicular volume in 57 (89%). No other testicular pathology was seen in the S-CD_USG examination in 34 (53%) patients but 17 (26%) had right subclinical varicocele, 3 (4%) had bilateral testicular microlithiasis, 4 (6%) had ipsilateral epididymal cyst, 3 had right epididymal cyst and 3 (4%) had left side inguinal hernia. There was no demographic difference between the three groups.

It was attempted to keep the spermatic artery, vas deferens, and lymphatic vessels as intact as possible. Only 1 patient in Group 1 had bleeding after the operation (Clavien grade 3a complication). Control S-CD_USG showed recurrence for 1 (4%) patient in Group 1 and 1 (5%) patient in Group 2. No hydrocele formation or testicular atrophy was observed in any patient postoperatively.

TABLE 1. **Semen characteristics**

Volume	1.6 ± 0.3 (1.3-1.7) mL
Concentration	64.1233 ± 35.0084 x 10^6 (6.4-145 x 10^6) per mL
Category A	29.00% ± 22.89% (0%-80%)
Progressive motile	51.9% ± 22.36%
Motile	64.71% ± 22.93%
Category B	22.90% ± 20.00% (0%-85%)
Progressive motile	51.9% ± 22.36%
Motile	64.71% ± 22.93%
Category C	13.21% ± 9.03% (0%-50%)
Category D	32.45% ± 21.25% (0%-99%)
Normal morphology	47.48% ± 27.10%

The preoperative motile sperm count (Category A+B+C) in patients with abnormal semen parameters was 36.82% ± 22.00% (range, 0%-80%) and this increased to 41.00% ± 33.86% (range 0%-80%) at postoperative end of year 1 ($p = 0.042$). No statistically significant changes were determined in other semen parameters. The preoperative semen characteristics of the patients are shown in Table 1.

The mean VAS score of patients before and after beginning continuous physical activity was 3.10 ± 0.9 (range, 2-5), and 7.65 ± 0.93 (range, 4-9), respectively ($p = 0.001$). These values were 3.36 ± 0.9 (range, 2-5), and 7.45 ± 0.82 (range, 6-8) in Group 1 ($p = 0.001$), 2.90 ± 0.83 (range, 2-4), and 7.54 ± 1.29 (range, 4-9) in Group 2 and 3.06 ± 1.06 (range, 2-5), and 7.87 ± 0.71 (range, 7-9) in Group 3 ($p = 0.001$). There was no statistically significant difference between the three groups ($p = 0.190$), Table 2. Firstly, conventional treatment modalities were ordered for 3 months. None of the

TABLE 2. **Comparison of visual analogue scale scores before and after varicocelectomy**

	p value	
	Before surgery	**After surgery**
Group 1-Group 2	0.494	0.190
Group 2-Group 3	0.926	0.378
Group 1-Group 3	0.320	0.011

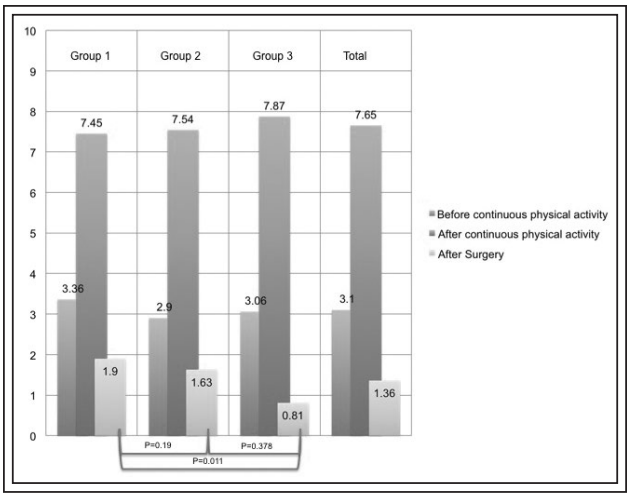

Figure 1. Comparison of visual analogue scale scores before and after varicocelectomy.

patients responded to the conventional treatments and all were willing to have surgery.

The mean postoperative VAS score decreased to 1.90 ± 1.13 (range, 0-4) in Group 1 (p = 0.002), 1.63 ± 1.32 (range, 0-7) in Group 2 (p = 0.003), and 0.81 ± 0.71 (range, 0-3) in Group 3 (p = 0.001), respectively. When the postoperative results were compared between the groups, there was no statistically significant difference between Groups 1 and 2 (p = 0.19), and Groups 2 and 3 (p = 0.378), but there was a statistically significant difference between Groups 1 and 3 (p = 0.011), Figure 1 and Table 2. Complete resolution of pain was determined in 1 (8.3%) patient in Group 1, in 3 (27.3%) patients in Group 2, and in 6 (42.9%) patients in Group 3. All other patients had partial resolution of pain.

Discussion

It is not yet fully understood how or over what time period varicocele deteriorates the semen parameters. Multiple theories of sperm damage have been suggested with the possible mechanisms of elevated scrotal temperature, pressure in the pampiniform plexus, basal lamina thickness, tissue hypoxia, oxidative stress, and reflux of adrenal metabolites to the testes. However, none has been universally accepted, and whether or not early detection and treatment of varicocele protects the sperm quality is not clear.[17] On the contrary, according to most studies, varicocelectomy increases the semen parameters in infertile men due to non-obstructive azoospermia (NOA): Czaplickki et al reported that varicocelectomy resulted in a 34% return of sperm in ejaculate but the study did not have a control group;[18] Matthews et al reported a 55% return of sperm in ejaculate and it was noted that 3 of their 12 patients achieved pregnancy without the help of assisted reproduction technology;[19] Schlegel et al reported a 60% sperm retrieval rate by testicular sperm extraction (TESE) after varicocelectomy.[20] Cozzolini et al detected 51%-74% improvement in semen quality and 24%-71% pregnancy rate after varicocelectomy and Ficarra et al reported significantly high pregnancy rates in the first year after varicocelectomy compared to a control group (36.4%, 20%).[21,22] Marmar et al supported these studies with rates of 33% and 15%.[23] Varicocelectomy still seems to be the most common treatment modality for surgically treatable infertility in men with a 60%-80% increase in semen parameters and high pregnancy rates. Selim et al reported an increase in all semen parameters in infertile men.[2] In the current research none of the patients were suffering from infertility and most of the patients' semen parameters were normal. Therefore, a control semen analysis was only applied to patients with preoperative abnormality in the semen analysis. The results of this study showed a motile sperm count (Category A+B+C) increase after varicocelectomy, and other semen parameters did not change significantly.

Testicular hypothyrophy is an indication for varicocele surgery in adolescent males. Decreased testicular volume may reflect impaired testicular function and impaired future sperm quality. Kolon et al found that 71% of boys who initially had a testicular volume differential (TVDiff) of > 15% had normalization of the size on serial observations.[24] Spinelli et al noted a testicular volume catch up after varicocele repair.[25] The patients in the current study were not adolescents, so the TVDiff was not calculated for these patients. Rather than TVDiff, testicular volume was categorized as < 10 cc or > 10 cc and most of the patients (89%) had > 10 cc testicular volume.

Following infertility and testicular hypotrophy, scrotal pain is considered to be the main varicocelectomy indication. Elevated scrotal temperature, and pressure in the pampiniform plexus trigger the pain impulses via neuronal fibers. Most patients describe the varicocele pain as a dull and throbbing ache, scrotal heaviness, and heat sensation especially worsened by standing, and alleviated by lying down.[4,5] Physical activity is not a well-known etiological factor for varicocele, but Rigano et al reported the aggravating effect of physical activity. A comparison was made of 150 adolescent athletes with 150 age-matched controls and higher rates of varicocele were reported in the athletic group. In addition, the athletic group was divided into two categories of those doing sporting activities for less than 6 hours per week and those doing 7-12 hours a week. The effect of the duration of the physical activity

was examined and an increased incidence of varicocele was determined in the patients undertaking longer sporting activity.[12] Zampieri et al observed adolescent athletes for 3 years and found a higher incidence of progression from subclinical varicocele to clinical varicocele.[26] To the best of our knowledge, the effect of physical activity on varicocele pain has not yet been evaluated. In the current study, the effect of physical activity on varicocele pain was evaluated using a VAS, and a significantly higher VAS score was determined after beginning continuous physical activity. There have been many studies investigating the effects of varicocelectomy on varicocele pain. Chen et al evaluated 76 patients, as 55 (72.4%) responders and 21 (27.6%) non-responders. Of the 55 responders, 52 (94.5%) had complete resolution of pain and 3 (5.5%) had partial resolution of pain after varicocelectomy. It was also reported that a greater number of ligated veins were a good prognostic factor for varicocelectomy in relieving painful varicocele.[11] Kachrilas et al reported a significant VAS score decrease from 4.8 to 0.8 after laparoscopic varicocele repair and 87.5% of patients were reported to have had a significant improvement in VAS score.[1] Soylemez et al compared laparoscopic and sub-inguinal microscopic varicocelectomy, and recorded significantly lower VAS scores on postoperative days 1, 3, and 7 in the laparoscopy group. An early return to daily life was noted after laparoscopic varicocelectomy.[27] Armagan et al conducted a study comparing VAS scores in microscopic varicocelectomy. A significant postoperative decrease was reported with mean preoperative and postoperative VAS scores of grade 1, 2 and 3 varicocele of 6.6 ± 2.0, 6.53 ± 1.96, 5.35 ± 1.88, and 0.94 ± 1.1, 1.48 ± 1.43, 1.02 ± 2.1, respectively.[6] In the current study, the mean postoperative VAS score decreased significantly in all groups, but the main decrease was detected with the MASV technique. Complete pain resolution was also higher in the MASV group.

Sub-inguinal varicocelectomy was preferred for the patients of the current study, who were randomly divided into three groups of OSV, LASV and MASV. Palamo described this technique in 1949 as the ligation of the veins after they enter the abdomen via the internal inguinal ring. Laparoscopic varicocelectomy can be thought of as high ligation of veins described in the Palamo technique. The Palamo technique has a rate of 8.24% hydrocele formation. Although laparoscopy offers a good visualization of spermatic vessels, it decreases the rate of hydrocele formation to 2.84%. Inguinal or sub-inguinal techniques are reported to have lower rates of hydrocele formation. Recurrence rates have been reported as 14.97% for the Palomo technique, 4.6% for laparoscopic varicocelectomy, 12.7% for the macroscopic inguinal method, 2.63% for the macroscopic sub-inguinal method (Ivanissevich) and 1.05% for microscopic varicocelectomy.[28] The sub-inguinal approach with or without magnification can be considered the best technique for varicocelectomy operations, and it was therefore decided to apply this approach in the current study. Recurrence occurred in 1 (4%) patient in the OSV group and 1 (5%) patient in the LASV group, and in no patients in the MASV group. No hydrocele formation or testicular atrophy developed during the first year postoperatively. Despite smaller patient numbers in the groups, these results are similar to those of previous studies, and MASV can be seen to have the best results both for complication rates and treatment success. The most important point in successful varicocelectomy can be considered to be meticulous dissection of the spermatic cord to identify and avoid injury to the arterial blood supply and lymphatic channels to the testicles and this can be achieved with effective use of the microscope.

Conclusion

Physical activity has a significant worsening effect on varicocele pain. Microscopic sub-inguinal varicocelectomy offers the best results for resolution of this pain with the lowest complication rates. □

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