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Role of Interventional Radiology in Gonadal Vein Embolization

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Abstract

Background: There are several options for the treatment of varicocele, including surgical repair either by open or microsurgical approach, laparoscopy, or through percutaneous embolization of the internal spermatic vein. The ultimate goal of varicocele treatment relies on the occlusion of the dilated veins that drain the testis. Percutaneous embolization offers a rapid recovery and can be successfully accomplished in approximately 90% of attempts. However, the technique demands interventional radiologic expertise and has potential serious complications, including vascular perforation, coil migration, and thrombosis of pampiniform plexus. This thesis discusses the common indications, relative contraindications, technical details, and risks associated with percutaneous embolization of varicocele.

Objectives: The aim of this study is to highlight the role of interventional radiology in gonadal vein embolization in treatment of varicocele causing testicular pain or infertility.

Methods: A prospective interventional study including 26 patients suspecting varicocele presented by testicular pain or infertility, the patients underwent Varicocele embolization under local anesthesia with digital subtraction, then follow up was done after 2 weeks, 3 months and 6 months. The study was conducted in the Radiology Department at Ain-Shams University Hospitals, the period was between January 2019 till the end of July 2020.

Results: The procedure done for the different categories of the patients in our study, 19 patient underwent left ISV embolization, 4 cases underwent bilateral ISV, and in one patient we embolized right ISV, and failed at one case to catheterize ISV.

The study showed that there was statistically significant decrease in percentage of pain from 60% pre procedure to 25% post procedure with p-value = 0.025. And statistically significant increase in number and motility of the studied cases with p-value = 0.030 and 0.002 respectively on follow up.

54% of our patients underwent minor complications with 26.9% of them underwent post procedural pain, 8% ISV perforation, 15.4% underwent extravasation and we failed to catheterize the ISV in 4% of the cases.

Conclusion: Gonadal Vein Embolization is an effective way in treating varicocele, with our study showing significant improve as regard sperm count /ml, with significant decrease in the patient in comparison to pre and post procedural data, with highly significant improve of sperm motility in 3 months follow up.

Keywords: Gonadal Vein Embolization; Varicocele Treatment; Interventional Procedure

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Introduction

Variocele is a common clinical condition with vast importance in reproductive medicine practice, being found in 15% of male population, 35% in those presented with primary infertility, and 80 % in those with secondary infertility, it is a dilation of veins within the pampiniform plexus [1].

The World Health Organization (WHO) has reported a higher incidence of varicocele in men with abnormal sperm analysis which is considered a treatable cause of infertility, it is also a frequent cause for chronic testicular pain and discomfort [2].

It is likely to be multifactorial. Recent studies showed that it resulted mainly in higher levels of reactive oxygen species (ROS) [3]. This excessive ROS is associated with sperm DNA fragmentation, which may mediate the clinical manifestation of poor sperm function and fertilization outcome related to varicocele [4].

Varicocele diagnosis is a multi-disciplinary process, involving physical examination by palpating the scrotal sac, colour Doppler examination which has a sensitivity of 97% and then the assessment of varicocele effect on semen analysis and other laboratory parameters [5]. It detects a varicocele either by measuring augmented scrotal vein size or by demonstrating blood refluxing through the pampiniform plexus during the Valsalva maneuver. The measurement of retrograde peak flow creates a possibility to detect further subclinical varicoceles [6].

Surgical ligation and percutaneous embolization of the internal spermatic vein are the main therapeutic options for men with varicocele. By comparison with surgical ligation, percutaneous embolization is

a cheaper and less invasive method, requiring only local anaesthesia and allows visualization of the internal spermatic vein and possible collaterals [7].

Percutaneous embolization of varicocele requires selective catheterization of the internal spermatic vein(s) followed by its occlusion with N-butyl cyanoacryalate: lipidol mixture [8].

Follow up 6 months after the procedure, for patients referred because of testicular pain, complete absence of symptoms was considered as clinical success. Regarding patients treated for infertility, sperm analysis immediately before and at least 3-6 months after the procedure is performed. Sperm concentration, motility and morphology after the procedure are compared to those before the procedure. Values of 15 million of sperm/mL, 40% of motile sperm and 4% of morphological abnormal forms are considered normalization and clinical success [9].

Aim and Objectives

The aim of this study is to highlight the role of interventional radiology in gonadal vein embolization in treatment of varicocele causing testicular pain or infertility.

Methodology

Type of Study: prospective interventional study

Study Setting: The study will be conducted at Radiology Department at Ain-Shams University Hospitals.

Study Period: 2 years

Study Population

Inclusion Criteria

Patients with symptomatic varicocele (Testicular pain or infertility).

No age predilection.

Exclusion Criteria

Patient with contraindication to contrast injection e.g., Allergy or Renal failure.

Sampling Method: simple random sample.

Sample size.

Ethical Considerations: Informed consents will be obtained from all patients prior to inclusion in the study.

Study Tools

- Detailed explanation of the procedure and full history taking
- Ultrasound doppler examination for assessment of varicocele grading (reflux, diameter and number of dilated veins)
- Informed consent
- Varicocele embolization will be done under local anaesthesia and digital subtraction.
- Follow up after 2 weeks by colour Doppler for assessment of reflux and diameter of veins
- Follow up after 3 and 6 months for assessment of semen analysis (Number - abnormal forms and type of motility)

Study Procedures

Patient preparation:

- Fasting 6-8 hours before the procedure.
- A thorough explanation of the procedure should be given to the patient and informed consent should be taken.
- Renal function test including serum creatinine will be revised to each patient and patients with serum creatinine >2.0 mg/dl will be excluded from the study.

Procedure duration: The study takes about 30-60 minutes.

Machine used: The study will be done in at Ain shams university hospitals on siemens Atis Zee machine.

Method:

1) Pre-procedural ultrasound Doppler assessment of pamipiniform plexus of veins for varicocele grading:

a) Grade 1

i) No dilated intrascrotal veins

ii) Reflux in spermatic cord veins of the inguinal region during Valsalva maneuver

b) Grade 2

i) Prominent veins at upper pole of testis

ii) Reflux at upper pole veins during Valsalva maneuver

c) Grade 3

i) No major dilatation in supine position

ii) Dilated veins up to lower pole of testis seen only in standing position

iii) Reflux at lower pole veins during Valsalva maneuver

d) Grade 4

i) Dilated veins even in supine position

ii) Reflux during Valsalva maneuver

e) Grade 5

i) Dilated veins

ii) Reflux without Valsalva maneuver

1) Ultrasound assessment used to diagnose dilated pampiniform plexus of veins when its diameter is more than 3mm.

2) The patient will lie in supine position wearing the hospital gown.

3) Sterilization of the neck is done.

4) Puncture of the right internal jugular vein.

5) A vertebral catheter is used and is advanced via right internal jugular to right brachiocephalic to right superior vena cava then right atrium and inferior vena cava to the left renal vein for left sided varicocele and anterolateral below the right renal vein in right sided varicocele.

6) The catheter tip is placed at the junction of the distal internal

spermatic vein and the pampiniform plexus. A venogram is performed by placing the patient in reverse Trendelenburg position or with the patient performing the Valsalva maneuver.

7) Embolization is done by injecting N-Butyl cyanoacrylate: Lipidol mixture within the refluxing vein .

8) Follow up after two weeks by color Doppler for assessment of grade of varicocele.

9) Follow up after 3 and 6 months for assessment of semen analysis.

Risks and complications

1) Risks related to contrast media

a) Risk of developing reaction to contrast media

b) Risk if contrast induced nephropathy

2) Risks related to the Jugular puncture

a) Risk of neck haematoma

b) Risk of pneumothorax

c) Risk of creating an arteriovenous fistula between Jugular and carotid vessels

3) One day after the procedure, the interventionist will call each patient to screen for any complications.

Treatment in cases of risks and complications: In case of complications the patient will be managed as per the guidelines in each case according to the severity.

1) If allergic reaction to the contrast medium happened, it will be managed through the inserted IV access plastic cannula, with administration of antihistaminic and adrenaline.

2) Immediate dialysis for patients with contrast nephropathy.

3) Prevention of puncture related complications can be achieved by proper puncture technique and ultrasound guidance in cases of difficult puncture, avoiding wrong site puncture, as well as adequate compression after removal of the sheath.

4) In cases of the remote possibility of pseudoaneurysms or A-V fistulas, ultrasound guided compression for 30 minutes can be used.

5) In cases of pneumothorax, management will be according to the case severity, varying from conservative management and follow up in mild cases and up to chest tube insertion in severe cases.

Interpretation of Results: Technical success with percutaneous embolization is defined as cessation of flow as demonstrated by intra-operative imaging.

Statistical Analysis

Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Sciences) version 23. Data were summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using Chi^2 and paired t test.

Chi-square test:

P-value > 0.05 Non significant

P-value < 0.05 Significant.

P-value < 0.01 Highly significant.

Results

The 26 patients enrolled in this study were ranging from 18 to 42 years with mean age of 30 years (Table 1 and Figure 1).

Presenting complaints included: 11 patients presented with infertility (42%), 14 patients presented with pain (54%) and one patient presented with recurrence after surgery (4%) (Table 2).

By imaging assessment: All cases were examined by U/S, the examination revealed, 15 cases had bilateral varicocele and 11 cases had left sided varicocele (Figure 2 and Table 3).

Table 1: Representing the statistical data analysis for different ages enrolled at our study.

Age (years)	No.= 26
Mean ± SD	30
Range	18 – 42
Age < 30	18 (69.0%)
Age > 30	8 (31.0%)

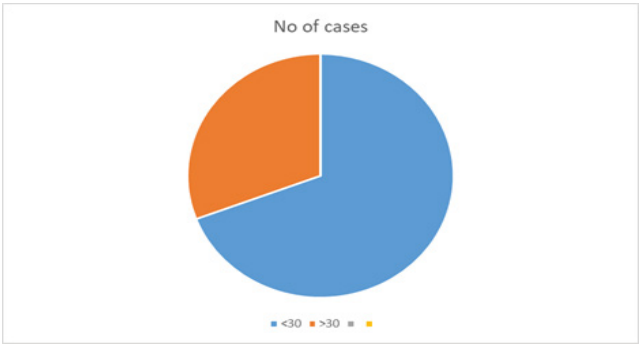

Figure 1: Showing that in our study 18 patients were less than 30 years (69%), and 8 patients were older than 30 years (31%).

Table 2: Demonstrating statistical analysis as regard the clinical indication for varicocele embolization.

Clinical Indication		No.	%
Pain	No	12	46.0%
	Yes	14	54.0%
Infertility	No	15	58.0%
	Yes	11	42.0%
Recurrence	No	25	96.0%
	Yes	1	4.0%

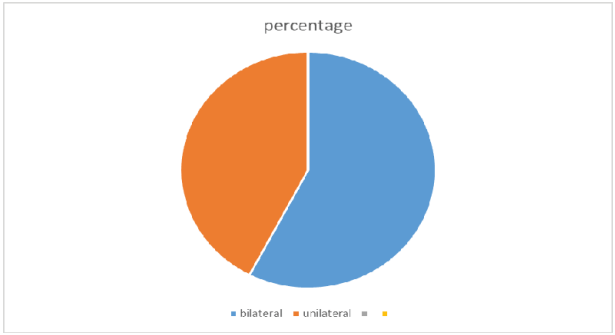

Figure 2: Representing the percentage of patient with unilateral varicocele (42.3%) and bilateral varicocele (57.6%).

Semen Analysis

11 patients with infertility (42%), 6 patients had low number only, 3 patients had low motility and 2 patients had low number and decreased motility (Table 4).

The procedure done for the different categories of the patients in our study, 19 patient underwent left ISV embolization, 4 cases underwent bilateral ISV, in one patient we embolized right ISV, and failed at one case to catheterize ISV (Tables 5 and 6) (Figure 3).

Comparison between pre procedure and post procedure regarding pain (Table 7).

The previous table shows that there was statistically significant decrease in percentage of pain from 60% pre procedure to 25% post procedure with p-value = 0.025 (Table 8).

Table 3: Demonstrating the percentage of patients with right and left side varicocele according to the grade.

		No.	%
Right side Grade			
	I	9	34..6%
	II	5	19.2%
	III	2	7.7%
Left side grade	I	4	15.4%
	II	12	46.2%
	III	7	30.0%

Table 4: Demonstrating the statistical data for patients presented with infertility, abnormal number range from (3-11 million/ml), and abnormality in motility range from 5-15 %.

		No.= 26
Semen analysis abnormality	Normal	15 (58.0%)
	Low	11 (42.0%)
Number (million/ml)	Mean ± SD	7.00 ± 2.44
	Range	2 – 12
Motility %	Mean ± SD	9.50 ± 4.2
	Range	4 – 15

Table 5: Demonstrating the procedure approach either jugular or femoral and the side of gonadal vein embolized.

		No.	%
Procedure	Failed	1	4.0%
	Left	19	73.0%
	Right	1	4.0%
	Bilateral	3	15.0%
Approach	Femoral	1	4.0%
	Jugular	24	92.0%
	Failed ISV	1	4.0%

Table 6: Demonstrating the percentage of complications among our patients sample:

		No.	%
Complications	**No**	12	46.0%
	Yes	14	54.0%
Pain		7	26.9%
ISV perforation		2	8.0%
Extravasation		4	15.4%
Failed procedure		1	4.0%

Table 7: Comparison between pre procedure and post procedure regarding pain.

		Pre		Post		Test value*	P-value	Sig.
		No.	%	No.	%			
Pain	No	12	46.00%	18	70.1%	5.013	0.025	S
	Yes	14	54.00%	7	26.9%			

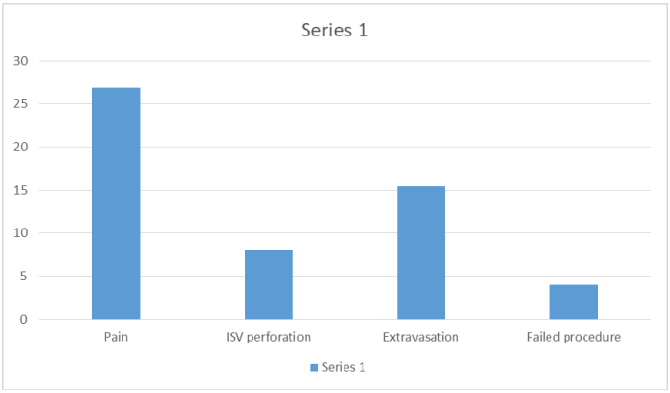

Figure 3: Representing the percentage of complications.

Table 8: Comparison between pre procedure and post procedure regarding number and motility.

		Pre	Post	Test value*	P-value	Sig.
Number (million/ml)	Mean ± SD	7.00 ± 2.44	28.00 ± 10.89	-3.909	0.030	S
	Range	2– 12	15 – 37			
Motility %	Mean ± SD	9.50 ± 4.2	45.80 ± 6.94	-7.641	0.002	HS
	Range	4 – 15	34 – 50			

The previous table shows that there was statistically significant increase in number and motility of the studied cases with p-value = 0.030 and 0.002 respectively.

Concerning three months follow up, 2 cases not improved as regard the semen analysis, one patient had improvement of the motility but the number was not improved, all patient with pain were improved, 9 out of 11 patients had improved semen analysis results at 3 months follow up.

Two cases with poor outcome, that after 3 months they had low number and motility results of their semen analysis and one case failed to catheterize the ISV.

Illustrated Case

- History: 3 years old, married for 7 years, presented with infertility.
- Ultrasound & color Doppler: left sided grade III varicocele.
- Semen analysis: Decreased number: 3.2 million / ml, progressive motility < 10% at first hour.
- Procedure: Embolization of the left internal spermatic vein via jugular approach
- Follow up after 3 months:

a) No reflux on ultrasound examination.

b) Semen analysis: number: 35million/ml, progressive motility > 31% (Figures 4 and Figure 5).

Discussion

Endovascular treatment of varicoceles is highly effective. Surgical treatment of varicoceles can be associated with high recurrence rates, most likely due to duplicated gonadal veins as well as collateralization with the IVC, azygous, and duplicated renal veins [1].

Ramasamy et al. (2014) in his study he said that varicocele embolization is a viable option for treatment of varicocele in patients

Figure 4: Scrotal US on the left side revealed grade III varicocele with reflux all through time of examination.

Figure 5: DSA images, Cyanoacrylate cast seen at left ISV after embolization.

complaining of scrotal pain and or primary infertility with good semen analysis improvement as well as pregnancy rates after embolization.

In most circumstances, if the varicocele recurs, endovascular treatment is still performed via a retrograde way by accessing the left gonadal vein via the left renal vein, either from a right internal jugular or right femoral vein approach. Jargiello T, et al. (2015) published 100 % technical success in the endovascular treatment of surgically recurrent varicoceles [6,10].

Wunsch R, et al. (2005) concluded that clinical outcomes of percutaneous ISV embolization or sclerotherapy are quite similar to surgical procedures. Semen parameters such as sperm concentration and motility improve in 70 to 82% of patients, which is almost the same situation concerning the morphology [11].

The percutaneous approach has the advantage of being both diagnostic and therapeutic. Embolization of the testicular vein results is a complete recovery in 70% of cases of permanent reflux and improvement of intermediate reflux in 20% of cases. It has several advantages such as low morbidity, low cost, short hospitalization and limited complications when compared with conventional surgery and laparoscopy [12].

As regard semen characters after successful varicocele embolization, there was improvement in semen in terms of motility and morphology in those with retreatment semen density 10-30 million/ml [10].

Another study performed on 244 patients by Gandini R, et al. (2008) concluded improvement in all semen parameters after treatment [13].

All the previously mentioned Studies support the role of percutaneous embolization of varicocele, in treatment of primary infertility and improvement of semen parameters which was one of the main aims of our study.

A study included 154 patients who underwent embolization of varicocele for pain. Using pain scale analogue questionnaires (range 1-10), median preoperative pain was 7 and postoperative pain was 0. At follow-up, 86.9% of patients were with no pain. Thus, results from our study and the previously mentioned study indicated that embolization technique for painful varicocele may be an appropriate option [14].

Jargiello T, et al. (2015) answered the question of how we manage recurrent varicocele after surgery as he said: if the varicocele recurs, endovascular treatment is still performed via a retrograde way by accessing the left gonadal vein via the left renal vein, either from a right internal jugular or right femoral vein approach. Jargiello T, et al. (2015) published 100 % technical success in the endovascular treatment of surgically recurrent varicocele [10].

Patients with cardiopulmonary comorbidities can undergo varicocele embolization under local anesthesia, whereas general anesthesia is routinely necessary with surgical repair. Additionally, patients with bilateral varicoceles can undergo catheter-based embolization via one single femoral vein access, in contrast to two separate surgical incisions with operative interventions. Without the need to create a surgical incision, catheter-based varicocele embolization is associated with a significant lower risk for wound complications such as infection or dehiscence. Lastly, embolization is associated with a high technical success rate in treating recurrent or persistent varicoceles, with studies reporting a success rate of 96% compared with 61% in those who were treated by surgical approach [15].

Cassidy D, et al. (2012) published a review which represents the largest contemporary series of varicocele embolization outcomes currently available in the literature [16]. The overall technical failure rate for varicocele embolization of 13.9% is consistent with the published meta-analysis rate of 13.05%. However, the high technical failure rate seen in Cassidy's series in patients with right-sided embolization attempts of 19% was previously addressed in the published literature and is something that can have significant implications for the infertile male seeking to optimize his semen parameters and fertility potential. The overall failure rate of 3.2% for left-sided embolization attempts is comparable to the 3.25% published rate of failure for surgical varicocele repair; this result suggests that these two options are equally effective, although embolization offers some advantages in terms of recovery time and safety.

These data appear to support the idea that men with bilateral varicoceles and male factor infertility are best managed with surgical varicocele repair, as the failure rates are equal from side to side at roughly 3%, compared to the 19% failure rate seen during bilateral varicocele embolization. The management of unilateral varicoceles, however appears less straight forward, with both embolization and surgery offering similar failure rates but embolization offering substantial advantages [13].

Embolization has been demonstrated to have no risk for

postoperative hydrocele formation compared to the 8.24% rate in surgical approaches. Embolization is also not associated with testicular loss secondary to inadvertent arterial injury, which is a risk with the surgical approaches with a poorly described rate in the literature of 1%; however, there have been case reports of renal loss as a result of coil migration. The recovery period following varicocele embolization is typically 48 to 72 hrs., compared to 1 to 2 weeks following surgical repair. The risks of surgical repair appear to be higher than that of varicocele embolization with no real advantage in terms of success rates, suggesting that embolization may be the better choice for unilateral varicoceles in the infertile male [17,18].

Summary and Conclusion

Gonadal Vein Embolization is an effective way in treating varicocele, with our study showing significant improve as regard sperm count /ml , with significant decrease in the patient in comparison to pre and post procedural data, with highly significant improve of sperm motility in 3 months follow up.

References

1. Alsaikhan B, Alrabeeah K, Delouya G, Zini A (2016) Epidimiology of varicocele. Asian J Androl 18: 179-181.
2. Sigman M (2011) There is more than meets the eye with varicoceles: current and emerging concepts in pathophysiology, management, and study design. Fertil Steril 96: 1281-1282.
3. Zini A, Azhar R, Baazeem A, Gabriel MS (2011) Effect of microsurgical varicocelectomy on human sperm chromatin and DNA integrity: a prospective trial. Int J Androl 34: 14-19.
4. Cho CL, Esteves SC, Agarwal A (2016) Novel insights into the pathophysiology of varicocele and its association with reactive oxygen species and sperm DNA fragmentation. Asian J Androl 18: 186-193.
5. Choi WS, Kim SW (2013) Current issues in varicocele management: a review, World J Mens Health 31: 12-20.
6. Cina A, Minnetti M, Pirronti T, Spampinato MV, Canadè A, et al. (2006) Sonographic quantitative evaluation of scrotal veins in healthy subjects: normative values and implications for the diagnosis of varicocele. Eur Urol 50: 345-350.
7. Urbano J, Cabrera M, Alonso-Burgos A (2014) Sclerosis and varicocele embolization with N-butyl cyanoacrylate: experience in 41 patients. Acta Radiol 55: 179-185.
8. Moon KH, Cho SJ, Kim KS, Park S, Park S (2012) Recurrent varicoceles: causes and treatment using angiography and magnification assisted subinguinal varicocelectomy. Yonsei Med J 53: 723-728.
9. Cooper TG, Noonan E, Von Eckardstein S, Auger J, Baker HW, et al. (2010) World Health Organization reference values for human semen characteristics. Hum Reprod Update 16: 231-245.
10. Jargiello T, Drelich-Zbroja A, Falkowski A, Sojka M, Pyra K, et al. (2015) Endovascular transcatheter embolization of recurrent postsurgical varicocele: anatomic reasons for surgical failure. Acta Radiol 56: 63-69.
11. Wunsch R, Efinger K (2005) The interventional therapy of varicoceles amongst children, adolescents and young men. Eur J Radiol 53: 46-56.
12. Bechara CF, Weakley SM, Kougias P, Athamneh H, Duffy P, et al. (2009) Percutaneous treatment of varicocele with micro coil embolization: comparison of treatment outcome with laparoscopic varicocelectomy. Vascular 17: 129-136.
13. Gandini R, Konda D, Reale CA, Pampana E, Maresca L, et al. (2008) Male varicocele: transcatheter foam sclerotherapy with sodium tetradecyl sulfate-outcome in 244 patients. Radiol 246: 612-618.
14. Puche-Sanz I, Flores-Martín JF, Vázquez-Alonso F, Pardo-Moreno PL, Cózar-Olmo JM (2014) Primary treatment of painful varicocoele through percutaneous retrograde embolization with fibred coils. Andrology 2: 716-720.
15. Reiner E, Jeffrey S, Robert I (2011) Varicocele Embolization. In: Handbook for interventional radiologic procedures. (4th edtn), Lippincott Williams & Wilkins, United States.
16. Cassidy D, Jarvi K, Grober E, Lo K (2012) Varicocele surgery or embolization: Which is better?. Can Urol Assoc J 6: 266-268.
17. Kubal A, Nagler HM, Zahalsky M, Budak M (2004) The adolescent varicocele: diagnostic and treatment patterns of pediatricians. A public health concern?. J Urol 171: 411-413.
18. Kondo Y, Ishikawa T, Yamaguchi K, Fujisawa M (2009) Predictors of improved seminal characteristics by varicocele repair. Andrologia 41: 20-23.