

How to Cite:

El-Rahman, M. A. E.-H. A., Zakaria, M. Y., Mahmoud, M. O., & Mousa, M. G. A. E.-S. (2022). Role of endovascular intervention in the treatment of primary varicocele. *International Journal of Health Sciences*, 6(S3), 4818–4829. <https://doi.org/10.53730/ijhs.v6nS3.6963>

Role of endovascular intervention in the treatment of primary varicocele

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Abstract---Varicocele are dilated tortuous veins of the pampiniform plexus—the venous sinuses that drain the testicles. These sinuses primarily drain into the internal spermatic vein (gonadal vein). The aim of this work was the assessment of the results of endovascular treatment of primary varicocele by embolization of the internal spermatic vein and pampiniform plexus of veins, as regard to its advantages over the traditional methods, disadvantage, efficiency and recurrent rate in an attempt to choose the best method for treatment of primary varicocele with least complication and highest success rate. This prospective randomized study was conducted on 30 patients with primary varicocele by endovascular treatment of primary varicocele through embolization of the internal spermatic vein and pampiniform plexus of veins under local anesthesia. The study was conducted in the department of vascular surgery, Al- Azhar University Hospitals – Cairo (Al-Hussein and and said-Galal University Hospitals). 90% of the patients showed post procedural normal duplex and 86.7% of the patients showed improvement of semen analysis. our study confirms that the embolization method presents a low complication rate and a higher success rate. This modality of treatment is associated with a significant improvement in semen parameters. These advantages, along with avoiding the use of general anesthesia and rapid recovery after the procedure suggest that: embolization may be the preferable method for treating primary varicocele.

Keywords---endovascular intervention, primary varicocele, pampiniform plexus.

Introduction

The incidence of varicocele in the general population ranges from 15% to 20%, and 30% to 40% in infertile men. ¹ This prevalence increases with age, approaching 42% in the elderly population. Due to certain anatomic causes, left-sided varicocele is 10 times more common than the right -sided varicocele. While bilateral varicocele occur in less than 10% of patients and isolated to the right occur in less than 1%. ² Percutaneous varicocele embolization is routinely performed by using moderate sedation and with the patient in the supine position. The approach used and the catheters selected are operator dependent. A right common femoral vein approach is often used, especially when treating an isolated left-side varicocele. However, some operators may prefer a right internal jugular vein approach. ³ The most common complaint following embolization is testicular pain that may last for up to 10 days. ⁴ Other minor immediate complications include: inguinal haematoma, temporary venotomy site pain, and contrast allergy. Multiple studies demonstrated no risk of hydrocele formation following embolization, likely due to sparing of the lymphatic system. ⁵ However, a single study reported a hydrocele incidence of 4.5% of patients, it is uncertain if this was reactive to thrombophlebitis rather than being lymphatic in nature. ⁶

Aim of the work

The aim of this work is the assessment of the results of endovascular treatment of primary varicocele by embolization of the internal spermatic vein and pampiniform plexus of veins, as regard to its advantages over the traditional methods, disadvantage, efficiency and recurrent rate, in an attempt to choose the best method for treatment of primary varicocele with least complication and highest success rate.

Patients and Methods

This prospective randomized study conducted on 30 patients with primary varicocele. The study was conducted in the vascular surgery department, Al-Azhar University Hospitals – Cairo (Al-Hussein and and said-Galal University Hospitals).

Inclusion criteria

Age from 16 to 45 years old, patients were sufficiently mentally healthy to consent to the procedure, significant testicular asymmetry (>20%) demonstrated on serial examinations, testicular pain, abnormal semen analysis results, palpable varicocele on physical examination, the couple has known infertility; the female partner has normal fertility or a potentially treatable cause of infertility, and time to conception is not a concern and progressive testicular atrophy.

Exclusion criteria

Inflammatory skin disorders in junction area, obstructive azoospermia, genetic abnormalities, above 45 years of age, below 16 years of age, patients with subclinical varicocele, patients with normal semen analysis and idiopathic non obstructive azoospermia (INOA).

Methods**Patient evaluation**

After taking a written consent, all patients will be subjected to the following: - Clinical evaluation and duplex Ultrasound for the primary varicocele. Clinical evaluation was carried out for all patients according to the following scheme: - Detailed history taking, detailed general examinations and also local examination.

Pre- procedure Assessment

CBC, coagulation profile, liver and kidney function tests. CT chest and Doppler/duplex scan for all patients.

**The procedure
Anesthesia**

The procedure is typically limited to the use of local anesthesia and strict sterile conditions.

Vascular access

For a left-sided varicocele, the right internal jugular vein or right common femoral vein approach. (Right-sided access is routinely preferred as it is technically easier and provides an optimal angle for catheter access into the left renal and internal spermatic vein). For a right-sided varicocele, the internal jugular or basilic vein approach. (The right internal spermatic vein is typically located at an acute angle on the right anterolateral inferior vena cava just below the right renal vein) and access done by using a six French vascular sheath.

Venography

Selective venography of the renal vein and the gonadal vein orifice should be performed using 4–5 French diagnostic catheters guided by 0.035-inch hydrophilic wire.

Choice of embolic agent

The sclerosing agent, which will be used, is polidocanol in a concentration of 3% solution. Only one injection (range: 2 – 12 ml) liquid or foam should be used for embolization of the pampiniform plexus depending on the diameter of the veins.

Post-procedure care

After removal of the catheter compression of the entry site should be performed. Patients should be observed for approximately 2–3 hours post- procedure before being discharged home. Although patients can return to routine activities within 24–48 hours, they should be advised to avoid heavy lifting and contact sports for 5–7 days and consume a soft solid diet for 3 days to prevent constipation.

Follow up of patients

All patients were followed up immediately at the first post- procedure day then at one week, 1 month, 3 months and after 6 months as regard to efficacy of the procedure as well as complications. Follow-up based on Doppler ultrasound should be performed at 3 months and semen analysis at 4–6 months in patients undergoing therapy due to infertility.

Ethical considerations

Written consent was taken from all patients before including them in the study.

Results

Table 1
Demographic characteristics of the patients

Variable		Cases (n=30)
Age (years)		
Mean $\pm$ SD		29.67 $\pm$ 5.82
Range		22 – 40
Residence	Rural	18 (60%)
	Urban	12 (40%)

The age of the patients ranges 22 – 40 years with mean 29.67 years, the majority of patients were rural by 60%.

Table 2
Varicocele side distribution among the studied patients

	Cases (n=30)
Left side	23 (76.7%)
Bilateral	7 (23.3%)

Right side was the fractured in 70% of the patients while the left was 30%

Table 3
Semen analysis parameters pre and postprocedural of the studied patients

	Preprocedural	Postprocedural	
Sperm count ($\times 10^6/\text{ml}$) Mean $\pm$ SD	9.65 $\pm$ 0.571	16.13 $\pm$ 0.682	<0.001
Sperm motility Mean $\pm$ SD	28.24 $\pm$ 0.934	33.81 $\pm$ 0.716	<0.001
Normal forms Mean $\pm$ SD	5.73 $\pm$ 0.438	6.12 $\pm$ 0.475	.002

There is a significant increase regarding semen analysis parameters from pre to post-procedural

Table 4
Clinical grades of the studied patients

	Cases (n=30)
Grade I	13 (43.3%)
Grade II	11 (36.7%)
Grade III	6 (20%)

The most common clinical grade was grade I (43.3%) followed by grade II (36.7%).

Table 5
Procedural time of the studied patients

Variable	Cases (n=30)
Procedural time (min) Mean $\pm$ SD	44.27 $\pm$ 9.84

The mean procedural time was 44.27 $\pm$ 9.84 minute.

Table 6
Postprocedural complications and recurrence among the studied patients

	Cases (n=30)
Puncture site hematoma	1 (3.3%)
Hydrocele	1 (3.3%)
Mild pain	3 (10%)
Failed catheterization	2 (6.7%)
Residual grade I varicocele	2 (6.7%)
Residual grade II varicocele	1 (3.3%)

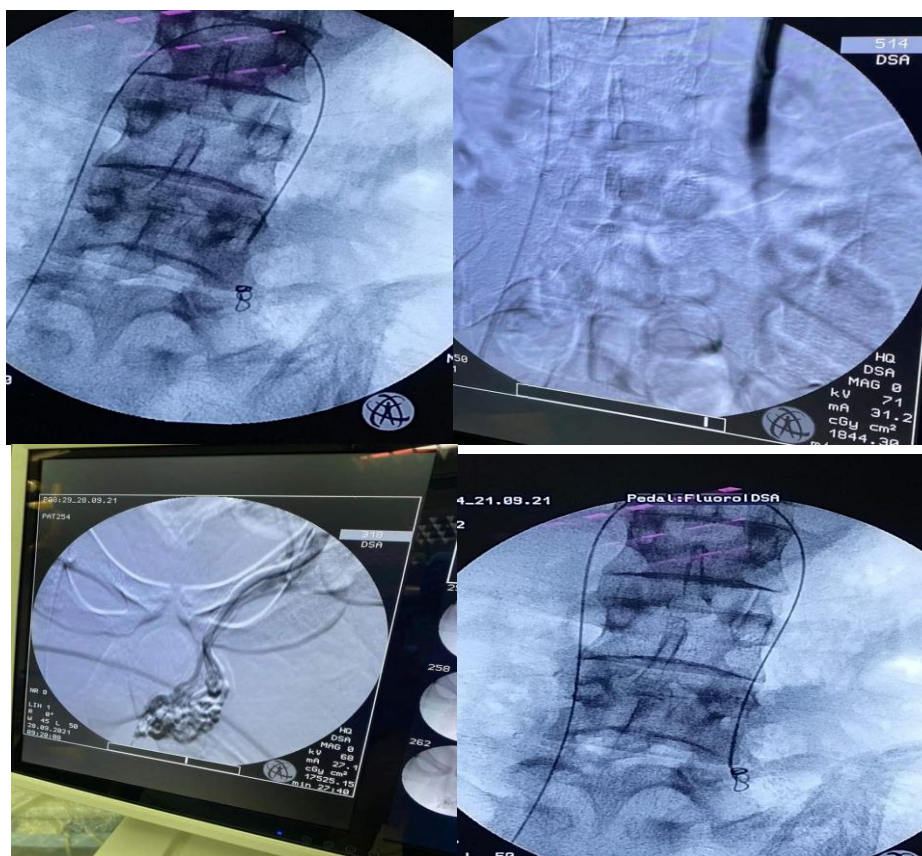
The most complication was pain (10%) followed failed catheterization (6.7%). Moreover, there were 2 patients with residual grade I varicocele and one patient with residual grade II varicocele

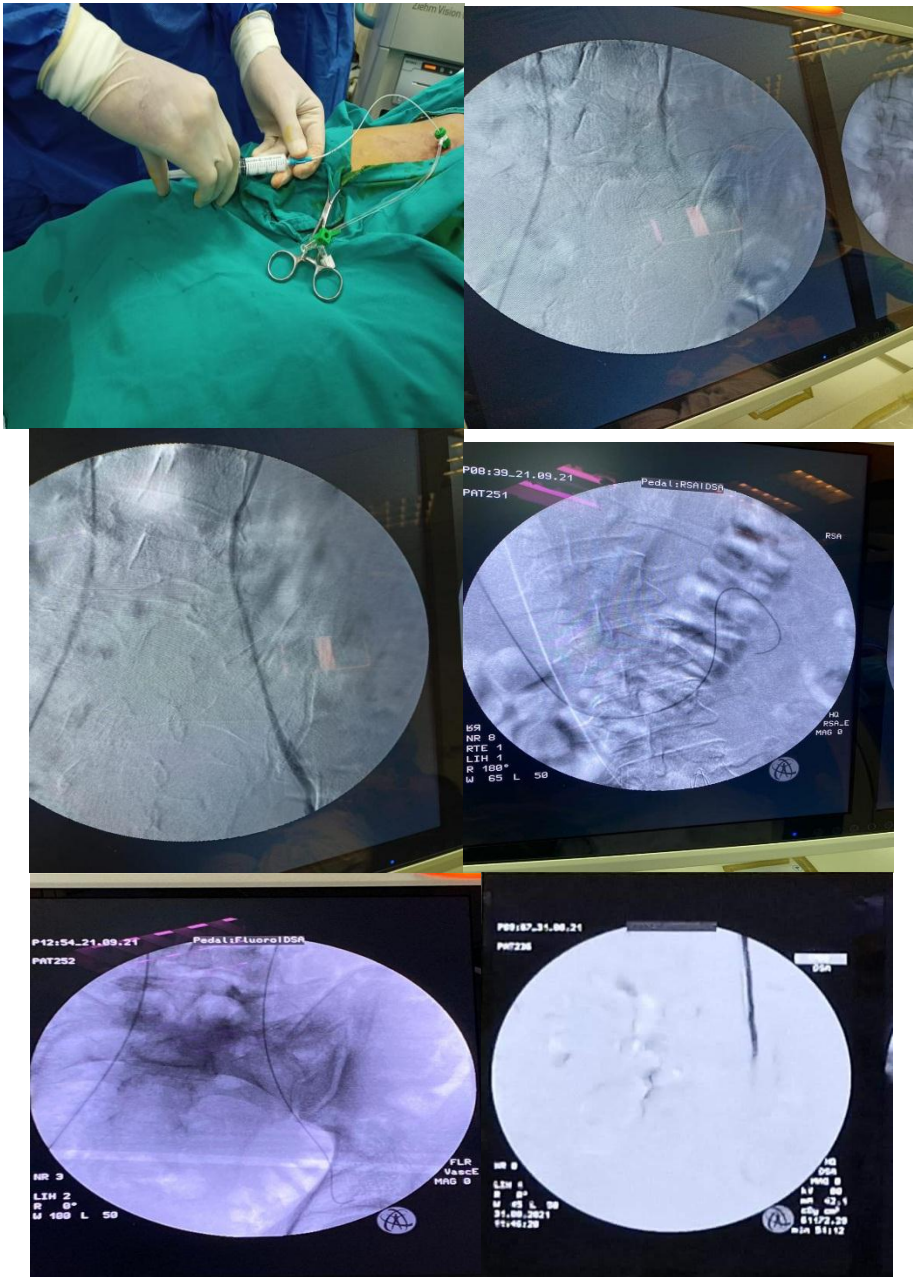
Table 7
Post-procedural outcome distribution among the studied patients

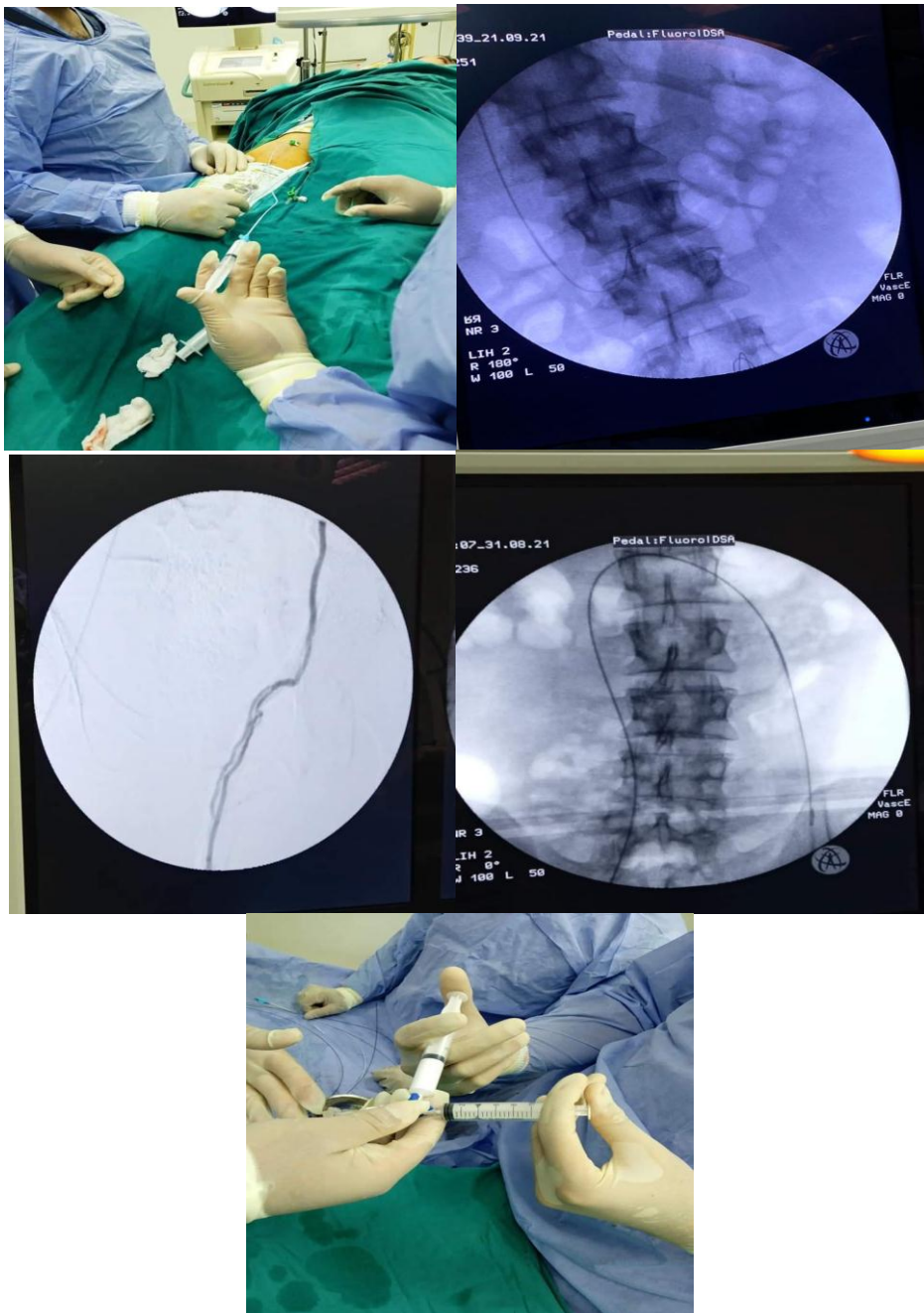
	Cases (n=30)
Post. Normal Duplex	27 (90%)
Semen analysis improvement	26 (86.7%)

90% of the patients showed post procedural normal duplex and 86.7% of the patients showed improvement of semen analysis.

Cases







Discussion

The incidence of varicocele in patients with secondary infertility rises to approximately 70% ⁷. This observation suggests that with age, the impact of varicocele on fertility becomes paramount. Because varicocele prevalence increases with advanced age, Canales et al., ⁸ hypothesized and evidenced that

the incidence of varicocele in the elderly population would be greater. Regarding the demographic characteristics of the patients, our results showed that: the age of the patients ranges from 22 – 40 years with mean 29.67 years, the majority of patients were rural by 60%. The present study was in line with the study by Broe et al.,⁹ aimed to assess the outcomes of consecutive patients who underwent spermatic vein embolization (SVE) for painful varicocele. Over a three-year period, 62 SVE procedures were performed for symptomatic varicocele. The mean age was 33.8 years (range 15–73).

Also, Prasivoravong et al., study¹⁰ aimed to analyze changes over time in initially abnormal sperm parameters (concentration, motility, vitality and morphology) and serum concentrations of testosterone, FSH and inhibin B after embolization treatment in males with varicocele. The study enrolled 119 patients with varicocele with mean age: 30.43 ± 5.16 years. As well, Chevallier et al.,¹¹ aimed to evaluate the impact of varicocele embolization using N-butyl cyanoacrylate (NBCA) glue on semen parameters in infertile men. The study included 186 infertile patients with stage 3 varicocele with a mean age of 32.3 years. In the present study regarding varicocele side distribution among the studied patients, we found that: right side varicocele was the fractured in 70% of the patients while the left was 30%. However, the study of Broe et al.,⁹ reported that: 96% (n=59) of cases were performed for a left-sided varicocele.

Also, the study of Chevallier et al.,¹¹ reported that: the most frequently embolized side was the left one (90.2%). Furthermore, the study of Edward et al.,¹² reported that: 77% of cases had left sided varicocele. As well Grosso et al.,¹³ showed that: in 1587 patients (98%) they performed unilateral left-side treatment. In general, the left side varicocele is present in 80%–90% of cases whereas the right side varicocele is present only in 5%–10% of cases, the condition being bilateral in 1%–15% of patients¹⁴. Regarding the Semen analysis parameters pre and post-procedural of the studied patients, our results showed that: there is a significant increase regarding semen analysis parameters from pre to post-procedural embolization. In agreement with our results the study of Prasivoravong et al.,¹⁰ concluded that: embolization treatment in men with clinically visible left side varicocele, abnormal sperm parameters and documented infertility is associated with a significant improvement in semen parameters including sperm head morphology.

Also, in line with the present study findings, the study of Chevallier et al.,¹¹ reported that: the use of N-butyl cyanoacrylate glue as an embolic agent for primary varicocele embolization in infertile men with stage 3 varicocele significantly improves the semen parameters. As well, the study of Edward et al.,¹² reported that: there was a significant improvement regarding semen parameters from pre to post embolization. In addition, Grosso et al.,¹³ reported that: post-sclerotherapy semen analysis showed significant improvements in sperm counts (mean 7.9 ± 3.8 million sperm/mL; $p < 0.005$) and motility ($7.2 \pm 2.1\%$; $p < 0.005$). Regarding the Clinical grades of the studied patients, we found that the most common clinical grade was grade I (43.3%) followed by grade II (36.7%). While the study of Broe et al.,⁹ reported that: the most common clinical grade on

examination was grade II (56%) followed by grade III (32%), while the study of Prasivoravong et al.,¹⁰ stated that: all the studied cases were grade III.

As well, the study of Edward et al.,¹² reported that the most common clinical grades on examination was grade II (61%) followed by grade I (23%). In the study of Grosso et al.,¹³ US-Doppler showed grade I–II primary varicocele in 49 patients (3%), grade III in 701 (43.3%) and grade IV–V in 869 (53.7%). In the present study we found that: the mean procedural time was 44.27 ± 9.84 minute. The study of Grosso et al.,¹³ reported that: the mean injection time of the sclerosant material was 30 minutes, the total treatment time being approximately 1 hour. Furthermore, the study of Bilreiro et al.,¹⁵ reported that: the varicocele embolization mean procedure time was 35.58 ± 13.44 (SD) min for glue and 45.97 ± 17.46 (SD) min for coils ($P = 0.0054$). Regarding post-procedural complications and recurrence among the studied patients, our results showed that: the most complication was pain (10%) followed failed catheterization (6.7%). Moreover, there were 2 patients with residual grade I varicocele and one patient with residual grade II varicocele.

However, the study of Broe et al.,⁹ reported that: 2 patients had a failed procedure on two occasions requiring subsequent surgical ligation. There was one clinically significant recurrence at the time of follow-up, as demonstrated by recurrence of pain and associated increased swelling. The average pain score on the post-procedure MEWS observation sheath was low. The only complications were: mild phlebitis (15%), treated successfully with NSAIDs, and wound seroma (1%). There were no major vascular or embolic complications. There was no incidence of hydrocoele at follow-up. While the study of Chevallier et al.,¹¹ reported that: no major complications were reported during or after varicocele embolization at mean clinical and radiological follow-up evaluations. No phlebitis of the pampiniform plexus was observed in the all-study population. No glue migration into the lung or non-target vessels was reported during or after varicocele embolization. Post-embolization syndrome, including groin discomfort on the embolized side within 1 month, was observed in 26 (14%) of the 186 patients, which was spontaneously resolved with conservative management. No early recurrence of varicocele was noted at mean US follow-up.

In Edward et al.,¹² study, as regard post procedural complications: 5 of our 13 patients had hypochondrial pain related to the site of gonadal vein embolization that last from 5 days to week that was controlled with analgesics. Also, the study by Grosso et al.,¹³ reported that: there were no major complications required additional hospitalization or surgical intervention. Identified minor complications included: left groin pain (26 patients, 1.6%) and puncture site haematoma (2 patients, 0.1%). Reiner et al.,¹⁶ concluded that: occurrence of post-embolization pain seems to be more frequent when using cyanoacrylate and sclerosing agents rather than coils, and this symptom is related to the secondary phlebitis that they cause. Regarding the post-procedural outcome distribution among the studied patients, we found that: 90% of the patients showed post procedural normal duplex while 86.7% of the patients showed improvement of semen analysis. However, the study of Broe et al.,⁹ reported that: the overall success rate of 95%, with a median follow-up of nine months. Two patients had a failed procedure on

two occasions requiring subsequent surgical ligation. There was one clinically significant recurrence. Also, Edward et al.,¹² concluded that: varicocele embolization has significant role in improving scrotal pain and infertility with technical success of 93.75%. A systematic review of Makris et al.,¹⁷ concluded that: despite the heterogeneity of the included studies, preliminary evidence supports the safe and effective use of the various embolic materials currently used for the management of primary varicocele. At 1 year, glue appears to be the most effective in preventing recurrence with coils being the second most effective. The addition of sclerosants to the coil embolization did not appear to have an impact on recurrence rates.

Conclusion

In conclusion, the present study confirms that: the embolization method presents a low complication rate and higher success rate. This treatment is associated with a significant improvement in semen parameters. These advantages, along with avoiding the use of general anesthesia and rapid recovery, suggest that embolization may be the preferable method for treating primary varicocele. Further research is required to elucidate the cost-effectiveness of this approach. Randomized trials comparing the main embolic agents, their effects on the semen parameters and pregnancy rates and their overall characteristics are warranted.

Conflict of interest: no conflicts of interest.

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