Pediatr Surg Int (2008) 24:583–587
DOI 10.1007/s00383-008-2124-x

ORIGINAL ARTICLE

Retrograde percutaneous sclerotherapy of left idiopathic varicocele in children: results and follow-up

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Accepted: 27 February 2008 / Published online: 26 March 2008

Abstract Treatment of pediatric patients with varicocele is based on the desire to prevent testicular dysfunction and possible infertility that may become irreversible in adults. The authors reviewed their experience with retrograde percutaneous sclerotherapy (RPS) via a trans-femoral approach to assess its results in children. A retrospective study was conducted, including all the children admitted between 2000 and 2004 who underwent RPS with at least 24 months follow-up (FU). The indication for treatment was grade II and III varicocele (Dubin–Amelar classification), confirmed by Doppler US. Three per cent sodium tetradecyl sulfate was the sclerosing agent. FU included Doppler US 1 month after the procedure and then yearly for at least 2 years. Eighty-six children (mean age 13.8 years) underwent phlebography and, when feasible, RPS. Varicocele was grade II in 49 cases and grade III in 37. RPS was feasible in 72 (84%) children because of unfavourable anatomic features of the left spermatic vein. RPS was successful in 66 (92%) out of 72 treated children. Median FU was 29 months. During FU, five (8%) patients relapsed. RPS of varicocele is a simple and effective treatment. A minimum of 2 years FU is recommended, as a few cured cases may relapse during this period.

Presented in part as scientific presentation at the 2006 RSNA (Radiological Society of North America) Annual Meeting, November 2006, Chicago, IL, USA.

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Keywords Varicocele · Sclerotherapy · Child

Introduction

Idiopathic varicocele is the varicose dilatation of the testicular pampiniform venous plexus and it is characterized by retrograde blood flow into the testicular venous system. Varicocele occurs in about 15% of boys and in adolescents aged 10–19 years, an incidence similar to that in the adult male population [1].

This condition may be associated with infertility, as oligoasthenozoospermia is common in affected adults [2]. The precise mechanism by which a varicocele impairs testicular function is still not clear, although several theories have been proposed. It has been hypothesized that the spermatogenetic impairment resulting from varicocele and its possible reversibility after the treatment could be related to the length of time the testis is exposed to the damage induced by the varicocele itself [3]. Treatment of adolescent and pediatric patients is thus based on the desire to prevent testicular dysfunction and possible infertility that may become irreversible in adults [4, 5].

The currently available surgical methods used in the therapy of idiopathic varicocele consist in the ligation of reflux-inducing veins either retroperitoneally, with conventional or laparoscopic technique, or inguinally, with conventional or microsurgical technique. All these approaches are invasive, especially in children, and require general anesthesia.

With interventional radiology techniques—initially proposed by Iaccarino in 1977 [6]—a sclerosing substance, either alone or associated with the placement of detachable balloons or coils, is injected in the spermatic vein with a

retrograde approach after percutaneous catheterization of the femoral [7] or brachial vein [8] under local anesthesia.

Treatment of varicocele with retrograde percutaneous sclerotherapy (RPS) is a well-known and widely used technique in adults [9]. However, just a few studies pertaining to children have been reported so far [4, 10–12], the majority of them with limited follow-up (FU).

The aim of our study was to evaluate the efficacy of RPS in the management of left side idiopathic varicocele in children in terms of feasibility and outcome, with emphasis on FU.

Materials and methods

A retrospective study was conducted, including all the patients with left side idiopathic varicocele (from January 2000 to March 2004, 86 patients) who underwent phlebography and, when feasible, RPS, with at least 24 months FU. Informed consent was obtained by the interventional radiologist in charge of the procedure, explaining to both the patient and his parents the indications of the procedure, its technique and possible complications. All persons gave their informed consent prior to their inclusion in the study. Clinical data, data on instrumental examinations, and pre- and post-intervention managements were collected from the clinical records.

US investigation included B-mode and Doppler studies of the morphology and vascularization of the testes. The indication for the treatment was a clinical evidence, as observed by our pediatric surgeons, of grade II and III varicocele, according to Dubin–Amelar classification [13], confirmed by US and Doppler US. US diagnostic criteria were findings of varicose dilation (minimum of 3 mm) of the veins of left testicular pampiniform plexus on US grey scale, associated with evidence of continuous spontaneous reflux in orthostatism and/or with Valsalva manoeuvre (grade 3–5 of Sarteschi's US classification [14]).

In all the patients venous access was via the right common femoral vein under US guidance, preceeded by local anesthesia (5 ml, 2% lidocaine). Using a Judkins left 6-Fr catheter, the left renal vein was catheterized and the catheter tip positioned in the left internal spermatic vein at the level of its junction with the renal vein. Selective venography of the spermatic vein was thus performed in order to provide a map of the vein and its collaterals (Fig. 1). If the anatomical conditions of the vein were favorable, an infusion wire or microcatheter was advanced as distally as possible, at least to the level of the internal inguinal ring to perform sclerotherapy (Fig. 2a).

In all the treated patients, the sclerosing agent was a solution of 4 ml of 3% sodium tetradecyl sulphate mixed with Iomeron 300 (Bracco, Milan, Italy) with the ratio of 4:1, to make it visible on fluoroscopy. The solution was slowly injected while withdrawing the catheter along the vein to about 10 cm from the junction with the renal vein (Fig. 2b). Compression of the spermatic vein at the inguinal ligament with a lead gloved hand which was used to avoid reflux of the sclerosing agent into the pampiniform plexus with consequent possible phlebitis.

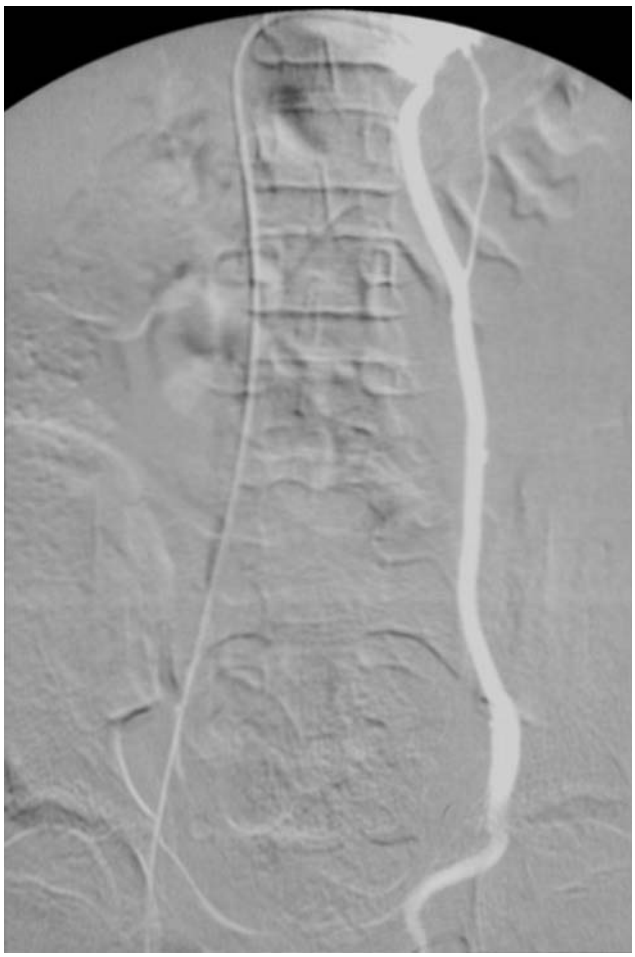

Fig. 1 A 14-year-old boy. Selective venography of the left internal spermatic vein showing a totally incontinent vessel, with a tiny collateral vein along its upper third

We used a digital multi-function angiographic facility with pulsed fluoroscopy, road map and last-image-hold functions for all the procedures. A gonadal shield was placed in all the cases.

After completion of the procedure, the patients were admitted to a surgical ward to stay overnight. Discharge criteria were that the patient was comfortable and with a clean access site.

Follow-up included Doppler US, 1 month after the procedure, and then yearly for at least 2 years. RPS was considered successful in case of shrinking of the vein of

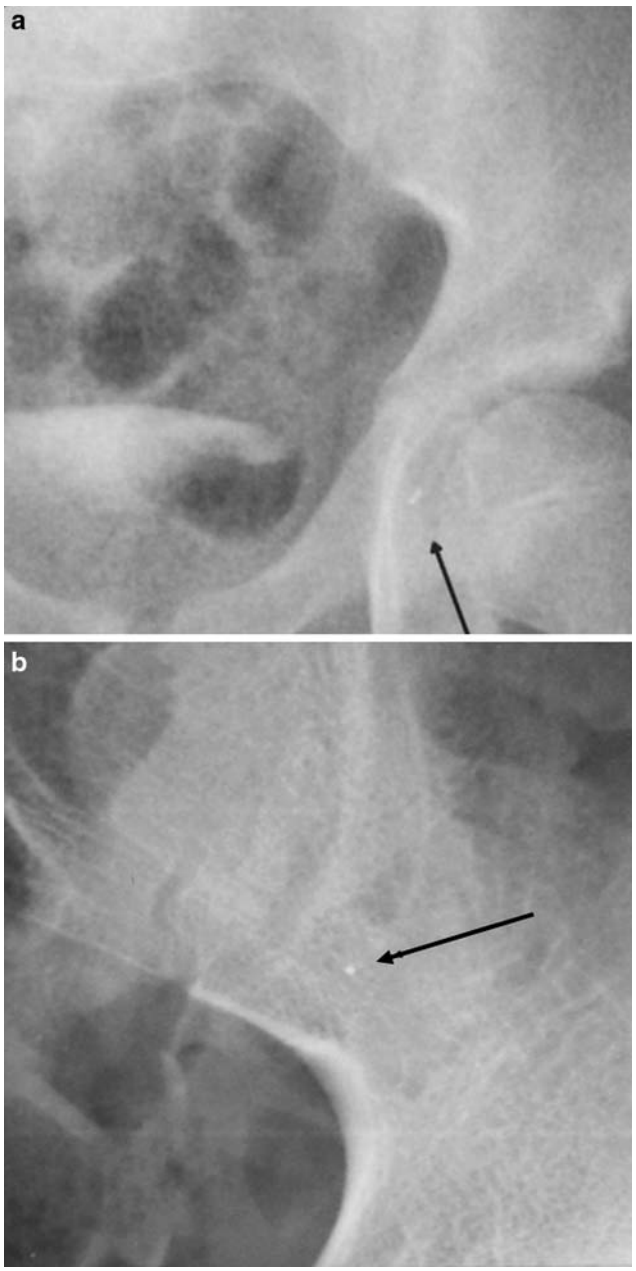

Fig. 2 Same patient. **a** The infusion wire or microcatheter is advanced through the left internal spermatic vein up to the level of the internal inguinal ring to perform sclerotherapy. **b** While injecting the sclerosing agent, the microcatheter is retracted along the vein to about 10 cm from the junction with the renal vein

pampiniform plexus associated with disappearing of reflux in orthostatism and with Valsalva manoeuvre.

Semen analysis was not carried out for ethical reasons.

Results

From January 2000 to March 2004, 86 patients with left side idiopathic varicocele underwent phlebography (mean age 13.8 years, range 11–16 years). All varicoceles were clinically palpable and discovered on routine physical examination or noted by the patients or by their parents.

Varicocele was grade II in 49 cases and grade III in 37, according to Dubin–Amelar classification. RPS was feasible in 72 (84%) children and not feasible in 14 (16%), because of unfavorable anatomic variants of the left spermatic vein.

At first attempt, RPS was successful in 64 (89%) out of these 72 patients. Phlebography was then repeated in five out of eight patients, in whom first RPS was ineffective; a further RPS was feasible and successful in two of them. Therefore, the total number of cured patients in whom RPS was feasible was 66 out of 72 (92%), whereas, the success rate in the whole group of 86 patients—including also those in whom RPS was not feasible—was 76%.

The whole procedure including sclerotherapy took a mean time of 50 min (range 35–75 min) in the interventional suite. Sedation was never necessary.

In patients who underwent phlebography and RPS, mean dose area product (DAP) was 290 cGy cm^2 (range 200–540).

Median length of FU was 31 months. During FU, 5 (8%) patients relapsed: four of them showed recurrence at 12 months FU on Doppler US, and 1 at 24 months. Three of these relapsed patients in whom phlebography showed recanalization of the left internal spermatic vein were successfully treated with a further RPS.

A total number of 77 RPS procedures were performed: a mild to moderate, self limiting pampiniform phlebitis was observed in 11 (14%) cases.

At FU, color Doppler US showed no difference in perfusion between the ipsilateral and contralateral testes in the whole group of treated children.

All patients were medically fit for discharge from the hospital within 24 h of the procedure.

Neither perioperative or late hydrocele, nor other complications were observed.

The patients in whom RPS was unfeasible (14 patients) or ineffective (6 patients), or with relapse not curable with further RPS (2 patients) were subsequently treated with conventional or laparoscopic surgery. Of these 22 patients, 10 were treated elsewhere, whereas 12 underwent laparoscopic surgery at our institution. Laparoscopic surgery was effective in all these 12 patients and no recurrence was observed during a median 21 month FU; a mild hydrocele was observed in two cases.

Discussion

Although, there is no unanimous consensus whether it is better to treat or just to observe children with varicocele,

treatment of pediatric patients is based on the desire to prevent testicular dysfunction and possible infertility that may become irreversible in adults [4, 15–17].

Some authors [18] suggest varicocele treatment just in case one or more of these conditions are found: abnormal semen analysis, left testicular hypotrophy in comparison with the volume of the right testis, supranormal response of LH or FSH to GnRH stimulation, bilateral palpable varicoceles, or large symptomatic varicocele. However, the same authors recognize that these screening methods may not be perfect as there is no definite way to identify a subpopulation of varicocele with significant testicular dysfunction.

Actually, spermatogenetic impairment is supposed to be related to the length of time the testis is exposed to the damage induced by the varicocele [3]. Therefore, similar to other authors [19] and with the agreement of the referring physicians at our institution, once a manifest idiopathic varicocele has been demonstrated, we propose sclerotherapy to each patient, believing that interventional radiology offers an effective and minimally invasive approach which may prevent infertility.

Techniques for varicocele treatment are still a matter of discussion. Beside RPS, a few surgical techniques are available.

Retroperitoneal repair of varicocele involves incision at the level of the internal inguinal ring, and exposure of the internal spermatic artery and vein, retroperitoneally, near the ureter. This approach involves ligation of the fewest number of veins and is fast. However, the recurrence is pretty high and approaches 20% [20], usually due to the presence of collaterals by passing the area of ligation. Furthermore, preservation of the testicular artery and lymphatics is difficult. Sectioning of lymphatics may result in post-operative hydrocele formation in 15–45% of the cases [21].

The inguinal approach allows the manipulation of the spermatic cord, where the testicular vessels may be identified without difficulty and the spermatic veins ligated, with easier preservation of the spermatic artery. Compared to retroperitoneal techniques, the inguinal technique has a lower incidence of varicocele recurrence, but a similar incidence of hydrocele formation [21].

Microsurgical techniques are characterized by a lower incidence of hydrocele formation, because the lymphatics can be easily identified and preserved. Furthermore, the spermatic artery may be more easily preserved, thanks to lens magnification. Recurrence rate is about 5% [21].

In young adolescents, laparoscopic retroperitoneal varicocelectomy with ligature of the spermatic vein only or ligation of testicular veins and artery has been reported to be effective in about 90% of the cases. Varicocele recurrence is the same as that of open retroperitoneal approach and the incidence of hydrocele is not dissimilar from that observed with conventional techniques [22].

Since 70s, especially in Europe, percutaneous sclero-embolization of the left spermatic vein for treatment of varicocele has been progressively gaining wide diffusion in adults. Success rate in adults—in whom cannulation of the left internal spermatic vein is feasible in about 90% of cases—approximates 90% [9]. Usually, the left internal spermatic vein is single and it joins almost perpendicularly to the left kidney vein, at approximately 1–3 cm from its junction with the inferior vena cava. However, several anatomical variants may prevent catheter advancement into the spermatic vein and effective sclero-embolization, namely the presence of two internal spermatic veins, the presence of perirenal collaterals, doubling of the kidney veins, or the presence of collaterals to inferior vena cava and/or to iliac or lumbar veins [23]. In children, internal left spermatic vein can be catheterized in 80–90% of the cases and RPS success rate is about 90% [4, 9, 11], although, worse results (65%) have also been reported [10].

Many authors, especially in adults, use coils, often in association with sclerosing agents. Our choice was not to use coils. In our opinion, not different from that of other authors who perform RPS in children [19], the use of coils may prevent cannulation of the vein, in case a subsequent procedure should be required in case of failure of first treatment. Moreover, in children, permanently implanted devices should be avoided if there are similarly efficacious non-permanent agents.

The only complication in our series—mostly observed at the beginning of our learning curve—was a mild to moderate pampiniform phlebitis. This is the most frequent complication of RPS and it is usually due to unintentional passage of the sclerosing agent into the scrotal portion of the varicocele [19]. Symptoms are scrotal swelling and pain, usually starting from 12 to 24 h after the procedure. This complication is usually self-limiting and in majority of the cases disappears within few days. The incidence of this complication may be reduced with compression of the spermatic vein at the inguinal ligament with a lead gloved hand during injection.

From our and other authors' experiences, differently from surgical techniques, no case of hydrocele following RPS was observed, as RPS causes selective sclerosis of the spermatic vein with no involvement of the spermatic artery and lymphatic vessels draining the testis [4, 10, 11]. Another possible complication, at least from a theoretical point of view, could be pulmonary embolism caused by a migrating thrombus. However, this complication has never been observed in a series including 5,500 patients [9].

Incidence of late recurrence in children who previously underwent RPS is poorly known [19]. Reyes et al. [8] reported 7% recurrence rate in a group of 59 children with

a median 4 year FU. Other authors did not differentiate failure from recurrence in their studies: Alqahtani et al. [4] reported 10% failure and recurrence rate in a group of 41 adolescents with median 22 month FU, whereas, Sivanathan et al. [10] observed a pretty disappointing 35% failure and relapse rate with median 13 month FU. To the best of our knowledge, our study reports one of the longest clinical and instrumental FUs available in a series including children only. Our results demonstrate that a few cured patients may show recurrence. However, in our study and in the most successful series of children receiving interventional therapy, the incidence of relapse is comparable with that observed with the most effective surgical techniques. Moreover, in our experience, it was possible to treat some of the relapsed patients with further RPS, and recurrence occurred in the majority of cases after a year from successful RPS. For this reason, we recommend a prudential 2 year FU.

The drawbacks of RPS are its unfeasibility in a minority of patients because of the anatomical variants of the spermatic vein preventing its cannulation and the risks related to irradiation. The latter drawback, however, can be minimized with the use of proper settings, pulsed fluoroscopy with last-hold-image function, and a gonadal shield.

In conclusion, our study shows that, in children in whom RPS is feasible, the success rate and the incidence of varicocele recurrence do not differ from those obtained with the best surgical procedures. Furthermore, the procedure is very well accepted by both the children and their parents, as it does not require general anesthesia, prolonged hospitalization, and a long recovery time.

For all these reasons, we think that RPS of idiopathic left varicocele in children could be considered at least as an alternative modality of treatment and proposed whenever a specialized interventional radiology team is available.

References

1. Oster J (1971) Varicocele in children and adolescents. An investigation of the incidence among Danish school children. Scand J Urol Nephrol 5:27–32
2. World Health Organization (1991) The influence of varicocele on parameters of fertility in a large group of men presenting to infertility clinics. Fertil Steril 57:1289–1291
3. Pozza D, Gregori A, Ossanna P et al (1994) Is it useful to operate on adolescent patients affected by left varicocele? J Androl 15:43S–46S
4. Alqathani A, Yazbeck S, Dubois J et al (2002) Percutaneous embolization of varicocele in children: a Canadian experience. J Pediatr Surg 37:783–785
5. Belloli G (1995) Fertility rates after successful correction of varicocele in adolescence and adulthood. Eur J Pediatr Surg 5:216–220
6. Iaccarino V (1977) Trattamento conservativo del varicocele: flebografia selettiva e scleroterapia delle vene gonadiche. Riv Radiol 17:107–117
7. Sigmund G, Bahren W, Gall H et al (1987) Idiopathic varicoceles: feasibility of percutaneous sclerotherapy. Radiology 164:161–168
8. Reyes BL, Trerotola SO, Venbrux AC et al (1994) Percutaneous embolotherapy of adolescent varicocele: results and long-term follow-up. J Vasc Interv Radiol 5:131–134
9. Wunsch R, Efinger K (2005) The interventional therapy of varicoceles amongst children, adolescents and young men. Eur J Radiol 53:46–56
10. Sivanathan C, Abernethy LJ (2003) Retrograde embolisation of varicocele in the pediatric age group: a review of 10 years' practice. Ann R Coll Surg Engl 85:50–51
11. Clarke SA, Agrawal M, Reidy J (2001) Percutaneous transfemoral testicular vein embolisation in the treatment of childhood varicocele. Pediatr Radiol 31:515–517
12. Rivilla F (1995) Percutaneous venography and embolization of the internal spermatic vein by spring coil for treatment of the left varicocele in children. J Pediatr Surg 4:523–527
13. Dubin L, Amelar RD (1971) Etiologic factors in 1924 consecutive cases of male infertility. Fertil Steril 22:469–474
14. Sarteschi M, Paoli R, Bianchini M et al (1993) Lo studio del varicocele con eco-color-Doppler. G It Ultrason 4:43–49
15. Hadziselimovic F, Herzog B, Liebundgut B et al (1989) Testicular vascular changes in children and adults with varicocele. J Urol 142:583–585
16. Lyon RP, Marshall S, Scott MP (1982) Varicocele in childhood and adolescence: implication in adulthood infertility? Urology 19:641–644
17. Lenzi A, Gandini L, Bagolan P et al (1998) Sperm parameters after early left varicocele treatment. Fertil Steril 69:347–349
18. Kass EJ, Reitelman C (1995) Adolescent varicocele. Urol Clin North Am 22:151–159
19. Lord DJE, Burrows PE (2003) Pediatric varicocele embolization. Tech Vasc Interv Radiol 6:169–175
20. Rothman LP, Newmark M, Karson R (1981) The recurrent varicocele. A poorly recognized problem. Fertil Steril 35:552–555
21. Goldstein M (1992) Surgery of male infertility and other disorders. In: Walsh PC, Retik AB, Stamey TA, Darracot Vaughan E (eds) Campbell's urology. Saunders, Philadelphia, pp 3114–3149
22. Esposito C, Valla JS, Najmaldin A et al (2004) Incidence and management of hydrocele following varicocele surgery in children. J Urol 171:1271–1273
23. Bahren W, Lenz M, Porst H et al (1983) Nebenwirkungen, komplikationen und kontraindikationen der perkutanen sklerotherapie der vena spermatica interna zur behandlung der idiopathischen varikozele. Rofo Fortschr Rontgenstr 138:172–179