



Adolescent varicocele: Efficacy of indication-to-treat protocol and proposal of a grading system for postoperative hydroceles

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Keywords

Adolescent; Hydrocele; Treatment; Varicocele; Varicocelectomy

Received 12 September 2017
Accepted 9 December 2017
Available online 8 February 2018

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Summary

Background

Varicocele is a common urologic anomaly in adolescent males; however, evidence-based treatment guidelines do not exist. Hydroceles are known to be a common complication after surgical therapy, with a wide variation in the reported incidence between 1 and 40%.

Aim

This study aimed to introduce a standardized indication-to-treat protocol and prove its efficacy by analyzing the outcome of patients. Secondly, it aimed to better define postoperative hydroceles because the wide variation of reported incidence is attributed to a lack of definition.

Methods

Our standardized treatment protocol included an initial assessment with clinical grading of varicoceles, ultrasound evaluation of testicular volume, and calculation of the atrophy index. Indications for surgical treatment were testicular volume asymmetry >20%, discomfort and pain, or bilateral varicocele. The Palomo procedure (laparoscopically since 2005) was the standard procedure. Postoperative hydroceles were graded according to clinical findings and symptoms: Grade I, sonographic chance finding without clinical correlate; Grade II, palpable but clinically insignificant; Grade III, symptomatic. All patients treated according to the defined protocol were prospectively monitored between January 2001 and December 2015.

Results

A total of 129 patients with left varicocele were referred to our institution; 70 fulfilled the indication criteria for surgical treatment. Twenty-eight of these patients were treated for volume asymmetry, 26 of these showed catch-up growth. Forty-two patients were treated for discomfort and pain; the symptoms subsided in all of them. Postoperative hydroceles were detected in 36 patients (51%). In 29 patients this was a sonographic chance finding (Grade I). Three patients showed a palpable but clinically insignificant postoperative hydrocele (Grade II) and four patients (5.7%) showed symptomatic hydrocele (Grade III) where treatment was recommended.

Discussion

The treatment protocol allowed judicious indication for surgery and postoperative outcomes similar to previous reports. The high rate of catch-up growth in operated cases represents a proxy for successful treatment in cases where more precise parameters, like semen quality or paternity rate, were not yet detectable. The introduced grading system for postoperative hydroceles proves to be a valid and appropriate instrument, and promises to be a standardized method for comparing outcomes in future studies.

Conclusion

The indication-to-treat protocol proved to be easily applicable, highly efficient, and have outcomes comparable to international literature. The necessity for a standardized grading of postoperative hydroceles was underscored in the data.

Background

Varicocele is a common urologic anomaly in adolescent males; the approximate incidence is 15% [1]. Evidence for the clinical significance of the condition is controversial. On the one hand, varicoceles are seen in up to 35% of men with primary infertility, on the other hand, approximately 80% of adults with varicoceles are asymptomatic and fertile [2].

Controversy still exists about the indications and the gold standard approach for varicocele treatment [3]. Until now, evidence-based treatment guidelines have not existed and recommendations have been phrased as suggestions. In 2001 the American Urological Association wrote: '... adolescent males who have unilateral or bilateral varicoceles and objective evidence of reduced testicular size ipsilateral to the varicocele should [also] be considered candidates for varicocele repair' [4]. The recommendations were updated in 2007 by the American Society of Reproductive medicine: 'Any adolescent with a varicocele who has a decrease in size of the ipsilateral testis should have that varicocele corrected, and adolescents who do not have any change in testis size should be followed expectantly until such a change in testis size becomes apparent' [5]. The European Association of Urology defines: 'varicocele associated with a small testis; additional testicular condition affecting fertility; bilateral palpable varicocele; pathological sperm quality; symptomatic varicocele' [6] as indications for treatment, even though the beneficial effect of treatment regarding chance of paternity is uncertain [7].

In 2000, a management protocol for adolescent varicocele was established at the Department of Pediatric Surgery and Pediatric Urology in Lucerne, Switzerland. It included clearly defined indications for treatment, a follow-up protocol, and a newly developed grading system for postoperative hydroceles. As a quality improvement initiative, patients treated according to the new protocol were prospectively monitored.

Methods

The protocol for varicoceles included an initial assessment with clinical grading of varicoceles according to Dubin and Amelar [8], clinical evaluation of testicular volume with the Prader orchidometer [9], ultrasound evaluation, and calculation of testicular volume with the formula $L \times W \times H \times 0.71$ [10] and calculation of the atrophy index with the formula

$$\left(\frac{\text{right testicular volume} - \text{left testicular volume}}{\text{right testicular volume}} \right) \times 100$$

The ultrasound evaluation further included an abdominal scan to rule out any pathological masses.

Indications for surgical treatment were:

- testicular volume asymmetry >20% at first presentation
- increasing volume asymmetry when reaching a difference of 20%
- discomfort and pain
- bilateral varicocele.

To quantify the postoperative hydroceles a grading system according to the clinical findings, relevance and necessity for further procedures was developed. Grade I postoperative hydroceles were classified as only a sonographic finding, with the patient unaware of the small collection of fluid and no pathological finding on physical examination. Grade II postoperative hydroceles were defined as a visible volume difference of the scrotal pouches without any reported discomfort. Physical examination findings were defined as a soft palpable hydrocele but scrotal skin folds unchanged, depending on the thickness of the skin, diaphanoscopy (transilluminate) may or may not be positive. Grade III postoperative hydroceles were defined as a visible volume difference of the scrotal pouches with the patient perceiving pressure and the physician palpating a firm hydrocele with the testis not separately palpable and skin folds effaced; diaphanoscopy is positive in Grade III. Fig. 1 displays the grading system.

The Palomo procedure was standard treatment [11], which was initially carried out as open surgery and changed to laparoscopic in 2005. Yearly clinical and ultrasound follow-up were carried out for all patients, treated or observed. Evaluation of catch-up growth was measured first at the 1-year mark and repeated yearly; the latest available result was used for the current study. The practice was to transition to adult urology at 16 years of age. If applicable, postoperative hydroceles were documented according to the grading system.

With the implementation of the new protocol, prospective data collection of all patients with varicocele was started. Patients were enrolled into this analysis when a minimum follow-up of 1 year was achieved.

Results

Between January 2001 and December 2015, 129 patients with the clinical diagnosis of varicocele were referred to our institution. Fourteen observed patients were lost to follow-up and therefore excluded from further analysis.

One hundred and fifteen patients were included into the analysis. Mean age at first consultation was 12.8 years. All varicoceles presented exclusively on the left side; no right or bilateral varicocele was seen.

Forty-five patients did not fulfill the criteria for surgical treatment. Of these, none presented with Grade I varicocele, 14 with Grade II, and 31 with Grade III varicocele. Mean time of follow-up for these observed patients was 2.6 years. Seventy patients fulfilled the indications for surgical treatment. Of these, 10 presented with a Grade II, and 60 presented with Grade III. These data are illustrated in Fig. 2.

Twenty-eight patients were treated for volume asymmetry >20%. Forty-two were treated due to discomfort and/or pain (Fig. 3). Standard surgical procedure was the retroperitoneal (high) ligation of the testicular artery and vein above the internal inguinal ring (Palomo technique). Two cases were deviated from the standard Palomo technique due prior orchiopexy: one patient was treated with suprainguinal ligation of the vein while sparing the artery (Ivanissevich technique) and another patient was treated with ligation of the cremasteric and internal spermatic

	Symptoms	Physical examination	Sonography	Treatment
Grade I	None: patient is unaware of the condition.	Not palpable by physician. Diaphanoscopy negative.	Collection of fluid detectable	None
Grade II	Volume difference of scrotal pouch visible, no discomfort reported.	Soft hydrocele palpable by physician and patient, testis palpable through fluid. Scrotal skin folds unchanged. Diaphanoscopy may be positive.	Collection of fluid detectable	None
Grade III	Volume differences of scrotal pouch visible. Patient perceives pressure in scrotal pouch.	Firm hydrocele palpable, testis not separately palpable within mass. Skin folds elapsed. Diaphanoscopy positive.	Collection of fluid detectable	Recommended

Figure 1 Definition of grades for postoperative hydroceles.

veins within the inguinal channel (Bernardi technique). Thirty-nine patients underwent open surgery and 31 were treated laparoscopically. Mean postoperative follow-up was 15 months.

Sixty-seven of the 70 patients (95.7%) were successfully surgically treated with a complete disappearance of the varicocele after surgery. Relapses were seen in three of the surgically treated patients. Two patients who were treated for Grade III varicocele presented with a Grade I varicocele 12 months postoperatively. Both patients were observed and did not require any further treatment. One patient treated for Grade III varicocele presented with a Grade II varicocele 24 months postoperatively. Ultrasound evaluation revealed obliterated Vasa spermatica. He was treated with embolization and had no further recurrence. All patients treated for discomfort and pain had complete resolution of their symptoms.

Of the 19 patients initially presenting with volume asymmetry $>20\%$, 17 presented with a Grade III varicocele and two presented with a Grade II varicocele.

Of the nine patients who were initially observed and later treated when testicular volume asymmetry reached $>20\%$, seven had a Grade III and two a Grade II varicocele at first presentation. The latter increased to Grade III within 12 months.

Twenty-six of the 28 patients treated for volume asymmetry resulted in catch-up growth. Sixteen showed complete catch-up. Within 2 years, 10 patients had symmetric testis, and in six patients the affected testis even exceeded the right side in size. Ten patients showed catch-up growth but a testicular volume asymmetry persisted (6–20%). Two patients did not show any catch-up growth. One patient had worsening volume asymmetry of 38% pre-operatively and 42% in the follow-up, and one patient had a growth arrest – the testicular volume remained 2.9 ml.

Postoperative hydroceles were detected in 36 (51%) of the operated patients. When classified according to the grading system, 29 patients (41%) presented with Grade I hydrocele, three (4.3%) with Grade II, and four (8.6%) with Grade III hydrocele (see Fig. 4). Of the four patients with

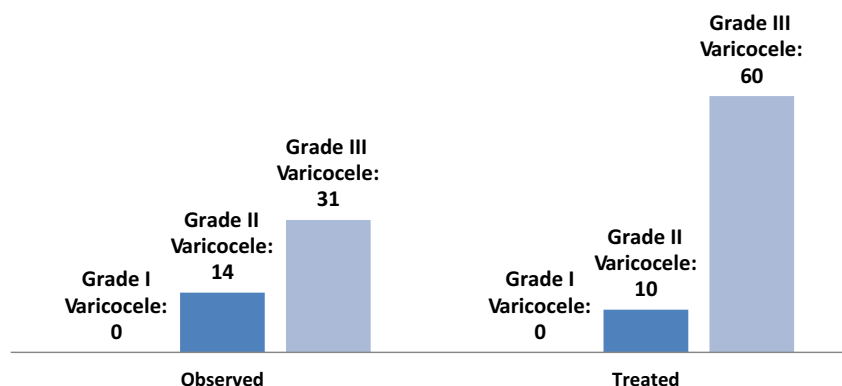


Figure 2 Grading of varicocele in observed and treated patients.

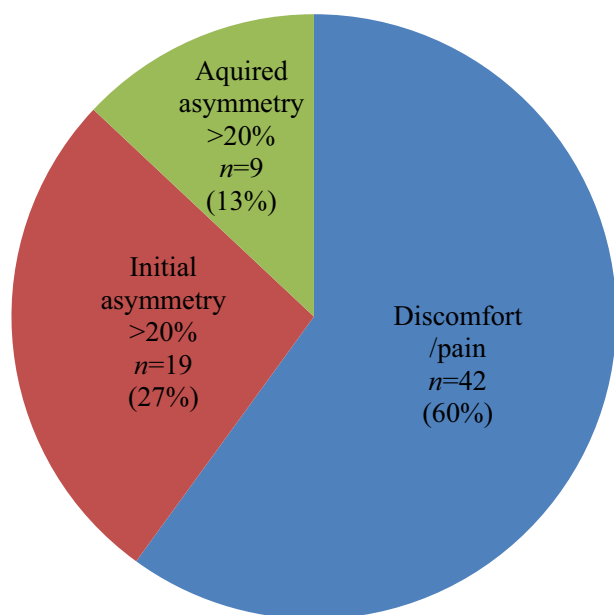


Figure 3 Indications for treatment (n = 70).

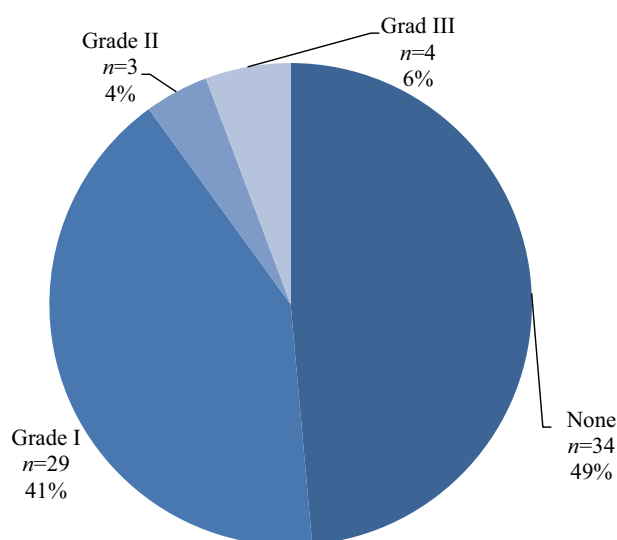


Figure 4 Grades of postoperative hydroceles.

Grade III hydrocele, three were treated operatively with scrotal hydrocelectomy according to Bergmann. The fourth patient was offered operative treatment but declined, the hydrocele has not resolved.

Discussion

The best management for adolescent varicocele has not yet been established. The implementation of a clearly defined management protocol at our institution proved extremely valuable in alleviating ambiguity in treatment indications. The treatment indications were determined in 2000 according to the then up-to-date literature. At that time there was evidence that varicocele may lead to atrophy or non-growth of the ipsilateral testis [12], and that surgical

treatment stops testicular growth arrest and enables catch-up growth [13]. This has been confirmed by more recent studies [2,3,14–16]. Additionally, a testicular volume differential of >20% has been found to significantly decrease the total motile sperm count [17]. Furthermore, varicocelectomy has been found to result in significant improvement or resolution of testicular pain [18] and therefore justifies surgical treatment [19]. The non-artery-sparing procedure (Palomo technique) was adopted as standard treatment because of its low recurrence rate, which has by now been confirmed by studies with large sample sizes [20–22]. After the clinical efficacy and safety of laparoscopic varicocelectomy was demonstrated, the minimal invasive procedure was established at our institution, with the same beneficial results [18,20,23–25].

Sixty-one percent of the patients referred to our institution met the indications for surgical treatment. The main indication was to treat discomfort and/or pain. Fifteen years after the indication-to-treat protocol was introduced, indications and effects of adolescent varicocele repair on paternity are still being called 'challenging to study, and firm conclusions are lacking' [26]. Treatment for pain seems easily justifiable, as the outcome is almost universally favorable [19]. Long-term observational studies assessing paternity and semen analysis are still missing, and the available literature is still heterogeneous. A very recent study has reported an alarmingly low paternity rate of 48% in untreated boys with (mostly) bilateral varicocele [27]. In contrast, Bogaert et al. found a paternity rate of 85% in untreated boys with left varicocele [7]. Despite the ambiguity in the literature, it is proposed that since there is a correlation between testis hypotrophy and total motile sperm count [17], which correlates to infertility, testis asymmetry is a justifiable indication and the indications to treat have not changed.

As repeatedly described in the literature, postoperative hydrocele is a common complication after varicocele surgery that might develop months or years after the procedure. There is wide variation in the reported incidence, between 1 and 40% [21,28,29]. These heterogeneous findings might have a number of reasons: a longer and closer follow-up might be the reason for the higher rate of hydrocele in some series [30]. The current study reports a hydrocele rate of 51%, which seems unacceptably high. It is believed that this series had a higher incidence due to including all patients with sonographic evidence of fluid in the scrotum, even if the hydrocele was not palpable. When counting only the clinically apparent forms, this rate would have been only 10%. In the literature, occurring hydroceles are described as 'small' or 'big'; these are extremely subjective parameters. It is believed that this is a major confounder for all studies comparing different surgical techniques. When discussing the occurrence of postoperative hydrocele after different types of varicocelectomy, establishing an objective and valid instrument is required. The current proposed classification proved immediately applicable during follow-up consultations and produced meaningful and relevant data. It is believed that a common definition will allow future studies to be more easily compared.

Nevertheless, there is evidence that dye-assisted lymphatic-vessel-sparing surgery reduces the amount of

postoperative hydrocele [31–33]. Paratesticular injection should be preferred since there is evidence that intra-testicular injection leads to necrosis, fibrosis and hyalinization [34].

In conclusion, this standardized treatment protocol allows judicious indication for surgery. These data confirm the need for a regular follow-up, due to the possible progression of volume asymmetry. The high rate of catch-up growth in operated cases functions as a proxy for successful treatment in cases where more precise parameters like semen quality or paternity rate are not yet detectable.

The introduced grading system for postoperative hydroceles proved to be a valid and appropriate instrument and promises comparability of future studies.

Funding

No funding was received. All authors declare that they have no conflict of interest. There are no competing interests for any of the authors.

Ethical approval

All procedures performed were in accordance with the ethical standards with the 1964 Helsinki declaration and its later amendments. Ethical approval was obtained by the local ethical committee Swissethics (project No.: 2017-00397).

Informed consent

Informed consent for participation and publishing was obtained from all individual participants included in the study.

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