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COMPARISON OF LAPAROSCOPIC VERSUS MICROSURGICAL VERICOCELECTOMY IN TERMS OF SPERM COUNT

Original Research

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ABSTRACT

Background: Infertility affects nearly 15% of couples of reproductive age, with male factors contributing to 40–50% of cases. Varicocele, an abnormal dilation of the pampiniform plexus veins, is one of the most common reversible causes of male infertility, observed in approximately 16–21% of men presenting to infertility clinics. It impairs spermatogenesis through testicular hyperthermia and venous congestion, leading to poor semen quality. Surgical correction through varicocelectomy remains the mainstay of treatment, with microscopic and laparoscopic techniques being the most widely practiced.

Objective: To compare the improvement in sperm count following laparoscopic and microscopic sub-inguinal varicocelectomy in infertile males diagnosed with varicocele.

Methods: This randomized controlled trial was conducted at the Department of Urology, Hayatabad Medical Complex, Peshawar, from January 1, 2025, to June 30, 2025. A total of 80 males aged 18–40 years with Doppler-confirmed unilateral varicocele were enrolled and randomly divided into two equal groups. Group A (n=40) underwent microscopic sub-inguinal varicocelectomy, while Group B (n=40) underwent laparoscopic varicocelectomy. Semen analyses were performed preoperatively and at four months postoperatively. Data were analyzed using SPSS version 22, applying paired t-tests for within-group and independent t-tests for between-group comparisons, with a p-value <0.05 considered significant.

Results: The mean preoperative sperm count in the microscopic group was 13.68 ± 4.77 million/mL, increasing to 23.86 ± 6.14 million/mL postoperatively ($t = -20.03$, $p < 0.001$). In the laparoscopic group, counts rose from 15.25 ± 3.79 million/mL to 21.55 ± 4.42 million/mL ($t = -13.84$, $p < 0.001$). The between-group comparison showed a near-significant difference ($t = 1.91$, $p = 0.061$), suggesting a trend favoring the microscopic approach.

Conclusion: Both microscopic and laparoscopic varicocelectomy significantly improved sperm counts, confirming varicocelectomy as an effective surgical treatment for varicocele-related male infertility. The microscopic technique showed a slight advantage in enhancing spermatogenesis, though larger multicenter trials are needed to validate this difference.

Keywords: Infertility, Laparoscopy, Male infertility, Microsurgery, Sperm count, Varicocele, Varicocelectomy.

INTRODUCTION

Infertility is a significant global health concern, affecting approximately 15% of couples of reproductive age, with male factors accounting for 40–50% of cases (1). Various underlying causes contribute to male infertility, including low sperm production, abnormal sperm function, and anatomical obstructions that hinder sperm transport. Additionally, conditions such as undescended testes, hormonal imbalances, genetic abnormalities like Klinefelter's syndrome, infections, and lifestyle factors—such as the use of tobacco, alcohol, and illicit drugs—further compromise male reproductive potential (2). Environmental exposures and occupational hazards also play a substantial role in diminishing sperm quality and overall fertility. Among the identifiable and potentially correctable physical causes of male infertility, varicocele remains one of the most prevalent. Characterized by dilated and tortuous veins within the pampiniform plexus of the scrotum, varicocele bears resemblance to varicose veins of the lower limbs (3). It is observed in about 16–21% of men presenting to infertility clinics and is known to impair spermatogenesis by increasing scrotal temperature and venous stasis, leading to oxidative stress, reduced sperm motility, and DNA damage (4). Typically developing during adolescence and more frequently occurring on the left side, varicocele has been strongly linked to secondary infertility—a condition where fertility declines over time (5). Although some men with varicocele remain fertile, numerous studies have demonstrated associations between varicocele and reduced semen quality, decreased testicular volume, and hormonal alterations affecting Leydig cell function (6). Varicocelectomy, the standard surgical intervention for varicocele, aims to interrupt refluxing veins in the spermatic cord to restore normal testicular hemodynamics and enhance spermatogenesis (7).

The main objectives of surgery include alleviation of scrotal pain, prevention of testicular atrophy, and improvement of semen parameters to facilitate spontaneous conception (8). Several surgical techniques are currently practiced, each with distinctive advantages and limitations. Microsurgical varicocelectomy, regarded as the gold standard, is usually performed through an inguinal or subinguinal approach under an operating microscope. This technique allows precise identification and preservation of arteries and lymphatics while ensuring effective ligation of dilated veins, thereby minimizing recurrence and postoperative complications such as hydrocele formation (9). In contrast, laparoscopic varicocelectomy, a minimally invasive alternative, offers shorter hospital stays, faster recovery, and reduced postoperative discomfort by ligating internal spermatic veins at a higher retroperitoneal level. However, it carries a slightly higher recurrence rate and risk of hydrocele due to possible incomplete ligation of external spermatic or cremasteric veins (10). Both surgical approaches have shown efficacy in improving semen quality and fertility outcomes; however, comparative evidence regarding their relative effectiveness remains variable. Microsurgical varicocelectomy generally offers superior precision and lower recurrence, while laparoscopic varicocelectomy provides faster postoperative recovery and reduced pain. A balanced evaluation considering patient condition, surgeon expertise, and institutional resources is essential for selecting the optimal surgical method. Therefore, this study was conducted to compare the improvement in sperm count following laparoscopic and microscopic sub-inguinal varicocelectomy, thereby determining which approach yields better reproductive outcomes.

METHODS

This randomized controlled trial was conducted in the Department of Urology, Hayatabad Medical Complex, Peshawar, from January 1, 2025, to June 30, 2025, after obtaining ethical approval from the Institutional Review Board of the hospital. Written informed consent was obtained from all participants prior to inclusion in the study, and confidentiality of patient data was maintained throughout in accordance with the Declaration of Helsinki. The study aimed to compare the improvement in sperm count following two surgical techniques—microsurgical and laparoscopic varicocelectomy—in men diagnosed with varicocele. A total of 80 male patients diagnosed with varicocele were enrolled using a randomized sampling technique and were equally divided into two groups, with 40 patients in each group. Group A underwent microsurgical sub-inguinal varicocelectomy, while Group B received laparoscopic varicocelectomy. All procedures were performed by experienced urologists using standardized surgical protocols to minimize operator bias. Eligible participants included men aged 18 to 40 years who had a confirmed diagnosis of varicocele within the preceding 12 months. Varicocele was defined as a spermatic venous diameter greater than 3 mm with demonstrable venous reflux on Doppler ultrasonography, while oligospermia was defined as a sperm count of less than 15 million per milliliter according to World Health Organization (WHO) criteria.

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Patients with bilateral or recurrent varicocele, or those with additional scrotal pathologies such as spermatocele, hydrocele, epididymitis, or inguinal hernia causing scrotal discomfort, were excluded to avoid confounding factors. Participants with systemic illnesses, previous pelvic surgery, or ongoing genitourinary infections were also excluded. Baseline demographic characteristics, including age and clinical history, were documented for all patients. Both surgical procedures were performed under appropriate anesthesia, and patients were discharged on the same day following post-operative stabilization. Standard postoperative care instructions were provided, including activity restrictions and analgesic use. Semen analysis was performed twice—initially before surgery to establish baseline sperm count and four months postoperatively to assess improvement. Semen samples were collected by masturbation following 3–5 days of abstinence and analyzed within one hour of collection according to WHO laboratory manual protocols. All data were recorded in Microsoft Excel spreadsheets and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 22. Continuous variables such as age and sperm count were expressed as mean ± standard deviation (SD). The independent t-test was employed to compare mean sperm counts between the two groups, while paired t-tests were applied for within-group pre- and post-operative comparisons. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study included 80 male participants diagnosed with varicocele, evenly divided between those undergoing microscopic and laparoscopic varicocelectomy. The mean age of patients in the microscopic group was 31.18 ± 7.24 years, whereas those in the laparoscopic group had a mean age of 32.83 ± 7.29 years. The mean body mass index (BMI) was 23.63 ± 2.90 kg/m² in the microscopic group and 24.09 ± 2.95 kg/m² in the laparoscopic group. The average duration of infertility was 4.92 ± 2.52 years in patients treated microscopically and 4.69 ± 2.83 years in those treated laparoscopically. These findings indicate that both groups were comparable in baseline demographics, with no substantial differences in age, BMI, or infertility duration. Preoperative semen analyses showed a mean sperm count of 13.68 ± 4.77 million/mL in the microscopic group and 15.25 ± 3.79 million/mL in the laparoscopic group. Following surgery, mean sperm counts improved to 23.86 ± 6.14 million/mL and 21.55 ± 4.42 million/mL, respectively. Both surgical techniques resulted in statistically significant postoperative improvements compared with preoperative values. Within-group paired t-test analysis demonstrated highly significant increases in sperm counts in both microscopic ($t = –20.03$, $p < 0.001$) and laparoscopic ($t = –13.84$, $p < 0.001$) procedures, confirming the effectiveness of both approaches in improving spermatogenic function. When comparing the two techniques directly using the independent t-test, the postoperative sperm count difference approached but did not reach statistical significance ($t = 1.91$, $p = 0.061$). This result suggests a trend toward superior sperm count improvement in the microscopic group, although the evidence was not conclusive within the present sample size. The higher t-value for the microscopic group indicates a greater magnitude of response, potentially reflecting enhanced efficacy of this method in restoring testicular function.

Table 1: Baseline Demographic and Clinical Characteristics of Patients Undergoing Microscopic and Laparoscopic Varicocelectomy

Surgery Type	Age (Mean ± SD)	BMI (Mean ± SD)	Infertility Duration (Mean ± SD)
Microscopic	31.18 ± 7.24	23.63 ± 2.90	4.92 ± 2.52
Laparoscopic	32.83 ± 7.29	24.09 ± 2.95	4.69 ± 2.83

Table 2: Comparison of Preoperative and Postoperative Mean Sperm Counts between Microscopic and Laparoscopic Varicocelectomy

Surgery Type	Pre-Op Mean (±SD)	Post-Op Mean (±SD)
Microscopic	13.68 ± 4.77	23.86 ± 6.14
Laparoscopic	15.25 ± 3.79	21.55 ± 4.42

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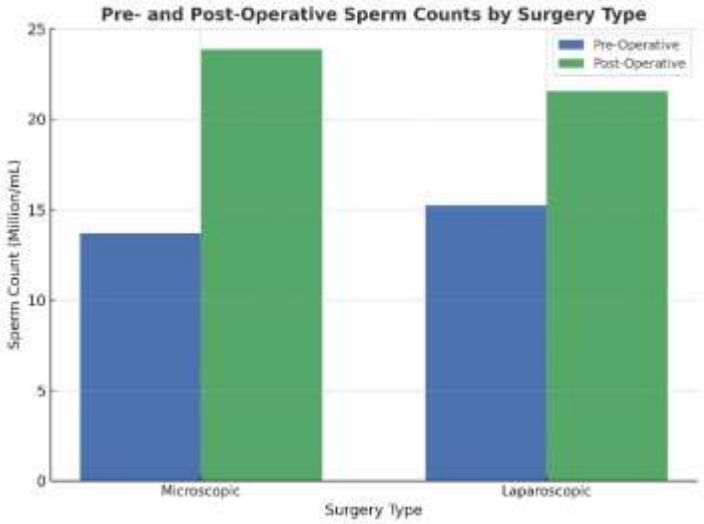

Figure 1 Pre- and Post-Operative Sperm Counts by Surgery Type

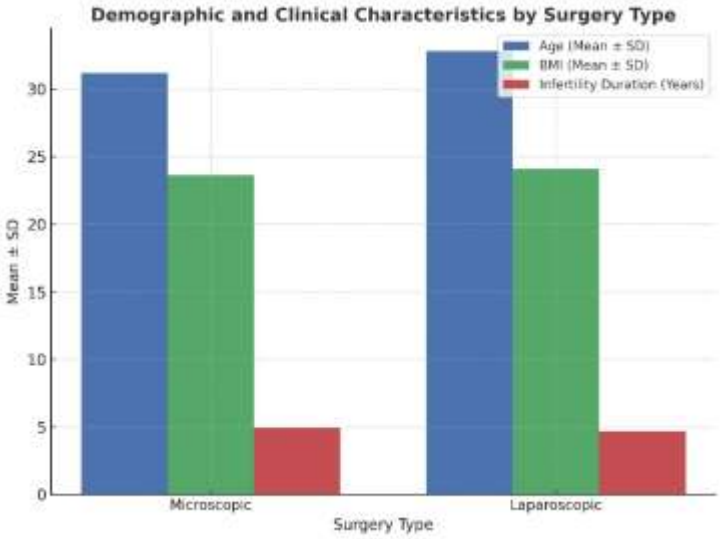

Figure 2 Demographic and Clinical Characteristics by Sugary Type

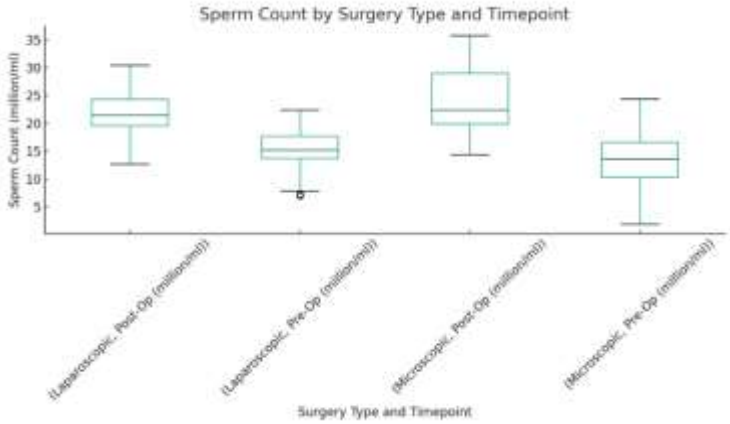

Figure 3 Sperm Count by Sugary Type and Timepoint

DISCUSSION

The study compared the clinical efficacy of laparoscopic and microscopic varicocelectomy procedures in improving sperm count among males with varicocele, taking into account patient demographics and postoperative quantitative outcomes. The findings revealed that both surgical approaches produced a statistically significant increase in sperm count, demonstrating the therapeutic value of varicocelectomy as an effective intervention for male infertility associated with varicocele. Although the difference between the two surgical techniques did not reach statistical significance, a trend favoring the microscopic approach was observed, suggesting potential superiority in enhancing spermatogenic recovery. The observed improvements in sperm count following both microscopic and laparoscopic varicocelectomy are consistent with prior research establishing varicocelectomy as a reliable treatment for male subfertility caused by venous reflux (11-13). Numerous studies have reported significant increases in sperm concentration within 3 to 6 months after surgery, with improvement rates ranging from 38% to over 70%, depending on the severity and laterality of varicocele as well as patient-specific factors (14). The underlying mechanism is believed to involve the restoration of normal testicular microcirculation, the reduction of scrotal temperature, and the mitigation of oxidative stress, which collectively contribute to improved spermatogenesis and hormonal regulation (15). In many cases, improvements in sperm motility and morphology accompany the rise in sperm count, though

to a lesser extent, possibly reflecting varying degrees of recovery in spermatogenic cell function (16). The findings also align with the understanding that spermatogenic recovery typically stabilizes within 3 to 6 months post-surgery, paralleling the duration of the spermatogenic cycle (17). This suggests that early postoperative improvements are a meaningful indicator of long-term outcomes. The comparable efficacy between the two surgical techniques reinforces the notion that the choice of approach should be guided by surgeon expertise, patient preference, and available resources rather than efficacy alone. However, the microsurgical approach, by virtue of its precision and reduced recurrence rates, may offer a marginal advantage in optimizing testicular function and preventing postoperative complications (18-20).

The study's strengths include its randomized design, homogeneity of patient characteristics, and standardized evaluation of outcomes. These factors minimize selection bias and enhance internal validity. Nevertheless, certain limitations must be acknowledged. The relatively small sample size limits the statistical power to detect subtle differences between the two procedures. The absence of additional semen parameters such as motility and morphology restricts the comprehensiveness of reproductive assessment. Moreover, the follow-up period of four months, although sufficient for early postoperative assessment, may not fully capture long-term fertility outcomes or spontaneous conception rates. Future research should therefore incorporate extended follow-up intervals, include female partner fertility assessment, and evaluate parameters such as serum testosterone, motility, and DNA fragmentation indices for a more holistic understanding of varicocelectomy outcomes. Overall, the present study reinforces existing evidence that both laparoscopic and microscopic varicocelectomy are effective in improving sperm count and thus hold substantial clinical value in managing male infertility. The comparable outcomes between both techniques affirm varicocelectomy as a cornerstone of surgical management for varicocele, while the slight advantage of the microscopic method supports its continued preference in specialized centers. Future large-scale multicenter trials are warranted to confirm these findings and to explore whether improved sperm quality translates into higher pregnancy and live birth rates (21,22).

CONCLUSION

In conclusion, the study demonstrated that both microscopic and laparoscopic varicocelectomy are effective surgical interventions for improving spermatogenesis in men with varicocele-related infertility. The significant postoperative enhancement in sperm count affirms the therapeutic value of varicocelectomy as a key treatment for male infertility, supporting its continued use in clinical practice. While both techniques yielded favorable outcomes, the microscopic approach showed a slight advantage in optimizing testicular function, suggesting it may be the preferred option where expertise and resources permit. These findings highlight the critical role of timely surgical correction in restoring male reproductive potential and improving the likelihood of natural conception.

AUTHOR CONTRIBUTION

Author	Contribution
Mir Abid Jan*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Khalil Ur Rehman	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Naveed Ahmad Khan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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REFERENCES

1. Babakhanzadeh E, Nazari M, Ghasemifar S, Khodadadian A. Some of the Factors Involved in Male Infertility: A Prospective Review. Int J Gen Med. 2020;13:29–41.

2. Kantartzi: Update on the role of varicocele in male... - Google Scholar [Internet]. [cited 2025 Aug 5].

3. Kotb S, Abdel-Rassoul MA, Elkousy MM, El-Shorbagy G, Elsayed AS, Abdel-Rahman S, et al. Comparison of the pulling technique versus the standard technique in microsurgical subinguinal varicocelectomy: a randomized controlled trial. African Journal of Urology. 2023 Dec 13;29(1):69.

4. Long-term effects of microsurgical varicocelectomy on pain and sperm parameters in clinical varicocele patients with sc… [Internet]. [cited 2025 Aug 6].

5. Mei Y, Ji N, Feng X, Xu R, Xue D. Don't wait any longer, conceive in time: a systematic review and meta-analysis based on semen parameters after varicocelectomy. Int Urol Nephrol. 2024 Oct;56(10):3217–29.

6. Cannarella R, Shah R, Hamoda TAAAM, Boitrelle F, Saleh R, Gul M, et al. Does Varicocele Repair Improve Conventional Semen Parameters? A Meta-Analytic Study of Before-After Data. World J Mens Health. 2024 Jan;42(1):92–132.

7. Shahzad S, Waqar Shahid M, Azeem Mughal M, Ullah I, Rehman Khan A ur. Comparison of Open Sub-Inguinal and Microscopic Sub-Inguinal Varicocelectomy for Improvement of Sperm Parameters. PJMHS. 2021 Oct 30;15(10):2882–5.

8. Kaya C, Eryilmaz S, Kapisiz A, Atan A, Karabulut R, Türkyilmaz Z, et al. Use of intraoperative microvascular Doppler during subinguinal microsurgical varicocelectomy in children reduces complications. Turk J Med Sci. 2024;54(4):778-83.

9. Syarief AN, Rahman IA, Sangadji ARS, Djojodimedjo T, Rizaldi F. A systematic review and meta-analysis on the efficacy of internal spermatic artery ligation during laparoscopic varicocelectomy in children and adolescents: Is it safe? Arch Ital Urol Androl. 2023;95(3):11627.

10. Lu LJ, Xiong K, Yuan SL, Che BW, Zhai JC, Wu CC, et al. Surgical approaches to varicocele: a systematic review and network meta-analysis. Asian J Androl. 2025;27(6):728-37.

11. Darves-Bornoz A, Panken E, Brannigan RE, Halpern JA. Robotic Surgery for Male Infertility. Urol Clin North Am. 2021;48(1):127-35.

12. Shomarufov AB, Bozhedomov VA, Sorokin NI, Matyukhov IP, Fozilov AA, Abbosov SA, et al. Predictors of microsurgical varicocelectomy efficacy in male infertility treatment: critical assessment and systematization. Asian J Androl. 2023;25(1):21-8.

13. Porto JG, Raymo A, Suarez Arbelaez MC, Gurayah AA, Ramasamy R. Patient Satisfaction and Long-Term Clinical Outcomes in Adolescent Sub-inguinal Microscopic Varicocelectomy. Cureus. 2023;15(8):e44349.

14. Su JS, Farber NJ, Vij SC. Pathophysiology and treatment options of varicocele: An overview. Andrologia. 2021;53(1):e13576.

15. Zhang G, Li J, Xu Z, Li J, Chen S. Microscopic Varicocelectomy under Local Anesthesia as the Treatment of Varicocele. J Vis Exp. 2024(212).

16. Al-Gadheeb A, El-Tholoth HS, Albalawi A, Althobity A, AlNumi M, Alafraa T, et al. Microscopic subinguinal varicocelectomy for testicular pain: a retrospective study on outcomes and predictors of pain relief. Basic Clin Androl. 2021;31(1):1.

17. Drlík M, Faltusová E, Vaĺová Z, Sedláček J, Dítě Z, Kočvara R. Laparoscopic lymphatic and artery sparing microsurgical varicocelectomy - technique, results and long-term outcomes. J Pediatr Urol. 2022;18(2):114.e1-.e6.

18. Kale S, Rashid T. Feasibility of loupe assisted subinguinal varicocelectomy in treatment of male infertility. Actas Urol Esp (Engl Ed). 2022;46(9):515-20.

19. Alkhamees M, Bin Hamri S, Alhumaid T, Alissa L, Al-Lishlish H, Abudalo R, et al. Factors Associated with Varicocele Recurrence After Microscopic Sub-Inguinal Varicocelectomy. Res Rep Urol. 2020;12:651-7.

20. Sharma S, Shimpi RK. Estimation of haemodynamic changes in varicocele testis and results after microsurgical sub-inguinal varicocelectomy. Urologia. 2023;90(1):164-9.

21. Zhang X, Deng C, Liu W, Liu H, Zhou Y, Li Q, et al. Effects of varicocele and microsurgical varicocelectomy on the metabolites in semen. Sci Rep. 2022;12(1):5179.

22. Mahdi M, Majzoub A, Khalafalla K, To J, Aviles-Sandoval M, Elbardisi H, et al. Effect of redo varicocelectomy on semen parameters and pregnancy outcome: An original report and meta-analysis. Andrologia. 2022;54(10):e14525.