Radiol med (2015) 120:483–488
DOI 10.1007/s11547-014-0478-9

URO-GENITAL RADIOLOGY

Left spermatic vein retrograde sclerosis: comparison between sclerosant agent injection through a diagnostic catheter versus through an occluding balloon catheter

Antonio Basile · Giovanni Failla · Sandro La Vignera · Rosita Angela Condorelli · Aldo Calogero · Enzo Vicari · Antonio Granata · Elena Mundo · Giuseppe Caltabiano · Marco Pizzarelli · Martina Messina · Giovanni Scavone · Franz Lanzafame · Roberto Iezzi · Dimitrios Tsetis

Received: 3 May 2014 / Accepted: 24 June 2014 / Published online: 2 December 2014

Abstract
Purpose The aim of this study was to compare the technical success between left spermatic vein (LSV) scleroembolisation achieved with the injection of sclerosant through a diagnostic catheter and through an occluding balloon (OB), in the treatment of male varicocele.
Materials and methods From January 2012 to September 2013, we prospectively enrolled 100 patients with left varicocele and an indication for LSV scleroembolisation related to symptoms or spermiogram anomalies; patients were randomised to two groups (we wrote a list of 100 lines assigned casually with A or B and each patient was consecutively allocated to group A or B on the basis of this list). Patients in group A underwent injection of the sclerosing agent through an angiographic diagnostic catheter (free catheter technique) and patients in group B through an OB catheter (OB technique). In cases of incomplete occlusion of the LSV, the procedure was completed with coils. Total occlusion of the LSV at post-treatment phlebography during a Valsalva manoeuvre before any coil embolisation was considered a technical success. The rate of complications was also evaluated. The Fischer's test was used for statistical analysis.
Results We evaluated a total of 90 patients because five patients for each group were not included in the statistical analysis owing to technical problems or complications. In group A we had a technical success of 75.6 versus 93.4 % in group B, and the difference was statistically significant ($P = 0.003$); in particular, we had to complete the embolisation with insertion of coils in 11 cases (24.4 %) in group A, and in three cases in group B (6.6 %). In group A, LSV rupture occurred in four cases (8 %) so the procedure was completed by sclerosant injection through the OB located distally to the lesion. These patients were not considered for evaluation. In another case, a high flow shunt towards the inferior vena cava was detected, so the patient

A. Basile · G. Failla · E. Mundo · G. Caltabiano · M. Pizzarelli · M. Messina · G. Scavone
Department of Diagnostic and Interventional Radiology, Garibaldi Centro Hospital, Piazza Santa, Maria Del Gesù, Catania 95124, Italy

A. Basile (✉)
Via Trieste 14, 95127 Catania, Italy
e-mail: antodoc@yahoo.com

G. Failla
Department of Radiology, Policlinico Universitario Vittorio Emanuele, Catania, Italy

S. La Vignera · R. A. Condorelli · A. Calogero · E. Vicari
Section of Endocrinology, Andrology and Internal Medicine, Department of Medical and Pediatric Sciences, University of Catania, Catania, Italy

A. Granata
Department of Nephrology, Ospedale Agrigento, Agrigento, Italy

F. Lanzafame
Service of Andrology, ASP Siracusa, Siracusa, Italy

R. Iezzi
Department of Radiology, University La Cattolica, Rome, Italy

D. Tsetis
Department of Radiology, Medical School of Crete, University of Crete, Heraklion, Greece

underwent OB injection to stop the flow to the shunt, and was not included for statistical evaluation. In group B, vein rupture with contrast leakage was noted in six cases (12 %); nonetheless, all the procedures were completed because the OB was positioned distally to the vessel tear, obviating any retrograde leakage of sclerosant. In group B, in five cases (10 %), we were unable to advance the OB though the LSV ostium so the procedures were completed with the diagnostic catheter and not considered for statistical evaluation.

Conclusion On the basis of our data, the embolisation of the LSV obtained by injecting the sclerosant through an OB rather than through a diagnostic catheter seems to be more effective in achieving total vein embolisation, as well as allowing a controlled injection of sclerosant even in cases of vein rupture.

Keywords Varicocele · Spermatic vein · Embolization · Occluding balloon · Sclerosing agent

Introduction

Percutaneous treatment of varicocele started approximately, four decades ago and now represents an effective alternative to surgery [1]. In particular, retrograde sclerotherapy could be considered the most frequently used percutaneous technique in the endovascular treatment of male varicocele [1]. The technique consists of injecting a sclerosing agent into the distal portion of the spermatic vein (SV) with common femoral, internal jugular or antecubital venous access through an angiographic diagnostic catheter; a distal barrage near the external inguinal ring is used to prevent the sclerosant flowing into the scrotal veins during a Valsalva manoeuvre. A variation to this technique refers to the use of a temporary proximal occluding balloon (OB) catheter in addition to distal barrage, to stop the retrograde blood flow; this technique is suggested in cases of large SV, or in patients with bidirectional flow because of increased cardiac output, as suggested by a recent review [2]. In this case, the sclerosant is injected through the OB catheter into the distal portion of the SV.

Our hypothesis in varicocele treatment is that this technique to stop the flow using an OB allows for a controlled injection of sclerosing agent and constant contact between the sclerosant and the vessel wall with the highest concentration; with the standard technique, the concentration of sclerosant is related to the flow and the calibre of the left spermatic vein (LSV) and dependent on the Valsalva manoeuvre held by the patient. No comparison exists in the literature between these two techniques for LSV embolisation.

Materials and methods

Patients

From January 2012 to September 2013, we prospectively enrolled 100 patients (age range 14 to 38 years; mean age 25 years) with left varicocele and an indication for retrograde LSV sclerosis for varicocele; the patients were previously randomised to two groups (we wrote a list of 100 lines assigned casually with A or B and each patient was allocated to group A or B on the basis of this list). In the same period, four patients refused to be enrolled in the study.

The study was approved by the institutional review board and every patient in the study provided signed informed consent to be enrolled in the study and undergo the procedure.

Patients in group A (age range 15–38 years; mean 23) underwent sclerotic agent injection through an angiographic diagnostic catheter ("free catheter technique") and patients in group B (age range 14–37 year; mean 26 years) through an OB catheter ("OB technique"). Total occlusion of the LSV at post-treatment phlebography with a Valsalva manoeuvre was considered a technical success.

In cases of incomplete occlusion of the LSV at post-treatment phlebography, the procedure was completed with coils. Retrograde sclerotherapy was performed in the outpatient clinic with the patient under local anaesthesia.

Technique

In both groups, an ultrasound-guided percutaneous access in the right common femoral vein was used and a 5 Fr valved introducer was positioned. An angiographic X-ray system (Philips Integris Allura, Eindhoven, The Netherlands) was used. The LSV was catheterised with a 0.035 hydrophilic guidewire (Terumo corporation, Tokyo, Japan) and with a C2 or C1 5 Fr Cobra-shaped (Terumo corporation, Tokyo, Japan) angiographic diagnostic catheter in both groups. In all patients, a rubber band was applied at the highest level of the scrotum, as a distal barrage to avoid reflux of the sclerosant into the scrotal vein and prevent phlebitis. A mixture of lauromacrogol foam (3 % atoxysclerol, Kreussler Pharma, Wiesbaden, Germany) and air was injected to perform sclerotherapy.

Standard technique

After diagnostic phlebography performed using a C2 or C1 Cobra-shaped hydrophilic angiographic diagnostic catheter, a hydrophilic guidewire was used to ensure that the catheter tip reached the most distal part of the LSV. Once distal catheterisation was obtained, a rubber band was applied

at the highest level of the scrotum and contrast media was immediately injected during a Valsalva manoeuvre to check that there was no reflux in the vessels below the rubber band.

Free catheter technique

After LSV catheterisation, depending on the size of the veins at phlebography, a foam containing 2–5 mL of sclerosant (70 %) mixed with air (30 %) was injected during a smooth Valsalva manoeuvre, held as much as possible. The scrotum rubber band was kept in place for 10 min and then released. Phlebography with a Valsalva manoeuvre was performed after 10 min. If persistent flow, even if reduced, was detected in the distal LSV, the procedure was completed by insertion of coils.

Occluding balloon technique

After phlebography, a metal stiff guidewire was inserted in the LSV and an angioplastic compliant balloon of appropriate size (range 4–8 mm) (Rival, Bard Peripheral Vascular, Tempe, USA) was coaxially advanced distal to the upper margin of the left iliac bone and inflated (Figs. 1, 2). Phlebography was then performed to visualise collaterals not previously seen with free flow and to measure the amount of contrast agent needed to fill the vein between the OB and the rubber band. Thus, the same amount of sclerosant foam (range 2–6 mL) containing 70 % of sclerosant and 30 % of air was injected without any Valsalva manoeuvre with stopped flow for 10 min (proximal and distal barrages). If systemic collaterals were seen at pre-injection phlebography, we injected a low dose of sclerosant with contrast and the injection was stopped once the origin of the collaterals was seen. The OB was then deflated and if phlebographic control, during Valsalva manoeuvre, revealed a reduced but persistent flow in the distal LSV, the procedure was completed by insertion of coils.

Data analysis

Complete occlusion of the LSV at post-procedural phlebography was considered a technical success. In both groups, we evaluated technical success and the number of cases requiring completion with coil embolisation. We also considered colour Doppler ultrasound (CDUS) evaluation at 3 months in both groups. The Fischer's test was used for statistical analysis.

Results

We evaluated the phlebographic findings of a total of 90 patients—45 in group A (median age 27 years; range 15–41) and 45 in group B (median age 31 years; range 14–39 years)—because five patients in each group were excluded from the statistical analysis. In group A, vein rupture occurred in four cases (8 %) so the procedure was completed by injection of sclerosant through the OB located distally to the lesion to avoid the possible outflow of sclerosant with the risk of stricture of the ureter [3]. These patients were not considered for evaluation. In another case, a high flow shunt towards the inferior vena cava was detected, the patient underwent OB injection to stop the flow to the shunt also this patient was not included in the statistical evaluation. In group B, in five cases (10 %) it was not possible to advance the OB through the LSV

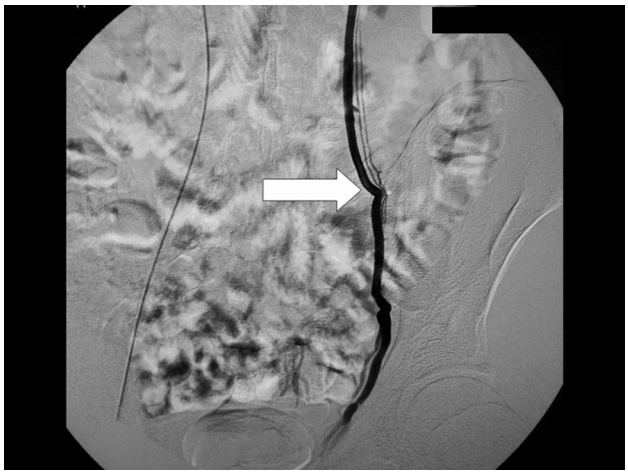

Fig. 1 Left spermatic vein phlebography with catheter tip (*white arrow*) in the middle portion of the vein shows contrast reflux

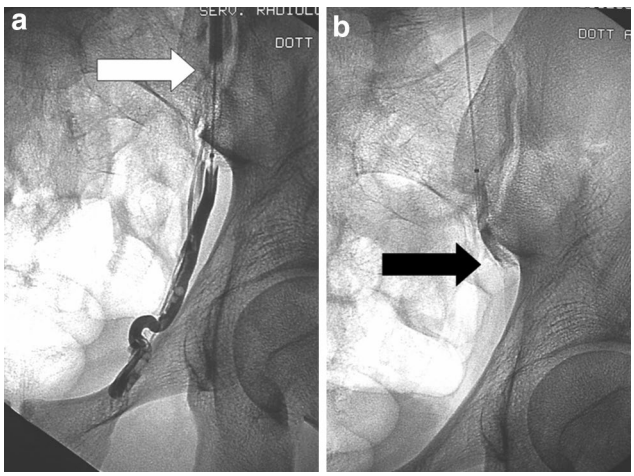

Fig. 2 **a** A balloon is advanced to the distal portion of the vein and inflated (*white arrow*) while a rubber band is applied in the proximal portion of the scrotum, so there is no blood flow between the two barrages. **b** Post-embolisation phlebography shows left spermatic vein occlusion (*black arrow*)

ostium, likely because of a sufficient valve, so the procedures were completed through the diagnostic catheter and not considered for statistical evaluation.

Technical success was 75.6 % in group A versus 93.4 % in group B and the difference was statistically significant on the basis of the Fischer's test ($P = 0.003$). Embolisation had to be completed with coil insertion in 11 cases (24.4 %) in group A, and in three cases in group B (6.6 %). In group B, vein rupture with contrast leakage was noted in six cases (12 %); nonetheless, all the procedures were completed because the OB was positioned distally to the vessel tear, obviating any retrograde leakage of sclerosant (Fig. 3). Mild groin haematoma needing only observation occurred in three patients in group A and in four patients in group B. The rates of vein rupture and haematoma were not significantly different between the two groups.

Follow-up CDUS examination at 3 months detected no pathological reflux in the left pampiniform plexus in 40 patients of group A (88.8 %) and in 42 patients of group B (93.3 %); the difference was not statistically significant.

Discussion

Several embolisation techniques have been reported for spermatic vein varicocele. Good results have been found either using retrograde sclerotherapy, coil embolisation, acrylic glue embolisation or antegrade sclerotherapy (AS) [2]. Retrograde sclerotherapy can be nowadays considered the most effective and safe procedure.

Many authors state that if reflux persists at post-sclerotherapy phleography, the procedure must be completed with coils [2–5]. Traditional coils carry a high rate of recurrence (20/30 %) and can be associated with several even serious complications such as coil migration, venous dissection, and venous perforation, while fewer technical complications have been reported with detachable coils [6]. Also glue embolisation, frequently used in cases of persistent and recurrent post-surgical varicoceles, has been associated with serious complications such as glue migration into the pulmonary circulation, glued catheter and severe venous phlebitis [7]. AS has been reported to be effective in cases in which retrograde percutaneous procedure was impossible or in some surgical recurrences; however, this technique is not widely used [8].

A recent review recommends the use of sclerotherapy as the standard percutaneous approach for varicocele [2]. The authors also indicated some important steps to make the embolisation more effective, in particular: (a) to perform the procedure with the catheter tip in the most distal part of the SV (generally the catheter tip must reach the lower edge of the ischiopubic ramus); (b) once distal catheterisation is obtained, a rubber band must be applied at the highest level

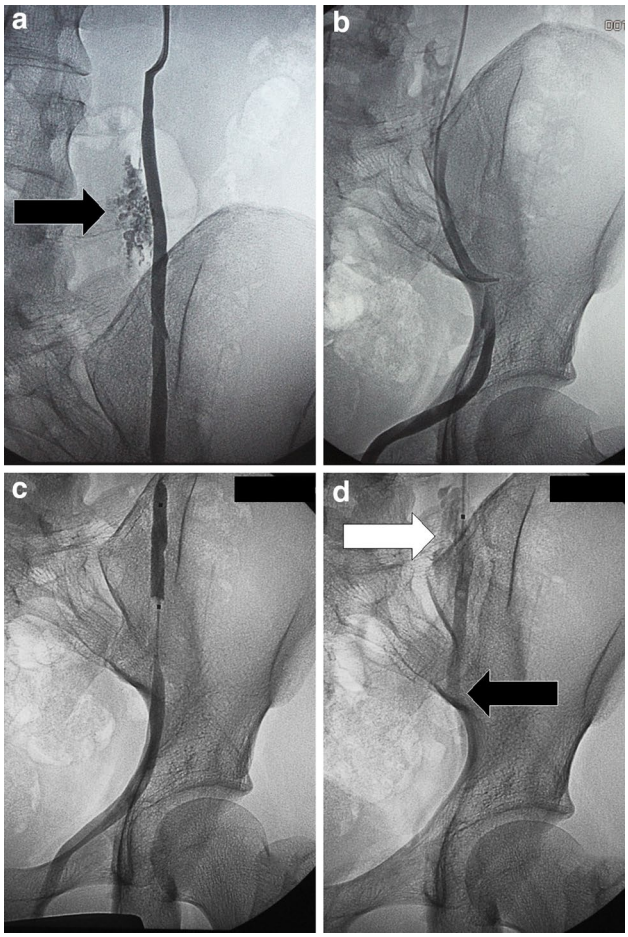

Fig. 3 **a** Phlebography shows contrast leak secondary to vessel wall laceration (*arrow*). **b** The catheter was positioned distally to the leak and coaxially changed for an occluding balloon (**c**). **d** Phlebography shows the post-procedure occlusion of the left spermatic vein

of the scrotum and contrast material immediately injected during a Valsalva manoeuvre to check that there is no reflux below the rubber band; (c) sclerosant must be injected during the Valsalva manoeuvre.

Commonly the sclerosant is prepared in foam form, more or less as described by Tessari et al. in 1999 for the treatment of varicose veins [9], by mixing together the contents of two syringes, one containing the sclerosant and the other containing air, connected through a two-way stopcock. The rationale for using foam is because the distribution of the sclerosing agent on the endothelial surface is improved resulting in more effective embolisation, also allowing simultaneous sclerotherapy of multiple collateral branches.

Good results have been achieved with different sclerosing agents such as sodium tetradecyl sulphate, hydroxy-polyethoxy-docanol and sodium morrhuate solution [10–12]. Foam sclerotherapy has been considered to offer several advantages over traditional liquid sclerotherapy [1].

The most popular foam sclerosing agents used in the literature include sodium tetradecyl sulphate and polydocanol; however, no comparative study exists evaluating neither the different injection techniques nor the different sclerosing agents.

This study was devised based on the rationale that by achieving the stop flow in the distal portion of the LSV, we are able to isolate the vessel between the OB and the rubber band in the distal portion of the external inguinal ring, so that the injected amount of sclerosant agent would be in contact with the vessel wall for the total time of occlusion at the highest concentration. The OB has been reported to be a useful tool in many interventional procedures [13, 14]. In particular, our technique is similar to that reported for balloon-occluded retrograde transvenous obliteration (BRTO) of gastric varices. The objective of BRTO is to completely obliterate the gastric varices with preservation of the anatomical hepatopetal flow of the splenoportal circulation, using a controlled sclerosant injection through an OB catheter or microcatheter [15].

Use of the OB technique in the treatment of LSV does not require any Valsalva manoeuvre and could therefore be even more comfortable for patients. When injecting the sclerosant through the diagnostic catheter, its concentration is related to the patient's ability to hold a deep Valsalva manoeuvre, so that the sclerosant could be diluted in cases of ineffective or intermittent Valsalva manoeuvre, in particular in patients who have pain or need sedation. Some authors between 1981 and 2005 [16–19] described an "air-block" technique, in which a small amount of air was injected before the sclerosant injection to avoid dilution of the liquid, but this technique showed only partial effectiveness and is basically no longer used today [20]. Using an OB, we should be able to maintain the highest concentration of sclerosant in the target vessel without any discomfort for the patient. Furthermore, use of the OB technique could avoid some complications such as LSV rupture considered a contraindication for scleroembolisation. With the OB technique, by advancing the balloon through the lesion, we were able to stop the flow and inject sclerosant agents also in those cases.

This study presents a major limitation. In particular, we considered only the immediate post-treatment phlebographic results as a technical success, not considering that LSV thrombosis can be achieved over a longer time period.

Conclusion

On the basis of our findings, the embolisation of the LSV obtained using injection of sclerosant through an OB rather than through a diagnostic catheter seems to be more effective in achieving total embolisation of the vein, as well as allowing a controlled injection of sclerosing agent even in cases of vein rupture.

Conflict of interest The authors declare no conflict of interest.

References

1. Porst H, Bahren W, Lenz M et al (1984) Percutaneous sclerotherapy of varicoceles—an alternative to conventional surgical methods. Br J Urol 56:73–78
2. Iaccarino V, Venetucci P (2012) Interventional radiology of male varicocele: current status. Cardiovasc Interv Radiol 35:1263–1280
3. Barrett J, Wells I, Riordan R et al (2000) Endovascular embolization of varicoceles: resorption of tungsten coils in the spermatic vein. Cardiovasc Interv Radiol 23:457–459
4. Bechara CF, Weakley SM, Kougias P et al (2009) Percutaneous treatment of varicocele with microcoil embolization: comparison of treatment outcome with laparoscopic varicocelectomy. Vascular 17(Suppl 3):S129–S136
5. Bittles MA, Hoffer EK (2008) Gonadal vein embolization: treatment of varicocele and pelvic congestion syndrome. Sem Interv Radiol 25:261–270
6. Paul N, Robertson I, Kessel D (1996) Fibre entanglement whilst using the Jackson detachable coil system: a potential pitfall. Chin J Interv Radiol 11:153–155
7. Sze DY, Kao JS, Frisoli JK et al (2008) Persistent and recurrent postsurgical varicoceles: venographic anatomy and treatment with *N*-butyl cyanoacrylate embolization. J Vasc Interv Radiol 19:539–545
8. Tauber R, Johnsen N (1994) Antegrade scrotal sclerotherapy for the treatment of varicocele: technique and late results. J Urol 151:386–390
9. Tessari L, Cavezzi A, Frullini A (2001) Preliminary experience with a new sclerosing foam in the treatment of varicose veins. Dermatol Surg 27:58–60
10. Li L, Zeng XQ, Li YH (2010) Safety and effectiveness of transcatheter foam sclerotherapy for testicular varicocele with a fluoroscopic tracing technique. J Vasc Interv Radiol 21: 824–828
11. Gandini R, Konda D, Reale CA et al (2008) Male varicocele: transcatheter foam sclerotherapy with sodium tetradecyl sulfate—outcome in 244 patients. Radiology 246:612–618
12. Gazzera C, Rampado O, Savio L et al (2006) Radiological treatment of male varicocele: technical, clinical, seminal and dosimetric aspects. Radiol Med 111:449–458
13. Pedicini V, Poretti D, Mauri G et al (2010) Management of postsurgical biliary leakage with percutaneous transhepatic biliary drainage (PTBD) and occlusion balloon (OB) in patients without dilatation of the biliary tree: preliminary results. Eur Radiol 20:1061–1068
14. Cozzaglio L, Cimino M, Mauri G et al (2011) Percutaneous transhepatic biliary drainage and occlusion balloon in the management of duodenal stump fistula. J Gastrointest Surg 15:1977–1981
15. Saad WE, Kitanosono T, Koizumi J et al (2013) The conventional balloon-occluded retrograde transvenous obliteration procedure: indications, contraindications, and technical applications. Tech Vasc Interv Radiol 16:101–151
16. Seyferth W, Jecht E, Zeitler E (1981) Percutaneous sclerotherapy of varicocele. Radiology 139:335–340

17. Sigmund G, Bähren W, Gall H et al (1987) Idiopathic varicoceles: feasibility of percutaneous sclerotherapy. Radiology 164:161–168
18. Lenz M, Hof N, Kersting-Sommerhoff B et al (1996) Anatomic variants of the spermatic vein: importance for percutaneous sclerotherapy of idiopathic varicocele. Radiology 198:425–431
19. Wunsch R, Efinger K (2005) The interventional therapy of varicoceles amongst children, adolescents and young men. Eur J Radiol 53:46–56
20. Wollmann JC (2004) The history of sclerosing foams. Dermatol Surg 30:694–703