

Adult Varicocele in Burkina Faso: A 10-Year Retrospective Multicenter Study of Clinical Features and Surgical Outcomes

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Abstract

Background: Varicocele is the most common surgically correctable cause of male infertility, yet data from sub-Saharan Africa remain scarce. **Methods:** We conducted a retrospective, two-center cohort study, with a nested paired-comparison analysis of pre- and postoperative semen parameters in the subgroup with available follow-up data, at two urology referral centers in Burkina Faso between 1 June 2015 and 30 May 2025. All men aged 18 years or older diagnosed with varicocele by clinical examination, confirmed by scrotal Doppler ultrasonography, were eligible; men with secondary varicocele, an unusable clinical record, or age over 65 years were excluded. **Results:** Of 537 varicocele cases identified, 503 were analyzed (CHU-SS, n = 196; CHU-YO, n = 307); the annual caseload rose from 15 in 2015 to 78 in 2025. Mean age was 35.3 ± 6.1 years. Couple hypofertility was the presenting complaint in 94.0% of patients (primary in 64.8%, secondary in 29.2%), with a mean reported duration of 55.5 ± 41.8 months. Varicocele was bilateral on clinical examination, confirmed by Doppler ultrasonography, in 93.2% of patients and grade II or III in 98.0%. Preoperative semen analysis showed asthenozoospermia in 84.7%, necrozoospermia in 83.7%, teratozoospermia in 64.8%, and severe count abnormalities in most patients (75.4% azoospermic). Higher varicocele grade was associated with reduced progressive motility ($p = 0.002$) and reduced vitality ($p = 0.04$) but not with semen volume ($p = 0.64$) or sperm morphology ($p = 0.52$). All patients underwent surgical repair; the immediate complication rate was 1.8%. Among the 104 patients (20.7%) with a postoperative semen analysis at a mean

of 3 months, progressive motility improved significantly (+12.0 percentage points, $p < 0.001$), in a subgroup whose markedly higher baseline sperm count than the overall cohort; changes in semen volume, count, vitality, and morphology were not consistently favorable. **Conclusions:** Varicocele is a frequent, often bilateral, and late-presenting condition among infertile men attending Burkina Faso's two largest urology referral centers, and surgical repair was associated with a significant improvement in sperm progressive motility in the minority of patients with postoperative follow-up. These findings support earlier referral pathways for couple infertility and systematic postoperative semen follow-up to better document the fertility benefit of varicocelectomy.

Keywords

Varicocele, Male Infertility, Semen Analysis, Varicocelectomy, Sub-Saharan Africa, Burkina Faso

1. Introduction

Varicocele is an abnormal dilation and tortuosity of the pampiniform plexus veins caused by valvular incompetence of the internal spermatic venous network, producing retrograde venous flow toward the gonad [1]. It affects 15% - 20% of the general male population, roughly 35% of men with primary infertility, and more than 70% of men with secondary infertility [2] [3].

Data on varicocele from sub-Saharan Africa remain heterogeneous and comparatively scarce. Regional case series consistently identify varicocele among the leading correctable causes of male infertility, although its reported proportion varies with referral pattern and diagnostic criteria, and varicocele grade has been shown to correlate with the severity of associated semen abnormalities [4]. In Burkina Faso specifically, published data are limited. A single-center series identified varicocele as the leading cause of male infertility, accounting for 22.1% of diagnoses, with 47.6% of these patients presenting with azoospermia [5].

Because decade-scale, multicenter data on the epidemiology, clinical presentation, and surgical outcomes of varicocele are lacking in Burkina Faso, we conducted this study to describe these features and to analyze the results of surgical treatment among patients managed at the country's two largest urology-andrology referral centers over a 10-year period.

2. Materials and Methods

We conducted a bicentric, retrospective cohort study encompassing all men managed in the Departments of Urology and Andrology of the two principal referral hospitals in Burkina Faso, namely the CHU Sourou Sanou in Bobo-Dioulasso and the CHU Yalgado Ouédraogo in Ouagadougou, between June 1, 2015, and May 30, 2025. A pre- and postoperative matched analysis was carried out within the subgroup of patients for whom follow-up semen analyses were available. The

study received approval from the National Health Research Ethics Committee of Burkina Faso (approval no. 2026-01-0080) and authorization from Joseph Ki-Zerbo University (authorization no. 2026-00252/MESRI/SG/UJKZ/P/SG/DEP). Eligible for inclusion were all men aged 18 years or older in whom the diagnosis of varicocele had been established on clinical examination and confirmed by scrotal Doppler ultrasonography, irrespective of the reason for consultation. Excluded were patients younger than 18 years or older than 65 years, those presenting with varicocele secondary to a known condition, and patients whose clinical records were unusable. Data were collected from hospital registries and individual clinical records using a standardized data collection form. The variables studied included sociodemographic, clinical, paraclinical, therapeutic, and outcome data. Hypofertility, which constituted the primary reason for consultation in the majority of patients, was defined according to World Health Organization (WHO) criteria as the inability of a couple to achieve pregnancy after at least 12 months of regular unprotected sexual intercourse. On the basis of clinical record data, it was classified as primary when the couple had never previously achieved a pregnancy, and as secondary when at least one prior pregnancy, with the current or a previous partner, was documented. Sperm parameters were classified according to the 2021 World Health Organization reference values. Venous reflux was assessed with the patient examined in both the supine and standing positions, at rest and during the Valsalva maneuver. Clinical grading of the varicocele was determined by physical examination using the three-grade classification described by Dubin and Amelar: Grade I corresponds to a varicocele palpable only during the Valsalva maneuver; Grade II, to one palpable at rest; and Grade III, to one visible at rest. This clinical grade was subsequently confirmed by scrotal Doppler ultrasonography in all patients. Surgical repair was indicated in men presenting with a varicocele confirmed both clinically and on Doppler ultrasonography, associated with abnormal sperm parameters or scrotal symptoms, in the context of a desire for paternity. The choice of surgical approach, among the inguinal technique according to Ivanissevich, the subinguinal technique according to Marmara, and the retroperitoneal technique according to Palomo, was left to the surgeon's discretion and was based primarily on the grade of the varicocele, testicular position, and prior inguinoscrotal surgical history. All operated patients received postoperative adjuvant oral treatment combining antioxidants and multivitamins. Statistical analyses were performed using R software version 4.4.2. Pre- and postoperative sperm parameters were compared using the paired Student's *t*-test. Associations between varicocele grade and sperm parameters were assessed using the chi-square test or Fisher's exact test, as appropriate. Statistical significance was set at a two-sided *p*-value below 0.05.

3. Results

Over the 10-year study period, 537 cases of varicocele were recorded in the two departments (mean, 53.7 cases per year). Thirty patients were excluded (second-

ary varicocele or an unusable clinical record) and 4 were not included (age under 18 years), leaving 503 patients for analysis: 196 (39.0%) at CHU-SS and 307 (61.0%) at CHU-YO. The annual number of cases increased steadily, from 15 in 2015 to a peak of 78 in 2025 (**Figure 1**).

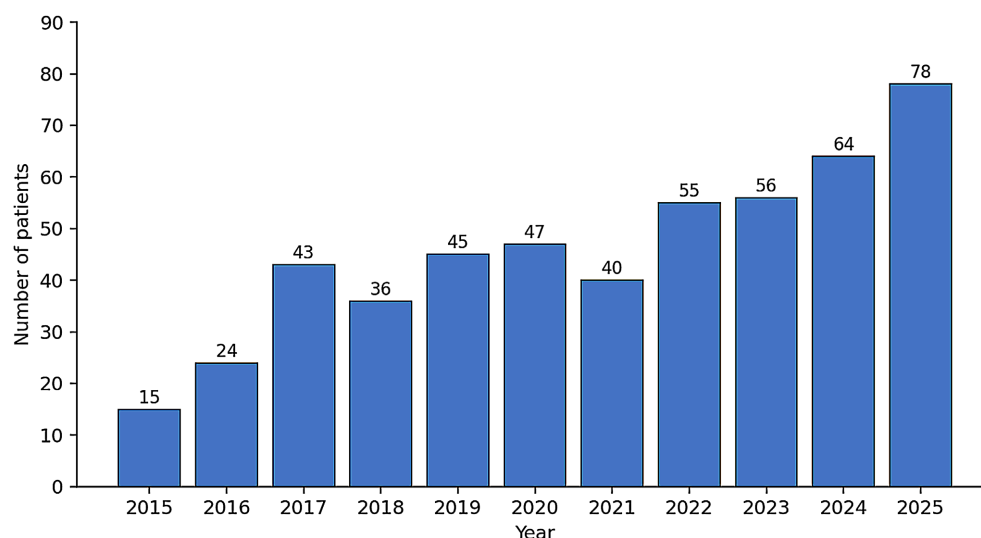


Figure 1. Annual number of patients treated for varicocele at CHU-SS and CHU-YO, 2015-2025 (N = 503).

Mean age was 35.3 ± 6.1 years (range, 22 - 56); patients aged 30 - 34 years formed the largest age band (36.4%). All patients were in a stable couple relationship (married, 85.9%; cohabiting, 14.1%). Roughly one-third of patients (34.6%) had no formal education, and 32.4% were public- or private-sector employees. Sociodemographic characteristics are summarized in **Table 1**.

Table 1. Sociodemographic characteristics of patients treated for varicocele (N = 503).

Characteristic	n	%
<i>Age group, years</i>		
<25	22	4.4
25 - 29	48	9.5
30 - 34	183	36.4
35 - 39	125	24.9
40 - 44	81	16.1
45 - 49	36	7.2
≥50	8	1.6
<i>Marital status</i>		
Married	432	85.9
Cohabiting	71	14.1
<i>Educational level</i>		
None	174	34.6

Continued

Primary	110	21.9
Secondary	135	26.8
Higher	84	16.7
Occupation		
Public/private employee	163	32.4
Trader	119	23.7
Farmer	116	23.1
Security forces	36	7.2
Manual worker	28	5.6
Student	18	3.6
Other	23	4.6

Note: mean age, 35.3 ± 6.1 years (range, 22 - 56). Percentages are calculated on N = 503 and may not sum to exactly 100% because of rounding.

Hypofertility was the presenting complaint in 94.0% of patients (n = 473): primary in 64.8% (n = 326) and secondary in 29.2% (n = 147). The mean reported duration of hypofertility was 55.5 ± 41.8 months (range, 12 - 204), and was longer for secondary (62.0 ± 38.5 months) than for primary hypofertility (52.6 ± 43.0 months). Scrotal pain or heaviness accompanied hypofertility in 52.9% of consultations overall and was the sole presenting symptom in 3.2% of patients (**Table 2**). A comorbidity was documented in 11.1% of patients (n = 56), most often hypertension (4.4%), followed by diabetes mellitus (2.0%), a history of sexually transmitted infection (2.0%), and asthma (1.6%).

Table 2. Reasons for consultation among 503 patients treated for varicocele.

Reason for consultation	n	%
Primary hypofertility + scrotal pain/heaviness	169	33.6
Primary hypofertility alone	137	27.2
Secondary hypofertility + scrotal pain/heaviness	97	19.3
Secondary hypofertility alone	32	6.4
Primary hypofertility + testicular hypotrophy	20	4.0
Secondary hypofertility + decreased testicular volume	18	3.6
Isolated scrotal pain/heaviness	16	3.2
Isolated decreased testicular volume	8	1.6
Isolated increased scrotal volume	6	1.2
Total	503	100.0

General condition was preserved in all patients. On scrotal examination, testicular volume was clinically reduced in 20.5% of right and 24.7% of left testes, and the Valsalva maneuver was positive in 60.4% on the right and 62.4% on the left.

Varicocele was bilateral on clinical examination, confirmed by Doppler ultrasonography, in 93.2% of patients ($n = 469$), with an isolated left-sided varicocele in 5.6% and an isolated right-sided varicocele in 1.2%.

Scrotal Doppler ultrasonography, performed in all patients, confirmed the diagnosis in every case. Using the higher grade of the two sides to classify each patient, grade II varicocele was present in 50.3% ($n = 253$), grade III in 47.7% ($n = 240$), and grade I in 2.0% ($n = 10$).

Among the 140 patients (27.8%) with an available hormonal assessment, mean follicle-stimulating hormone (FSH) was 9.86 ± 7.80 mIU/mL (range, 2.63 - 39.43), above the normal range (>12 mIU/mL) in 17.9%; mean luteinizing hormone (LH) was 7.70 ± 5.25 mIU/mL (range, 0.8 - 20.83), elevated (>10 mIU/mL) in 8.6% and low (<2 mIU/mL) in 2.9%; mean serum testosterone was 6.96 ± 1.44 ng/mL (range, 4.36 - 9.27).

A preoperative semen analysis was available for all 503 patients after an abstinence period of 3 - 6 days. Mean semen volume was 2.84 ± 1.03 mL, with hypospermia (<1.5 mL) in 10.7%. Sperm count was severely reduced in most patients: azoospermia was recorded in 75.4% ($n = 379$) and oligospermia (<15 million/mL) in 20.5% ($n = 103$), with a normal count in only 4.2% ($n = 21$). Progressive motility was below the normal threshold (asthenozoospermia, $<32\%$) in 84.7%, vitality was reduced (necrozoospermia, $<58\%$) in 83.7%, and the proportion of normal forms was below 4% (teratozoospermia) in 64.8% of patients. Motility, vitality, and morphology could be qualitatively graded only in the 124 patients (24.6%) whose semen contained spermatozoa; in the 379 azoospermic patients (75.4%).

Higher varicocele grade was significantly associated with reduced progressive motility ($p = 0.002$) and reduced vitality ($p = 0.04$), but not with semen volume ($p = 0.64$) or the proportion of normal sperm forms ($p = 0.52$).

All 503 patients underwent surgical varicocelectomy combined with adjuvant antioxidant and vitamin therapy. The inguinal Ivanissevich approach was used most often (59.8%, $n = 301$), followed by the subinguinal Marmara approach (34.2%, $n = 172$) and the retroperitoneal Palomo approach (6.0%, $n = 30$). The immediate postoperative course was uneventful in 98.2% of patients ($n = 494$); documented complications, present in 1.8% ($n = 9$), comprised postoperative hydrocele (1.0%, $n = 5$), inguinal hernia (0.4%, $n = 2$), and inguinal-site bleeding (0.4%, $n = 2$). No arterial or testicular loss complication was recorded.

A postoperative semen analysis was available for 104 patients (20.7% of the cohort), obtained at a mean interval of 3 months after surgery. Semen parameters before and after varicocelectomy in these 104 patients with matched data are shown in **Table 3**.

4. Discussion

In this decade-long, two-center analysis of 503 men treated for varicocele in Burkina Faso, couple hypofertility was the presenting complaint in the large majority of patients, varicocele was bilateral in more than nine of ten men, and

Table 3. Semen parameters before and after varicocelectomy among 104 patients with paired data (mean follow-up, 3 months).

Semen parameter (n = 104)	Preoperative	Postoperative	Difference	p value
Mean volume, mL	2.82	2.15	−0.66	<0.001*
Mean sperm count, /mL	32,022,048	23,920,196	−8,101,852	0.35
Mean progressive motility, %	8.99	21.02	+12.03	<0.001*
Mean vitality, %	26.40	25.07	−1.33	0.67
Mean normal forms, %	5.40	7.29	+1.89	0.19

*Statistically significant (paired t test, $p < 0.05$).

surgical repair was followed by a statistically significant improvement in sperm progressive motility among the minority of patients with postoperative follow-up.

The mean age of 35.3 years in our cohort closely matches series from Guinea (35 - 38 years) [6], Senegal (36.2 years) [7], and Togo (33.4 years) [8], consistent with the observation that men consult for infertility investigation predominantly in their thirties, when the desire for paternity is most actively pursued. The near-universal finding of couple hypofertility as the reason for consultation (94.0%) also matches earlier African series (62% - 81%) [6] [7] and reflects the well-established role of varicocele as the most common surgically correctable cause of male infertility [3].

The predominance of bilateral disease on Doppler ultrasound (93.2%) contrasts with several European and North African series reporting a left-sided predominance of 85% - 90% [9], but is consistent with other West African cohorts (Senegal, 96.7%; Togo, 66%) [7] [8] and with the clinical position that varicocele should be regarded as a bilateral condition when actively sought with duplex ultrasonography rather than relying on inspection and palpation alone [10]. The high proportion of grade II - III disease (98.0%) and the long mean duration of hypofertility before consultation (55.5 months) both point to delayed presentation. The severity of semen abnormalities in our cohort (asthenozoospermia in 84.7%, necrozoospermia in 83.7%, and teratozoospermia in 64.8%) exceeds proportions reported in a Moroccan series (oligozoospermia 41.0%, asthenozoospermia 38.5%, necrozoospermia 35.9%) [11] and other African series [12]. The azoospermia proportion we observed (75.4%) is markedly higher than typically reported in varicocele-associated infertility, where oligo-astheno-teratozoospermia rather than azoospermia is the characteristic pattern. This high rate of azoospermia is unusual and could reflect obstructive causes of the vas deferens coexisting with varicocele in this population. A previous study conducted at one of these two referral centers similarly reported a high rate of azoospermia (47.6%) among men consulting for infertility [5].

The significant association between higher varicocele grade and both reduced progressive motility ($p = 0.002$) and reduced vitality ($p = 0.04$), without a corresponding association for semen volume or sperm morphology, is consistent with a Nigerian ultrasound-based study that correlated varicocele grade with seminal fluid parameters among infertile men [13]. Whether varicocele grade also predicts

the magnitude of improvement after surgical repair, as distinct from baseline severity, remains debated: a systematic review specifically addressing grade as a predictor of surgical response found inconsistent associations across studies [14], and our dataset did not stratify postoperative outcomes by preoperative grade. Mechanistically, the baseline association between grade and impaired motility or vitality fits the oxidative-stress model of varicocele-associated infertility, in which reactive oxygen species preferentially damage the sperm membrane and axonemal structures that govern motility and vitality while having a less direct effect on nuclear morphology [12] [15]. The absence of an association with semen volume is expected, because volume is determined chiefly by accessory gland secretion (seminal vesicles, prostate) rather than by testicular or epididymal function.

The Ivanissevich inguinal approach was the dominant surgical technique in our cohort (59.8%), followed by the Marmara subinguinal approach (34.2%); this mirrors the pattern in several other African series, where open inguinal surgery remains the mainstay because of its low cost and lack of dependence on microsurgical equipment [6].

The significant improvement in progressive motility after surgery (+12.0 percentage points, $p < 0.001$) is consistent with prior evidence that varicocelectomy most reliably improves sperm count and motility, with a less consistent effect on vitality and morphology [9] [16] [17]. Our finding specifically parallels that of Ajina *et al.*, who reported that varicocele repair significantly improved sperm count and motility in men with severe oligozoospermia or asthenozoospermia without a corresponding change in vitality or the proportion of abnormal forms [16]. The significant decrease in mean semen volume after surgery (-0.66 mL, $p < 0.001$) is a less expected finding that runs counter to most published cohorts, in which semen volume is generally unaffected by varicocelectomy, and should be interpreted cautiously given the selection bias discussed below.

Strengths

This study's principal strengths are its 10-year duration and its inclusion of both of Burkina Faso's largest urology-andrology referral centers, which together provide the largest multicenter dataset on adult varicocele reported from this country to date.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, its retrospective design, based on registers and clinical records collected over a 10-year period, limited the completeness of some variables. Hormonal assessment, in particular, was available for only 27.8% of patients, thereby limiting the ability to assess the relationship between endocrine parameters and the observed outcomes. Postoperative semen analysis was available for only 20.7% of patients (104 of 503). Because baseline sperm count was significantly higher in this subgroup than in the overall cohort, selection bias favoring patients with more favorable baseline semen parameters or better access to postoperative follow-up cannot be excluded. A formal comparison of baseline characteristics between pa-

tients who did and did not undergo postoperative semen analysis would have allowed this potential bias to be quantified; however, this analysis could not be performed because the original individual-level data were unavailable. Consequently, changes in semen parameters observed after surgery should be considered hypothesis-generating rather than representative of the surgical response of the entire cohort. No data on fertility or pregnancy outcomes were collected, precluding direct assessment of whether improvements in semen parameters translated into clinically meaningful benefits in couple fertility. The classification of subfertility as primary or secondary was based exclusively on the male partner's medical history, without systematic documentation of a concurrent evaluation of the female partner. Therefore, the presence of an unidentified female infertility factor cannot be excluded. Furthermore, the choice of surgical approach was left to the discretion of the operating surgeon in the absence of a standardized decision-making algorithm. The formulation, dosage, and duration of adjunctive treatment with antioxidants and multivitamins could not be reliably reconstructed from the source registries, limiting comparability with therapeutic protocols reported in other studies. Finally, because both participating centers were public university hospitals, the generalizability of these findings to private healthcare facilities or rural settings in Burkina Faso remains uncertain.

5. Conclusion

Varicocele is a frequent, often bilateral, and late-presenting condition among men consulting for couple infertility at Burkina Faso's two largest urology referral centers, and it is associated with severe semen abnormalities that worsen with increasing clinical and Doppler grade. Surgical repair, most often through an open inguinal or subinguinal approach, was safe and was followed by a significant improvement in sperm progressive motility in the minority of patients with postoperative follow-up, a finding that should be confirmed in a more representative sample before it is generalized to the full operated population. Strengthening early referral pathways for male-factor infertility and routine postoperative semen follow-up would help to better document and improve the fertility benefit of varicocelectomy in this and similar low-resource settings.

Ethics Approval and Consent to Participate

The study protocol was reviewed and approved by Burkina Faso's National Health Research Ethics Committee (Comité National d'Éthique pour la Recherche en Santé), and administrative authorization for data collection was granted by the directors of CHU-YO and CHU-SS. The study was conducted in accordance with the Declaration of Helsinki. Because data were obtained through retrospective review of routinely collected clinical records, the ethics committee waived the requirement for individual written informed consent; all records were anonymized with a unique identification code prior to analysis. This study did not involve a clinical trial and was not prospectively registered.

Consent for Publication

Not applicable. This manuscript does not contain any individual person's identifiable data, images, or videos.

Availability of Data and Materials

The de-identified dataset analyzed during the current study is not publicly available because it contains clinical information collected under an ethics approval that did not authorize public data sharing, but it is available from the corresponding author on reasonable request and subject to the approval of Burkina Faso's National Health Research Ethics Committee.

Author Contributions

Author contributions are reported using the CreDiT (Contributor Roles) taxonomy. All authors read and approved the final manuscript.

CRedit Role	B.K.	W.H.S.S.	O.J.D.Z.	Y.J.R.P.T.	H.S.	A.K.P.	A.K.O.	C.A.M.K.D.Y.	F.A.K.
Conceptualization	x	x	☐	☐	☐	☐	☐	☐	☐
Data curation	☐	☐	x	☐	☐	☐	☐	☐	☐
Formal analysis	x	☐	☐	☐	☐	☐	☐	☐	☐
Funding acquisition	☐	☐	☐	☐	☐	☐	☐	☐	☐
Investigation	☐	x	x	☐	x	☐	☐	☐	☐
Methodology	x	x	x	☐	☐	☐	☐	☐	☐
Project administration	☐	☐	☐	☐	☐	☐	☐	☐	x
Resources	☐	☐	☐	☐	☐	☐	☐	☐	☐
Software	☐	☐	☐	x	☐	x	☐	☐	☐
Supervision	x	☐	☐	☐	☐	☐	☐	x	x
Validation	x	x	☐	☐	☐	☐	☐	☐	x
Visualization	☐	☐	☐	☐	☐	☐	☐	☐	☐
Writing—original draft	x	x	x	x	x	x	x	x	x
Writing—review & editing	x	x	x	x	x	x	x	x	x

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

AI Disclosure Statement

No generative artificial intelligence tool was used in the design of the study, the collection or analysis of data, or the interpretation of results.

References

- [1] Lomboy, J.R. and Coward, R.M. (2016) The Varicocele: Clinical Presentation, Evaluation, and Surgical Management. *Seminars in Interventional Radiology*, **33**, 163-169. <https://doi.org/10.1055/s-0036-1586143>
- [2] Zini, A., Alsaikhan, B., Alrabeeah, K. and Delouya, G. (2016) Epidemiology of Varicocele. *Asian Journal of Andrology*, **18**, 179-181. <https://doi.org/10.4103/1008-682x.172640>
- [3] Jensen, C.F.S., Østergren, P., Dupree, J.M., Ohl, D.A., Sønksen, J. and Fode, M. (2017) Varicocele and Male Infertility. *Nature Reviews Urology*, **14**, 523-533. <https://doi.org/10.1038/nrurol.2017.98>
- [4] Ogunjimi, M.A., Abudu, O.A., Jeje, E.A., Ojewola, R.W. and Arogundade, R.A. (2024) A Prospective Study of the Association between Varicoceles and Semen Quality in Men with Infertility. *African Journal of Urology*, **30**, 1-7. <https://doi.org/10.1186/s12301-024-00452-z>
- [5] Kirakoya, B., Barnabé, Z., Abdoul Karim, P., Aristide, K.F., Clotaire, Y. and Amélie, N. (2015) Epidemiological and Clinical Profile of Male Hypofertility in Consultation at the Urology-Andrology of Yalgado Ouedraogo Teaching Hospital (Burkina Faso). *Advances in Sexual Medicine*, **5**, 1-6. <https://doi.org/10.4236/asm.2015.51001>
- [6] Diallo, A.B., Bah, I., Barry, M., Diallo, T.M.O., Bah, M.D., Kanté, D., et al. (2015) Adult Varicocele: Anatomico-Clinical Aspects and Therapeutic Results at the Urology-Andrology Department of Conakry University Hospital, Guinea. *African Journal of Urology*, **21**, 137-141. <https://doi.org/10.1016/j.afju.2015.02.002>
- [7] Diao, B., Sy, M.R., Fall, B., Sow, Y., Sarr, A., Mohamed, S., et al. (2012) Varicocèle et infertilité masculine. *Basic and Clinical Andrology*, **22**, 29-35. <https://doi.org/10.1007/s12610-012-0157-9>
- [8] Sikpa Komi, H., Agbédey Messan, S., Sewa Edoé, V., Zoléko Voufack Jorès, P., Botcho, G., Mbuya Musapudi, E., et al. (2023) Varicocele: Epidemiological, Clinical, and Paraclinical Profile in a Sub-Saharan City. *European Scientific Journal*, **19**, 193-204.
- [9] Huyghe, E., Methorst, C. and Faix, A. (2023) Varicocèle et infertilité masculine. *Progrès en Urologie*, **33**, 624-635. <https://doi.org/10.1016/j.purol.2023.09.003>
- [10] Gat, Y., Bachar, G.N., Zukerman, Z., Belenky, A. and Gornish, M. (2004) Varicocele: A Bilateral Disease. *Fertility and Sterility*, **81**, 424-429. <https://doi.org/10.1016/j.fertnstert.2003.08.010>
- [11] Benazzouz, M.H., Essatara, Y., Sayegh, H.E., Iken, A., Benslimane, L. and Nouini, Y. (2014) Impact of Varicocele on Testicular Volume and Semen Parameters. *Pan African Medical Journal*, **19**, Article No. 334. <https://doi.org/10.11604/pamj.2014.19.334.4693>
- [12] Agarwal, A., Cannarella, R., Saleh, R., Boitrelle, F., Gül, M., Toprak, T., et al. (2023) Impact of Varicocele Repair on Semen Parameters in Infertile Men: A Systematic Review and Meta-Analysis. *The World Journal of Men's Health*, **41**, 289-310. <https://doi.org/10.5534/wjmh.220142>
- [13] Abdullahi, M.Z., Mato, I.I., Suleiman, I.A. and Aliyu, I. (2026) Correlation of Ultrasonographic Varicocele Grading with Seminal Fluid Analysis in Male Infertility at Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. *Nigerian Medical Journal*, **67**, 1617-1622.
- [14] Asafu-Adjei, D., Judge, C., Deibert, C.M., Li, G., Stember, D. and Stahl, P.J. (2020) Systematic Review of the Impact of Varicocele Grade on Response to Surgical Man-

- agement. *Journal of Urology*, **203**, 48-56.
<https://doi.org/10.1097/ju.0000000000000311>
- [15] Bisht, S., Faiq, M., Tolahunase, M. and Dada, R. (2017) Oxidative Stress and Male Infertility. *Nature Reviews Urology*, **14**, 470-485.
<https://doi.org/10.1038/nrurol.2017.69>
- [16] Ajina, M., Amor, H.B., Mehdi, M., Mosbah, S., Mougou, A.T., Saad, H., *et al.* (2002) Short- and Long-Term Effects of Varicocele Repair on Semen Characteristics. *Andrologie*, **12**, 186-193. <https://doi.org/10.1007/bf03034964>
- [17] Fallara, G., Capogrosso, P., Pozzi, E., Belladelli, F., Corsini, C., Boeri, L., *et al.* (2023) The Effect of Varicocele Treatment on Fertility in Adults: A Systematic Review and Meta-Analysis of Published Prospective Trials. *European Urology Focus*, **9**, 154-161.
<https://doi.org/10.1016/j.euf.2022.08.014>