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# Endovascular transcatheter embolization of recurrent postsurgical varicocele: anatomic reasons for surgical failure

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## Abstract

**Background:** Formation or pre-existence of collateral gonadal veins in varicocele patients has been reported as the main cause of surgical treatment failure.

**Purpose:** To describe venographic findings in patients with postsurgical recurrent varicoceles and to assess the efficacy of the following minimally invasive endovascular treatment.

**Material and Methods:** Thirty-three men with failed surgical treatment of left-sided varicocele were examined between 2006 and 2013, using retrograde venography to assess the anatomy of varicocele draining veins before the attempted transcatheter embolization. Anatomic variants of gonadal veins were categorized according to the classification modified for the purpose of the present study. 3% polidocanol was used as an embolic agent together with pushable fibered coils.

**Results:** In 31 (93%) out of 33 patients venography demonstrated incompetence of the gonadal vein or veins draining varicoceles after failed surgical treatment. The most frequent venographic finding was gonadal vein duplication – 66% of cases (39% in its mid-portion). Technical success of embolization was achieved in all 31 patients. No major complications were observed.

**Conclusion:** Retrograde varicocele embolization may be superior to surgery because of its ability to detect gonadal vein variants. In our study group, transcatheter embolization with 3% polidocanol and fibered coils allowed successful, minimally invasive treatment of postsurgical varicoceles.

**Keywords**
Varicocele, venography, postsurgical recurrence, trancatheter embolization

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## Introduction

Varicocele is defined as an abnormally dilated vein within the spermatic cord caused mainly by retrograde blood flow through the internal spermatic vein. There are many theories explaining the formation of varicoceles, the congenital absence or malfunction of valves, and a specific shape and course of the left spermatic vein are the most popular ones (1–3). Compression of the left renal vein between the aorta and the superior mesenteric artery (nutcracker syndrome) or post-thrombotic complications are less common. More than 90% of varicoceles are left-sided. Bilateral or isolated right-sided varicoceles are very rare, and are frequently related to a retroperitoneal mass. The disease may lead to impaired fertility resulting from increased temperature in the scrotum, moreover venous hypertension causing hypoxia and prostaglandin reflux, as well as effects of adrenal and renal

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metabolites are also associated with abnormal sperm parameters (4,5).

For decades, surgery (open varicocelectomy) has been the only available method of varicocele treatment. Conventional surgery was however associated with recurrences because of anatomic variability of gonadal veins (GVs). A persistent reflux in the pampiniform plexus was reported in up to 28% of patients. Laparoscopic and microsurgical techniques currently used are associated with lower albeit still significant recurrence rates – up to 9% (6–9).

Endovascular embolization of varicoceles was first described by Laccariono in 1977 and various embolization techniques (different embolizing agents) have been successively described. Recurrence rates in transcatheter, minimally invasive methods as well as laparoscopic and microsurgical methods are comparable. Formation and/or pre-existence of collateral veins have been reported as the mechanism of failure observed in all the methods mentioned above (10–12).

Anatomic variability and venography-based classification of varicoceles were described 30 years ago. The widely accepted classification by Bahren et al. showed possible collaterals of the left GV. Their classification published in 1983 described six types of varicocele: type O, no reflux in GV; type 1, reflux in a single incompetent GV; type 2, reflux to the main single GV tributing via multiple collaterals to lumbar or iliac veins, perivertebral venous plexus, or to inferior vena cava; type 3, reflux to a duplicated GV; type 4, reflux through renal hilar or capsular veins when the renal/GV junction valve is competent; and type 5, reflux into a GV drained by an additional (doubled) renal vein. Three years later, Murray et al. published their classification of varicoceles after failed surgical treatment and divided them into: type R (renal) with reflux to multiple collateral veins tributing to the renal vein; type S (scrotal) demonstrating a cross-reflux to the incompetent right-sided GV; and type P (parallel) demonstrating GV duplications at three different levels – high, middle, and low. Their classification seems to complement the Bahren's system by adding possible right side GV collateralization, multiplication of GV confluence to the renal vein and dividing parallel duplication of the left GV into different levels. Unfortunately, both the abovementioned systems fail to define all collateral possibilities, nevertheless, they are still frequently used to describe varicocele vascularization (7,13–16).

In our study, the GV anatomy was assessed using a self-modified combination of Bahren and Murrey classifications. Possible variants were similar to those described by Bahren while type 3 (most common in our study population) was divided into four subtypes (high, mid, low, multiple) resembled the Murray's classification.

The main goal of our study was to describe and categorize venographic findings in patients with recurrent varicocele after unsuccessful surgery and to assess the efficacy of further minimally invasive endovascular treatment.

## Material and Methods

Thirty three male patients (age range, 15–32 years; mean age, 18 years) with symptomatic recurrent/persistent varicoceles after failed surgical treatment – all left-sided and primary idiopathic – were referred to the Department of Interventional Radiology for endovascular treatment between January 2006 and June 2013. Detailed characteristics of patients are listed in Table 1.

Prior to surgery, all patients suffered from symptomatic varicocele, including 16 with grade II (48%) and 17 with grade III varicocele (52%). Eighteen patients underwent laparoscopic GV clipping, five microsurgical varicocelectomy with supra-inguinal GV ligation (artery-sparing), four conventional open varicocelectomy with retroperitoneal GV ligation, two laparoscopic GV clipping with GV ligation, one two-time laparoscopic GV clipping, and three open surgery (technical details unavailable). In the study group, three patients were initially treated with laparoscopic GV clipping, which failed, therefore, two of them had subsequent open GV ligation and one underwent another laparoscopy. Thirty patients had one and three had two unsuccessful surgical operations. Urological examinations and color Doppler ultrasound (scrotal imaging and varicocele staging) showed that none of the patients had right-sided varicoceles.

Patients were scheduled for embolization 2–9 months (median, 4.2 months) after failed surgery. Pre-embolization ultrasound-based assessment revealed no changes in varicocele grading in 22 cases and changes from grade III to II in 11 patients. Unfortunately, neither patients' detailed history taken nor analysis of their medical records was sufficient to determine whether the varicocele was persistent or recurrent.

Venographic GV images of all patients were analyzed to assess venous anatomy of recurrent/persistent varicoceles and classify them according to the self-modified classification (Fig. 1).

Embolization was performed under local anesthesia (2% lidocainum hydrochloricum). No sedation was used, as catheterization itself and sclerosant administration were painless or slightly painful and cooperation of patients was required during Valsalva maneuvers. Using the Seldinger technique (right femoral vein puncture), a selective 5 F Cobra catheter was placed in the left renal vein. A contrast medium was injected during the Valsalva maneuver to better visualize the left

**Table 1.** Clinical characteristics of patients and venographic findings.

| No. | Age (years) | Initial varicocele grade | Type of surgery | Time to recurrence/symptoms after surgery | Postsurgery varicocele grade | Venography findings (Fig. 1) |
|---|---|---|---|---|---|---|
| 1 | 15 | II | Laparoscopic GV clipping | 2 m | II | 4 |
| 2 | 21 | III | Laparoscopic GV clipping | 4 m | II | 3 mid |
| 3 | 23 | III | Laparoscopic GV clipping | 6 m | II | 3 mid |
| | | | → open GV ligation | → 2 m | | |
| 4 | 13 | III | Open GV ligation | 7 m | III | 3 mid |
| 5 | 32 | II | Laparoscopic GV clipping | 5 m | II | 3 multiple |
| 6 | 17 | II | Laparoscopic GV clipping | 9 m | II | 5 |
| 7 | 17 | III | Microsurgical varicocelectomy, supra-inguinal GV ligation (artery-sparing) | 2 m | II | 2 |
| 8 | 19 | II | Microsurgical varicocelectomy, supra-inguinal GV ligation (artery-sparing) | 3 m | II | none |
| 9 | 14 | III | Laparoscopic GV clipping | 3 m | II | 3 high |
| 10 | 30 | III | Microsurgical varicocelectomy, supra-inguinal vein ligation (artery-sparing) | 2 m | III | 3 mid |
| 11 | 15 | II | Laparoscopic GV clipping | 4 m | II | 3 multiple |
| 12 | 31 | III | Laparoscopic GV clipping | 6 m | II | 3 low |
| 13 | 26 | II | Laparoscopic GV clipping | 7 m | II | 3 mid |
| 14 | 28 | II | Laparoscopic GV clipping | 5 m | II | none |
| 15 | 21 | III | Laparoscopic GV clipping | 2 m | II | 3 mid |
| 16 | 15 | III | Microsurgical varicocelectomy, supra-inguinal vein ligation (artery-sparing) | 2 m | II | 4 |
| 17 | 19 | II | Laparoscopic GV clipping | 4 m | II | 3 low |
| 18 | 18 | III | Open surgery – no documentation available | 2 m | II | 3 mid |
| 19 | 25 | II | Open surgery – no documentation available | 6 m | II | 3 mid |
| 20 | 24 | II | Laparoscopic GV clipping | 8 m | II | 5 |
| 21 | 19 | II | Laparoscopic GV clipping | 3 m | II | 3 high |
| | | | → open GV ligation | →4 m | | |
| 22 | 14 | III | Laparoscopic GV clipping | 4 m | III | 3 mid |
| 23 | 16 | III | Open GV ligation | 6 m | III | 2 |
| 24 | 13 | II | Laparoscopic GV clipping | 5 m | II | 3 high |
| 25 | 20 | II | Laparoscopic GV clipping | 6 m | II | 2 |
| 26 | 13 | II | Open GV ligation | 7 m | II | 3 mid |
| 27 | 14 | III | Laparoscopic GV clipping | 3 m | III | 3 mid |
| 28 | 15 | II | Laparoscopic GV clipping | 3 m | II | 5 |
| 29 | 18 | III | Open GV ligation | 5 m | III | 3 mid |
| 30 | 25 | III | Laparoscopic GV clipping | 2 m | II | 4 |
| | | | → another laparoscopic GV clipping | → 4 m | | |
| 31 | 21 | II | Open surgery no documentation available | 7 | II | 3 high |
| 32 | 28 | III | Laparoscopic GV clipping | 5 | II | 3 multiple |
| 33 | 19 | III | Microsurgical varicocelectomy supra-inguinal vein ligation (artery-sparing) | 8 | II | 3 mid |

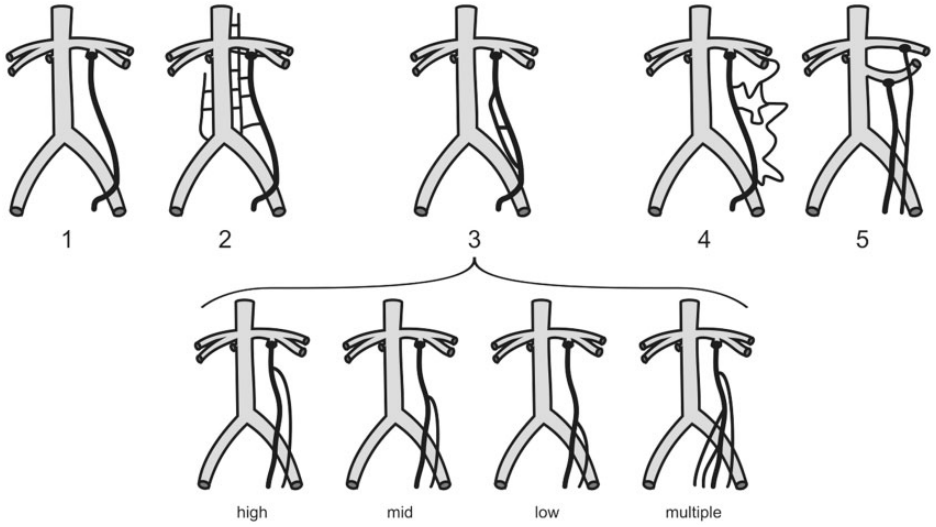


**Fig. 1.** Schematic presentation of self-modified varicocele classification: 1, single GV; 2, GV with accessory communicating veins to SVC and / or perivertebral plexus; 3, duplicated GV (high – duplication above iliac crest, mid – between iliac crest and the line of inguinal ligament, low – below the line of inguinal ligament, and multiple – more than two GVs with confluence on different levels); 4, single GV with or without reflux, but with multiple collaterals the left renal vein; 5, single or double GV (with or without duplications) in patients with double left renal vein.

GV confluence. The catheter was introduced into the GV over a hydrophilic guidewire (Glidewire, Terumo Europe, Leuven, Belgium). Retrograde phlebography visualized the GV anatomy, its possible collaterals, and additional veins. Subsequently, the catheter was advanced to the level of the inguinal crease and the sclerosing agent (1 or 2 of 2 mL 3% polidocanolum ampoules) was administered. To avoid sclerosant distal penetration, the GV was externally compressed, and 1-2 fibered coils (MReye® Embolization Coils, William Cook Europe, Bjaeverskov, Denmark) were implanted. The sclerosant was also injected slowly along the length of the internal spermatic vein while the catheter was withdrawn, and two to three coils were implanted in the proximal internal spermatic vein. The size and number of coils were adjusted to the GV diameter.

After embolization, 26 patients were under observation until late evening and seven overnight due to moderate albeit prolonged pain. Postprocedural medications were not routinely used. In the case of pain, burning, or swelling of the scrotum, oral anti-inflammatory therapy was administered (usually two or three routine doses of ketoprofen, diclofenac, or nimesulide per day). Patients were followed up for 7–32 months; ultrasound examinations were performed 3, 6, and 12 months after embolization.

## Results

In 31 (93%) out of 33 patients venography demonstrated incompetent gonadal veins draining the varicocele. In the two remaining patients there was no venographic evidence of any vein draining the varicocele, moreover, no other inefficient veins emptying directly to the inferior vena cava or to iliac veins were found.

The majority of patients (22; 66 %) were classified as type 3 with GV duplications (Fig. 2). The remaining nine patients were classified as types 2, 4, and 5 (Fig. 3). Venographic findings are listed in Table 1. Recurrent varicoceles were most frequently detected following a laparoscopic GV clipping in patients with mid-portion GV duplication (13 patients; 39%).

Technical success of embolization was achieved in all 31 patients with evident varicocele draining veins. No major complications occurred. We did not note any case of vein perforation with external leakage of contrast medium. In two cases, a GV spasm occurred, but subsided spontaneously within several minutes and embolization was successfully completed. Only seven patients required anti-inflammatory drugs and mild analgesics.

The mean follow-up was 14 months (range, 7–32 months). Both physical examinations and Doppler ultrasound were performed 3, 6, and 12 months after the procedure. No recurrences were observed and none of the patients required re-treatment. All patients reported subsidence of varicocele symptoms 6 months after embolization. In 10 patients with laboratory diagnosis of subfertility, seminal parameters significantly improved after embolization; in five of them the spermogram was normal (according to WHO 2010).

Two patients in whom we did not find incompetent varicocele drainage on retrograde venography were

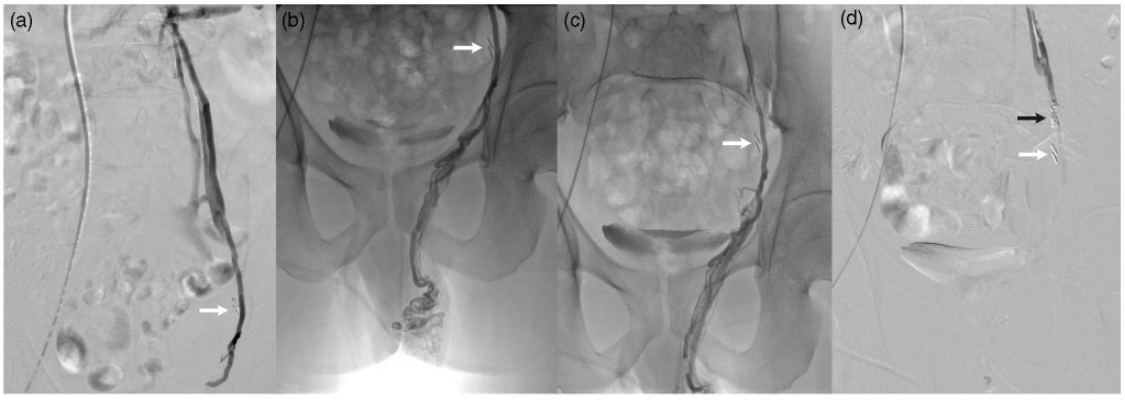


**Fig. 2.** Patient no. 31 – recurrent varicocele, 6 months after laparoscopic GV clipping. (a) Retrograde phlebography showed GV duplication (type 3 mid) but with collateral veins draining to inferior vena cava and left common iliac vein – type 2. (b) Surgical clips seen in duplicated GV (white arrow). (c) Catheter tip placed in remained after clipping GV for sclerosant injection. (d) Fibered, pushable coils implanted at the level of surgical clips (black arrow).

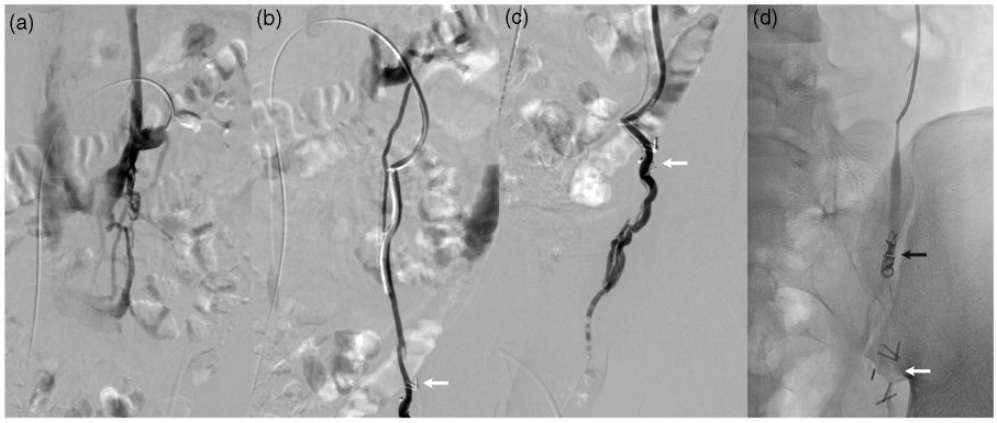


**Fig. 3.** Patient no. 25 – varicocele recurrence after laparoscopic clipping of GV (8 months). (a) Initial venography shows double left renal vein. Catheter introduced through the upper arm of renal vein. Type 5. (b) Selective venography after catheterization of GV remained after clipping its mid-portion duplication (white arrow – clips). (c) Catheter tip placed at the level for sclerosing agent injection. (d) Control venography after coils placement (black arrow).

referred back to urologists and underwent microsurgical subinguinal varicocelectomy, which proved successful in all cases.

## Discussion

Endovascular treatment of primary and postsurgical varicoceles has well-known advantages. The procedure is minimally invasive, performed under local anesthesia, and generates lower levels of anxiety, compared to conventional surgical operations (17). Modern percutaneous transcatheter procedures have comparable or even lower recurrence/persistence rates compared to microsurgical and laparoscopical methods (14). Nevertheless, according to some reports, surgery remains the treatment of first choice (18). All operations are aimed at ligation of the GV. Three urological techniques are available today: conventional open varicocelectomy, laparoscopic varicocelectomy (usually transperitoneal), and microsurgical subinguinal varicocelectomy (18–21). In our series, laparoscopic GV clipping was the most frequent surgical technique, despite its higher complication and recurrence rates as compared to microsurgical varicocelectomy (20–22). Our data demonstrating 63% of patients with post-laparoscopic recurrent varicoceles support the above observation. Although the previously mentioned surgical methods differ, all of them are carried out without any prior visualization of GVs. Intraoperative venography is extremely rarely performed. Some authors recommend preoperative venography or preferably a non-invasive CT-angio or MR-angio imaging of GVs which should improve the outcomes of therapy. Unfortunately, in the majority of centers, such

examinations are not performed due to financial or logistic reasons (23–26).

Unless possible GV duplication or collaterals are known, all surgical procedures may be potentially ineffective. To date, possible variants of varicocele anatomy have been described in numerous papers (12,23,25). The highest reported surgical failure rate was 28% (21,27).

The majority of clinical data on varicocele published in the literature is based on the Bahrens' classification of 1983. According to this classification, it seems that most men with primary varicocele diagnosed with venography (up to 70%) could be classified as type 1. The remaining varicocele cases are classified as types 2–5 (26,28). Thus it could be assumed, that varicoceles classified otherwise than type 1 are more likely to be recurrent/persistent after surgery. Unfortunately, there are no data to support this assumption, as studies encompassing surgically-treated varicocele patients with presurgical because venography are lacking. (21,23,26)

Our results indirectly support the above-mentioned hypothesis, showing the most common anatomic variations in patients with recurrent varicoceles after failed surgery. In our group, the majority of patients (22; 66%) were classified as type 3 – with the GV duplications. The distribution of patients in this type is also interesting: the majority of them (13; 39%) had mid-portion GV duplication, four (12%) high, two (6%) low, and three (9%) multiple GV duplication. The remaining nine patients were evenly classified to three different types (2, 4, and 5) without statistical significance.

Interestingly, retrograde venography was not able to demonstrate any pathologic venous drainage in two patients with evident postsurgical varicoceles. Antegrade venography through direct varicocele puncture was initially considered in this patients, but after urological consultation, microsurgical infrainguinal varicocelectomy was decided, which proved to be successful in both cases.

In conclusion, our results confirm the thesis that retrograde varicocele embolization may be superior to surgery because of its ability to detect gonadal vein variants. Transcatheter embolization with 3% polidocanol and fibered coils carried out in our patients enabled minimally invasive treatment of postsurgical varicoceles.

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