

Pediatric Urology

Clinical Characteristics and Surgical Outcomes in Adolescents and Adults with Varicocele

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Purpose: To compare clinical characteristics and surgical results in adolescents and adults with varicocele.

Materials and Methods: We retrospectively analyzed the characteristics of 93 patients, 34 adolescents (mean age, 14.4±2.1 years) and 59 adults (mean age, 30.4±12.4 years), who underwent surgical repair of varicocele between 2006 and 2009. Median follow-up time in all patients was 18.7 months. The most bothersome symptoms, bilaterality, grades, surgical methods, artery-sparing rates, operation times, semen analysis, success rates, and recurrence-free period were compared between the two groups.

Results: The overall success rate of surgical repair was 92.5%. The most bothersome symptoms were scrotal mass, pain, and hypotrophy in adolescents and pain, scrotal mass, infertility, and hypotrophy in adults (p=0.008). There were no significant between-group differences in bilaterality, grades, surgical methods, operation times, pre- or postoperative semen analyses, success rates, or recurrence-free periods. Patients who underwent artery-sparing surgery had higher recurrence rates than did those who underwent surgery that did not spare arteries. In adults, semen density increased significantly after surgery, from 35.6 million/ml to 49.6 million/ml (p=0.046).

Conclusions: There were no significant differences in clinical characteristics or surgical results between adolescents and adults with varicocele, except for the most bothersome symptoms. Semen density increased after surgery in both groups.

Key Words: Arteries; Semen analysis; Spermatic cord; Treatment outcome; Varicocele

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INTRODUCTION

Varicocele occurs in about 15% of the general male population and in 20% to 40% of men presenting to infertility clinics [1]. Varicocele is also detected in 2% to 11% of pre-pubertal boys [2-4], increasing to 15% to 16% in post-pubertal adolescent males [5].

Although varicocele may be treated by selective embolization of the enlarged testicular vessels during antegrade or retrograde venography, it is usually treated surgically. Because varicocele is less common in children and is anatomically smaller, surgical methods in children have been

developed only over the past two decades. New surgical approaches, including subinguinal and laparoscopic varicocelectomy, have gained acceptance, and older approaches, including the Ivanissevich and Palomo techniques, have been modified [6]. Many reports have compared surgical techniques, the use of magnification, artery and/or lymphatic sparing techniques, and complications [7-11]. Postoperative complications are fairly common and may include hydrocele, recurrence, persistence, and testicular atrophy [12]. Most of these studies, however, assessed adults, adolescents, and children separately, with few reports directly comparing clinical outcomes in adolescents

and adults with varicocele. We therefore compared the clinical characteristics and surgical results of adolescents and adults who underwent open or laparoscopic surgical repair of varicocele.

MATERIALS AND METHODS

1. Patient characteristics

We retrospectively reviewed the medical records of 93 patients who underwent varicolectomy at our institution between January 2006 and December 2009. Of these 93 patients, 34 were defined as adolescents (mean age, 14.4 years; range, 11-18 years) and 59 were adults (mean age, 30.4 years; range, 19-64 years). Varicocele was on the left side in 83 patients and was bilateral in 10; it was grade 2 in 7 and grade 3 in 86. Of these 93 patients, 26 underwent open and 67 underwent laparoscopic varicolectomy (Table 1).

Varicocele was diagnosed on the basis of a physical examination in the upright and supine positions using Valsalva's maneuver. Varicoceles were classified as grade 1 (palpable only during the Valsalva maneuver), grade 2 (palpable without the Valsalva maneuver), and grade 3 (visible without palpation) [13]. Preoperative and postoperative testis volumes were measured with an ellipsoid Prader orchidometer (ASSI, Westbury, New York, NY, USA). If the difference in testicular size was > 2 ml or $\geq 10\%$ on the affected side, it was considered testicular hypotrophy. Semen samples were not obtained from patients with no experience of masturbation or if the patients or parents refused the test. Indications for varicolectomy were infertility or abnormal semen results, scrotal discomfort or pain, palpable varicocele (grade 2 or 3), testicular hypotrophy, bilaterality, and patient request or anxiety. We excluded patients with additional pathology of the scrotum or urinary tract (e.g., history of urinary tract infection, prostatitis, or epididymitis).

TABLE 1. Patient demographic characteristics

| | Adolescents (n=34) | Adults (n=59) | Overall (n=93) |
|---------------------------------|-----------------------|------------------|-------------------|
| Mean age (yr) | 14.4 (11-18) | 30.4 (19-64) | 24.5 \pm 12.6 |
| Laterality | | | |
| Left | 34 | 59 | 93 |
| Bilateral (%) | 2 (5.9) | 8 (13.5) | 10 (10.8) |
| Grade | | | |
| 2 | 3 | 4 | 7 |
| 3 | 31 | 55 | 86 |
| Operative methods | | | |
| Open (inguinal/ subinguinal) | 9 | 17 | 26 |
| Laparoscopy | 25 | 42 | 67 |
| Median follow-up (mo) | 19.2 \pm 14.7 | 18.4 \pm 11.4 | 18.7 \pm 12.6 |

2. Varicolectomy techniques

All procedures were performed under general anesthesia, with the patient in a slight head-down position. Open inguinal or subinguinal varicolectomy was performed by using standard techniques with ligation of dilated veins. During laparoscopic varicolectomy, the first 5 mm port was inserted just below the umbilicus under direct vision. A pneumoperitoneum was created by using carbon dioxide insufflations with a maximum intraabdominal pressure of 12 mmHg and a gas flow of 1 or 2 l/min. A 30 telescope was subsequently introduced, the intraabdominal cavity was carefully explored, and the enlarged vessels were identified. Two additional 5 mm ports were inserted, one at the flank of the involved side and the other in the suprapubic region. The parietal peritoneum overlying the enlarged vessels was divided high above the internal inguinal ring to create a wide window. All enlarged vessels were consecutively mobilized, clipped, and divided in the middle. Patients with bilateral varicocele underwent bilateral varicolectomies in a single session. Attempts were made to preserve the artery, and all the patients underwent a lymphatic-sparing method (Fig. 1). Before the procedures ended, the patients were changed to a slight head-up position and the ipsilateral testicles were squeezed to identify the remaining varicose vein. The peritoneal window was sutured and the pneumoperitoneum was evacuated, the ports were removed, and the skin wounds were closed with subcuticular absorbable sutures. The mean operation times for open and laparoscopic surgery were 122.1 \pm 35.4 minutes and 69.9 \pm 29.2 minutes, respectively.

All patients were discharged the day following surgery and were examined 1 week later to check the wound. All patients were evaluated at 3, 6, and 12 months postoperatively, and every 12 months thereafter. The evaluations included physical examination with or without color Doppler ultrasonography of the scrotum. Success was defined as the absence of a varicocele and recurrence was defined as the presence of a varicocele (\geq grade 1) on clinical examination after surgery. All patients were followed up for a minimum of 6 months; the mean follow-up time was 18.7 \pm 12.6 months.

3. Statistical analyses

The most bothersome symptoms (pain or discomfort, palpable mass, infertility, and hypotrophy), bilaterality, varicocele grade distribution, surgical methods, internal spermatic artery sparing, operation times (from incision to closure), semen analysis, success rates, and recurrence-free period were compared in adolescents and adults, using independent t-tests, chi-square tests with Fisher's exact tests, and Pearson chi-square tests, as appropriate. All statistical analyses were performed by using SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA). All statistical analyses were two-sided, with $p < 0.05$ considered statistically significant.

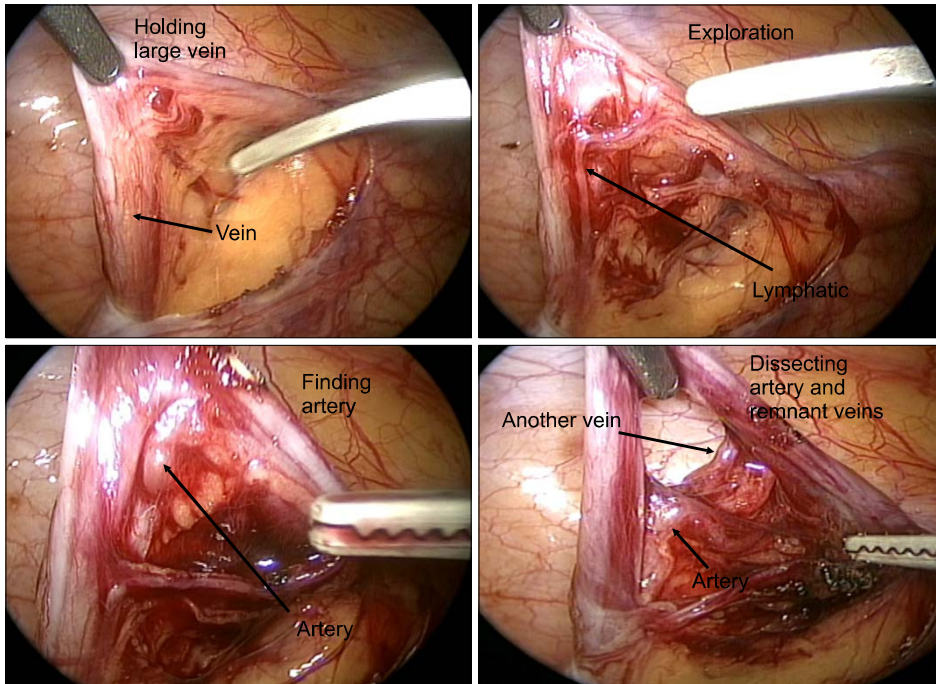


FIG. 1. The process of laparoscopic varicocelectomy. Artery and lymphatics are well identified and saved.

TABLE 2. Mean operation times and overall recurrence rates in children and adults

| Operative methods (No.) | Adolescents (n=34) | Adults (n=59) | Overall (n=93) | p-value |
|-------------------------------|--------------------|---------------|----------------|---------|
| Open (inguinal/subinguinal) | 9 | 17 | 26 | 0.524 |
| Recurrence/artery-sparing | 2/7 | 1/17 | 3/24 | |
| Recurrence-free period (mo) | 4.5 | 3 | | |
| Recurrence/non-artery-sparing | 0/2 | 0/0 | 0/2 | 0.811 |
| Mean operation time (min) | 131.7±43.0 | 117.1±30.9 | 122.1±35.4 | 0.627 |
| Laparoscopy | 25 | 42 | 67 | |
| Recurrence/artery-sparing | 1/11 | 2/23 | 3/34 | |
| Recurrence-free period (mo) | 6 | 7.5 | | |
| Recurrence/non-artery-sparing | 1/14 | 0/19 | 1/33 | 0.575 |
| Recurrence-free period (mo) | 6 | - | | 0.217 |
| Mean operation time (min) | 63.4±31.2 | 73.7±27.5 | 69.9±29.2 | |
| Recurrence (%) | 4 (11.8) | 3 (5.1) | 7 (7.5) | |

RESULTS

The overall success rate in all 93 patients was 92.5%. No patient experienced testicular atrophy after surgery. Recurrence rates in adolescents and adults were 11.8% and 5.1%, respectively. There were no significant between-group differences in the recurrence rates or operation times (Table 2). The artery-sparing method was used in 58 patients, 18 adolescents and 40 adults, with 3 patients in each group having recurrences, at 3 or 6 months in adolescents and at 3 or 12 months in adults. One adolescent who underwent laparoscopic surgery without artery sparing had a recurrence 6 months after surgery. We found that the patients who underwent artery-sparing surgery had higher recurrence rates but the difference was not statistically significant (p=0.249).

Preoperative and postoperative semen analyses were

performed in 31 patients (5 adolescents and 26 adults). There were no significant between-group differences in semen volume, density, or motility either before or after varicocelectomy (Table 3). However, in the adults, sperm density significantly increased, from 35.6 million/ml before to 49.6 million/ml after varicocelectomy (p=0.046). Although semen density and motility improved in adolescents after varicocelectomy, these differences were not statistically significant.

Adolescents and adults showed significant differences in the most bothersome symptoms (p=0.008). Of the 34 adolescents, 23 (67.6%) underwent surgery owing to a palpable scrotal mass, 9 (26.5%) because of pain or discomfort, and 2 (5.9%) owing to hypotrophy of the testis. Of the 59 adults, 34 (57.6%) underwent surgery because of pain or discomfort, 17 (28.8%) owing to a palpable scrotal mass, 7 (11.9%) owing to infertility, and 1 (1.7%) because of tes-

TABLE 3. Preoperative and postoperative semen analyses

| | Adolescents (n=34) | Adults (n=59) | p-value |
|------------------------------|-----------------------|------------------|---------|
| Preoperative semen analysis | n=5 | n=26 | |
| Volume (ml) | 2.7 | 3.3 | 0.831 |
| Density (million/ml) | 25.7 | 35.6 | 0.548 |
| Motility (%) | 41.3 | 48.9 | 0.882 |
| Postoperative semen analysis | | | |
| Volume (ml) | 1.6 | 3.7 | 0.052 |
| Density (million/ml) | 32.2 | 49.6 | 0.501 |
| Motility (%) | 60.0 | 52 | 0.382 |
| p-value | 0.121 | 0.046 | |

ticular hypotrophy (Table 4). After varicocelectomy, 20 of the 23 adolescents (90%) with a palpable mass no longer had a palpable mass, 5 of the 9 (55.6%) with pain or discomfort no longer had these symptoms, and both (100%) with testicular hypertrophy had increased testicular volume. Of the adults, 14 of 17 (82.4%) with a palpable mass no longer had a palpable mass, 28 of the 34 (82.4%) with pain or discomfort no longer had these symptoms, 5 of 7 (71.4%) infertile men achieved pregnancy, and the 1 (100%) patient with testicular hypotrophy had an increased testicular volume.

DISCUSSION

Varicoceles, the most common cause of secondary infertility in men, is a progressive and surgically correctable disease that causes deterioration in testicular function and semen parameters [1,14]. Varicocele has been associated with a loss of testicular mass that appears to be progressive with age [15]. Thus, repair of varicoceles at an early age may be recommended to prevent deterioration of testicular function, including size and fertility, with prophylactic treatment considered to be the best therapeutic approach. Varicocele may become apparent peripubertally, and early corrective therapy may prevent damage to an individual's fertility status [16,17]. Moreover, increased testicular volume after varicocelectomy has been reported in adolescents, however rarely in adults, although adults do experience significant increases in total motile sperm count [16,18,19]. Accurate comparison of outcomes using different treatment modalities is difficult because of innumerable and inconsistently controlled variables. In our study, although the follow-up time was short (18.7 months), 26 adults showed significant improvements in semen quality, especially in sperm count after varicocelectomy. In addition, 5 of the 7 infertile men succeeded in having a baby. Mean sperm density in the 5 children tested improved, from 25.7 million/ml before to 32.2 million/ml after varicocelectomy, although the difference was not statistically significant because of the small number of patients.

Varicoceles are treated in men with severe dilatation of testicular vessels (i.e., grades 2 and 3), testicular atrophy,

TABLE 4. Most bothersome symptoms before and symptom-free rates after varicocelectomy

| | Adolescents (n=34) | Adults (n=59) | Overall (n=93) | p-value |
|---|-----------------------|------------------|-------------------|---------|
| Most bothersome symptoms before varicocelectomy (%) | | | | 0.008 |
| Scrotal mass | 23 (67.6) | 17 (28.8) | 40 (43.0) | |
| Pain or discomfort | 9 (26.5) | 34 (57.6) | 43 (46.2) | |
| Infertility | 0 | 7 (11.9) | 7 (7.5) | |
| Hypotrophy | 2 (5.9) | 1 (1.7) | 3 (3.2) | |
| Symptom-free rates after varicocelectomy (%) | | | | 0.121 |
| Scrotal mass | 20 (90.0) | 14 (82.4) | 34 (85.0) | |
| Pain or discomfort | 5 (55.6) | 28 (82.4) | 33 (76.7) | |
| Infertility | 0 | 5 (71.4) | 5 (71.4) | |
| Hypotrophy | 2 (100) | 1 (100) | 3 (100) | |

or bilateral varicocele, although men with symptoms such as discomfort or chronic pain may also undergo surgical repair. About 2% to 10% of men with varicocele have been reported to experience pain or discomfort, although other investigators have reported that 52% of patients with varicocele underwent surgery for pain [20,21]. Most of our patients with varicocele had symptoms other than infertility. Of our 93 patients, 43 had pain or discomfort in the testis or inguinal area. When we compared symptoms in our two patient groups, we found that 23 (67.6%) of 34 adolescents had a palpable scrotal mass and 9 (26.5%) had pain or discomfort, whereas 34 (57.6%) of the 59 adults had pain or discomfort and 17 (28.8%) had a palpable scrotal mass. Varicocelectomy has been shown to be effective in the control of pain [22]. One study found that, of patients with pain before surgery, 73% had complete or marked resolution and 10% had partial resolution after varicocelectomy, which suggests that surgical treatment is effective for painful varicocele [23]. In a Korean study, 78.6% of men experienced complete relief of pain and 9.7% had partial relief, whereas 11.6% had persistent or worsened symptoms [24]. These findings suggest that the postoperative degree of pain relief was affected by the preoperative quality of pain. Of our patients, 76.7% had complete resolution of symptoms after varicocele repair, 55.6% of the adolescents and 82.4% of the adults. The lower success rate in adolescents may have been because of the small number of these patients and their nonreporting of symptoms. Although the reasons for pain remaining after varicocelectomy are unclear, these individuals may also have other causes of testicular discomfort, such as testicular pain syndrome or chronic prostatitis not detected on laboratory tests.

Varicocelectomy requires efforts to preserve testicular arterial blood flow and lymphatic channels while ligating the internal and external spermatic veins. However, the effectiveness and outcomes of artery-sparing and non-sparing varicocelectomy are still controversial [25,26]. In

the current study, we found that patients who underwent artery-sparing surgery had higher recurrence rates but the difference was not statistically significant ($p=0.249$).

This study had several limitations, including the small number of patients and the inclusion of patients from a single center. Moreover, we did not compare the effectiveness of the two surgical methods, nor was there a control group to assess the effectiveness of varicocele repair.

CONCLUSIONS

Adolescents and adults who underwent varicocelectomy showed no significant differences in bilaterality, grades, surgical methods, artery-saving rates, operation times, success rates, or recurrence-free periods. The most bothersome symptoms were pain or discomfort in adults and scrotal mass in adolescents. Recurrence rates were higher in patients who underwent artery-sparing surgery than in those who did not, but the difference was not significant. Additional studies in larger patient populations are warranted.

Conflicts of Interest

The authors have nothing to disclose.

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