

Adult Varicocelelectomy for Testosterone Recovery Scrotal Pain Relief and Health Related Quality of Life: A critical review with structured synthesis of published meta analyses

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Danilo Ferreira de Sousa

Postdoctoral training at Universidade Federal de Alfenas.
PhD in Nursing, Universidade Federal do Ceará. Email:
prof.danilofersousa@gmail.com. ORCID: 0000-0001-9281-165X.

Maria Isabel Pires Teixeira

Medical student, Faculdade de Petrolina, Petrolina,
Pernambuco, Brazil. Email: belzinhapt@gmail.com.

Davi Pedro Soares Macedo

Medical student, Faculdade Paraíso (FAP), Araripina,
Pernambuco, Brazil. Email: davipedros123@gmail.com.

Edglê Pedro de Sousa Filho

Degree in Medicine, Universidade Federal do Ceará (1992).
PhD in Health Sciences, Centro Universitário Saúde ABC
(2018). Email: edglefilho@gmail.com.

Uilna Natércia Soares Feitosa

PhD in Health Sciences in Clinical Investigation, Faculdade
de Medicina do ABC. Degree in Veterinary Medicine,
Universidade Estadual do Ceará (1998). Degree in Nursing,
Universidade de Fortaleza (1991). Email:
uilna@hotmail.com.

Rafaela Nonato de Menezes

Postgraduate Program in Biotechnology, Universidade
Federal do Ceará. Email: rafaela.nonato@hotmail.com.
ORCID: 0000-0001-7468-3391.

ABSTRACT

Adult varicocele has consequences beyond infertility, including impaired androgen production, persistent scrotal discomfort, and reduced well-being. This review evaluates the evidence for varicocelelectomy across these outcomes while distinguishing biochemical change from patient-centered benefit. PubMed-indexed publications were identified through topic-based electronic searches and targeted retrieval, with records verified on 7 October 2026. Published meta-analyses were summarized at their original level of aggregation; overlapping reviews were not pooled again. Primary observational studies were used to examine clinical applicability and directly measured quality of life. The largest selected endocrine meta-analysis reported a postoperative testosterone increase of 82.45 ng/dL, while a hypogonadism-focused review reported an increase of 113.87 ng/dL. Pain-focused meta-analyses favored selected microsurgical approaches, although heterogeneous definitions and nonrandomized comparisons limited causal interpretation. A recent prospective study of 45 operated men reported an improvement in WHOQOL-BREF scores at three months, providing direct but uncontrolled evidence for broader well-being. Across outcomes, fertility-clinic

recruitment, baseline hormonal status, selection for surgery, and short follow-up constrain generalizability. Varicocelectomy may offer meaningful endocrine and symptomatic benefits in appropriately evaluated adults, but biochemical recovery cannot establish improvement in global quality of life. Controlled studies integrating repeated hormone measurements, standardized pain outcomes, validated quality-of-life domains, and longer follow-up remain necessary.

Keywords: Varicocele, Testosterone, Scrotal pain, Quality of life, Evidence synthesis.

1 INTRODUCTION

The adult with a clinical varicocele may seek care because of infertility, discomfort, concern about declining testosterone, or a combination of these problems. These presentations create different treatment questions. A man with persistent pain wants to know whether surgery will permit comfortable activity. A man with biochemical androgen deficiency wants to know whether endogenous production will recover. Someone troubled by both problems may reasonably expect improved well-being, but that expectation requires evidence that measures well-being directly.

The literature on varicocele repair developed largely within male infertility practice. Consequently, endocrine and symptomatic findings frequently come from patients selected for reproductive indications. The coexistence of infertility, sexual symptoms, and a surgically correctable venous abnormality complicates attribution: postoperative satisfaction can arise from counseling, perceived restoration of fertility potential, reduced pain, or hormonal change. These mechanisms may coexist without being equally supported by the available studies (Lundy et al., 2018; Hayden et al., 2016).

The relevant clinical question is therefore broader than whether a laboratory concentration rises after an operation. It concerns the balance between improvement, uncertainty, procedural burden, and the patient's original reason for seeking treatment. Testosterone is an objective biochemical outcome, pain is a subjective symptom with multiple possible causes, and global quality of life is a multidimensional construct. Combining them into a single success rate obscures clinically important distinctions.

This review examines adult varicocelectomy through these three outcome domains. Its objectives are to describe the magnitude and meaning of published endocrine estimates, assess the evidence for relief of varicocele-associated pain, and identify what can currently be concluded about health-related quality of life. Quantitative results are drawn from verified PubMed-indexed articles and are presented as estimates from the original publications rather than as a newly calculated pooled treatment effect.

2 THEORETICAL FRAMEWORK

2.1 Biological plausibility and clinical heterogeneity

Proposed pathways linking varicocele to testicular dysfunction include altered venous drainage, increased local temperature, hypoxia, and oxidative stress. These mechanisms provide a plausible explanation for disturbed spermatogenesis and Leydig-cell function. They do not establish that every clinically apparent varicocele causes testosterone deficiency or that repair will restore a particular individual's hormonal output. Mechanistic plausibility and average treatment response answer different questions (Hayden et al., 2016; Lundy et al., 2018).

Pain introduces a further causal challenge. Varicoceles are common enough to coexist with unrelated scrotal symptoms. The detection of dilated veins therefore cannot by itself establish the source of pain. A symptom pattern linked to prolonged standing or exertion may strengthen clinical attribution, whereas abrupt, atypical, or persistent neuropathic symptoms require a broader evaluation. The pain literature emphasizes the need for careful selection before surgical repair (Owen et al., 2017).

Hormonal status also varies. Infertile men with low baseline testosterone differ from eugonadal adults undergoing surgery mainly for discomfort. A postoperative increase may be more important when it accompanies improvement in relevant symptoms than when it merely moves a normal concentration within its reference interval. Age, metabolic health, concurrent medications, and the timing of measurement can further influence clinical interpretation.

2.2 Defining benefit across three domains

The endocrine domain concerns total or free testosterone and related pituitary hormones. The symptomatic domain concerns pain intensity, pain resolution, recurrence, and interference with daily activity. The quality-of-life domain concerns physical, psychological, social, and contextual functioning. An erectile-function score can contribute to this assessment, but it does not replace a generic or comprehensive health-related quality-of-life instrument.

The conceptual model used here treats these outcomes as connected but noninterchangeable. An operation may improve one domain without improving the others. This distinction guides the evidence tables, graphical summaries, and interpretation that follow.

3 METHODOLOGY

3.1 Review design and retrieval

This manuscript is a structured critical review with synthesis of published meta-analytic evidence. It is not a registered systematic review or a de novo meta-analysis of primary studies. Retrieval combined topic-based PubMed searches with targeted searches for relevant reviews and illustrative clinical studies. The search and verification date was 7 October 2026. Only articles with a verified PubMed record were used as references.

The principal PubMed query combined varicocele with testosterone, hypogonadism, pain, or quality of life, using title and abstract fields and a publication-date limit ending on the verification date. It returned 1,072 records at the time of retrieval. This count describes the electronic query, not the number of records screened. Targeted retrieval was then used to identify publications addressing the prespecified outcome domains. Seventeen records were retained for the critical synthesis. A complete screening of the 1,072 records, independent duplicate selection, and a PRISMA exclusion flow were not performed.

Published summaries and PubMed bibliographic information formed the verified extraction basis. Reported effect estimates, confidence intervals, participant counts, study designs, and assessment instruments were transcribed where available. Full-text-only outcomes were not inferred when the relevant information was unavailable in the verified record. This restriction makes the synthesis transparent but limits detailed appraisal of individual study conduct.

3.2 Eligibility and scope

Priority was given to meta-analyses of clinical varicocele repair, reviews of painful varicocele, and adult observational studies assessing hormonal or patient-reported outcomes. Infertility-centered publications were retained when they contributed relevant endocrine or symptom evidence, with their restricted applicability stated. Review-level results with mixed or incompletely characterized age distributions were not treated as adult-specific causal effects. Animal experiments, nonindexed material, and unsupported clinical claims were excluded from the narrative.

3.3 Quantitative synthesis and safeguards

Meta-analytic estimates were retained in their published units and original comparator structures. Mean differences in testosterone were not combined with odds ratios for hypogonadism. Comparative pain

odds ratios were not interpreted as absolute postoperative success rates. Because reviews may include the same primary studies, no overall pooled estimate across reviews was calculated. Summing their participant totals would similarly overstate the amount of independent evidence.

The graphical summaries display source estimates and their reported confidence intervals. They do not contain recalculated study weights, a new pooled diamond, publication-bias tests, or simulated patient observations. For the quality-of-life illustration, the two reported means are shown without a confidence interval for the paired change because the covariance needed for that calculation was not available.

Table 1. Outcome definitions and interpretation rules

Outcome	Extracted measure	Interpretive boundary
Androgen production	Total testosterone mean difference in ng/dL	Biochemical improvement does not establish symptom resolution
Varicocele and hypogonadism	Odds ratio from association studies	Association does not establish a surgical treatment effect
Pain	Resolution odds ratio or reported clinical improvement	Comparative odds and absolute success are different quantities
Sexual function	Reported erectile-function scale change	A sexual-function scale is not a global quality-of-life measure
Global well-being	WHOQOL-BREF assessment	An uncontrolled change cannot establish benefit relative to observation
Safety	Reported recurrence and complications	Rates require comparable follow-up and case definitions

Source: Review framework informed by the outcome structures of the cited publications.

The appraisal considered confounding, ascertainment, attrition, outcome selection, and applicability. It did not assign formal Newcastle-Ottawa, AMSTAR, or GRADE scores. A statement of methodological concern should therefore be read as a reasoned interpretation of the available evidence rather than a validated risk-of-bias rating.

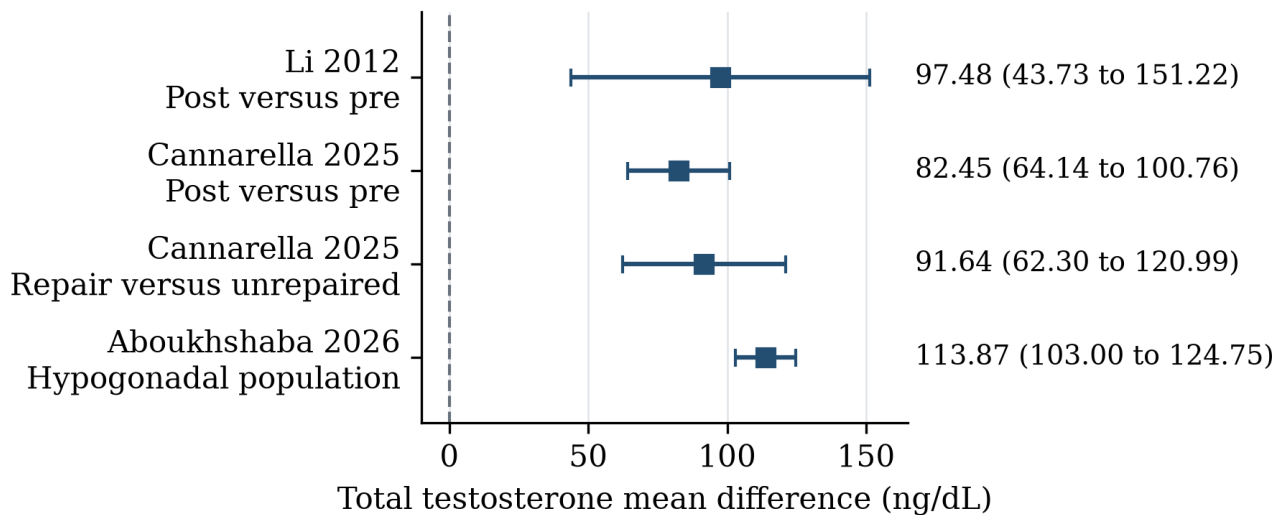
4 RESULTS AND DISCUSSION

4.1 Testosterone estimates from published meta analyses

Cannarella et al. (2025) included 48 articles in an endocrine review and reported a postoperative total-testosterone mean difference of 82.45 ng/dL relative to pretreatment values. Its comparison with

unrepaired varicocele yielded 91.64 ng/dL. These are separate contrasts, and the controlled comparison is more directly relevant to the counterfactual question of what would occur without repair. Neither estimate establishes uniform recovery across individual patients.

Figure 1. Published testosterone estimates by review and comparator.



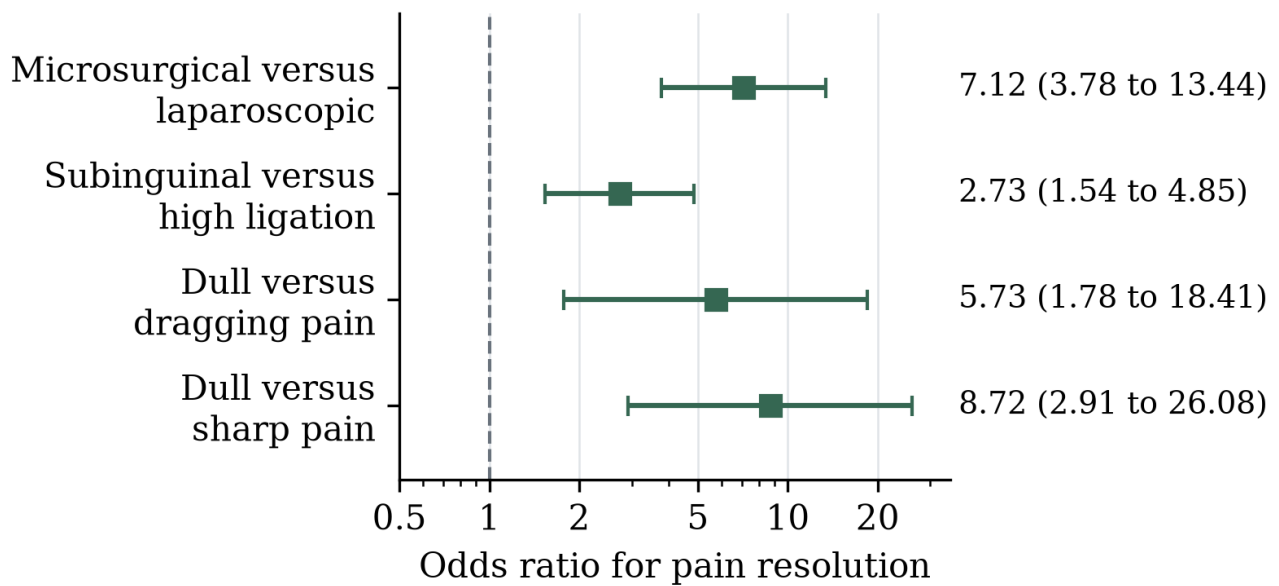
Source: Li et al. (2012), Cannarella et al. (2025), and Aboukhshaba et al. (2026). Bars are the reported 95% confidence intervals. Reviews and contrasts may overlap; no new pooled estimate is calculated.

Aboukhshaba et al. (2026) focused on hypogonadal men and reported an increase of 113.87 ng/dL across 18 studies involving 1,225 patients. Li et al. (2012) reported 97.48 ng/dL in an earlier infertility-centered synthesis. Their differences may reflect population selection, study inclusion, and analytic choices. Agreement in direction is clinically relevant, but overlap prevents treating the estimates as independent replications of a single treatment effect.

4.2 Pain outcomes and surgical comparisons

Park et al. (2021) included 14 studies and reported greater odds of pain resolution for microsurgical than laparoscopic repair. The same review favored subinguinal over high ligation and found higher odds of resolution for dull than for sharp or dragging pain. These comparisons suggest that selection and technique matter, but they do not isolate surgical expertise, differences in patients, or outcome assessment.

Figure 2. Comparative pain resolution estimates from an updated published meta analysis.



Source: Park et al. (2021). Odds ratios and 95% confidence intervals are shown on a logarithmic axis. Each row has a different comparator; no overall summary is appropriate.

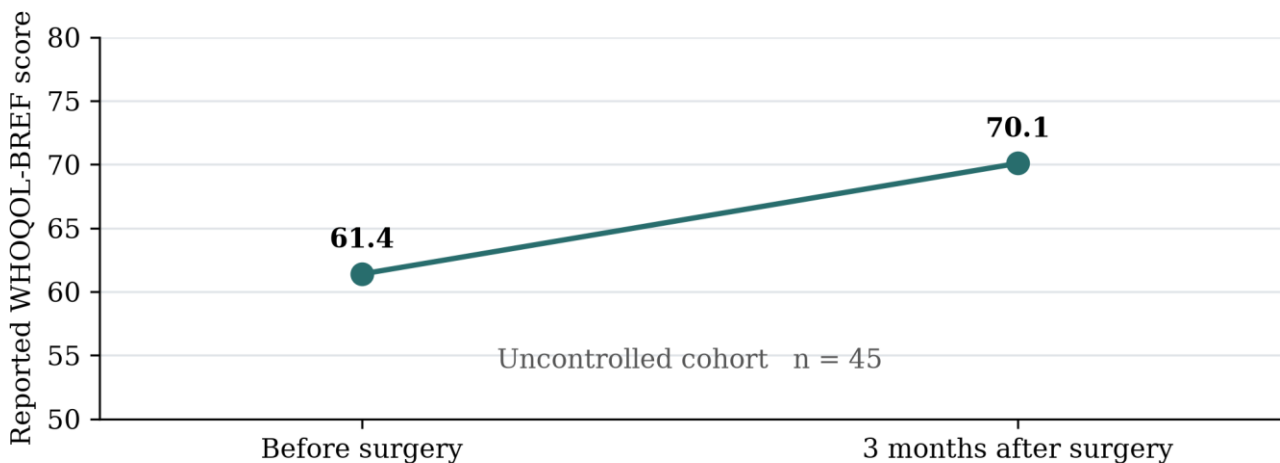
The earlier review by Han et al. (2016) also favored selected approaches, but its risk-ratio orientation and comparisons differ. Its estimates should not be placed on the same scale as the odds ratios without careful harmonization. Both reviews found no consistent relationship between clinical grade and pain resolution, a useful caution against basing prognosis on grade alone.

In the series by Kim et al. (2012), complete resolution occurred in 58 of 81 patients and partial resolution in 16. This distinction illustrates why a combined improvement endpoint can appear more favorable than a pain-free endpoint. The age indexing also limits an unqualified adult-only interpretation of that series.

4.3 Direct evidence for health related quality of life

Özmez and Özgür (2026) assessed 45 men with clinical varicocele before microsurgical subinguinal repair and at three months. They reported WHOQOL-BREF total scores of 61.4 before surgery and 70.1 afterward. The arithmetic difference is 8.7 points, but its importance depends on the instrument's scoring method, measurement properties, and the patient's functional experience. The verified summary reported a statistically significant change; it did not provide a nonsurgical comparator.

Figure 3. Reported quality of life means in a prospective observational cohort.



Source: Özmez and Özgür (2026), n = 45. Points show published mean scores; the connecting line is descriptive. No paired-change confidence interval or causal treatment effect is inferred.

This report contributes direct evidence to a question often approached through hormonal or sexual-function proxies. Its short follow-up cannot demonstrate sustained global benefit, and improvement after an elective operation may include expectation, recovery of confidence, symptom relief, or other contemporaneous changes. The results justify inclusion of validated patient-reported outcomes in future trials rather than a conclusion that all operated adults experience improved global quality of life.

4.4 Primary endocrine studies and clinical relevance

Zohdy et al. (2011) compared 103 men undergoing microsurgical varicocelectomy with 38 who pursued assisted reproduction. The operated group showed a rise in mean total testosterone, and the hypogonadal subgroup showed improvement in IIEF-5 scores. The comparator is informative, but the decision to undergo surgery was not randomized. Men choosing different fertility strategies may differ in ways that also affect follow-up outcomes.

Abdel-Meguid et al. (2014) evaluated operated infertile men alongside observed varicocele groups and fertile controls without varicocele. Hormonal improvement was more apparent in the baseline hypogonadal subgroup than in the eugonadal subgroup. This supports stratification by pretreatment status, while also illustrating why cohort composition influences a study's average response.

Table 2. Selected primary studies and limits of clinical extrapolation

Study	Clinical contribution	Main interpretive limit
Zohdy et al. 2011	Hormonal and erectile-function assessment after repair	Nonrandomized choice of surgery or assisted reproduction
Abdel-Meguid et al. 2014	Controlled observation and baseline hormonal stratification	Small subgroups and residual confounding
Kim et al. 2012	Complete and partial pain resolution reported separately	Retrospective assessment and mixed age applicability
Wang et al. 2021	Pain relief and procedural outcomes in a clinical series	Pain-specific denominator and selection require caution
Özmez and Özgür 2026	Direct WHOQOL-BREF assessment	Uncontrolled short-term follow-up

Source: Verified PubMed records of the studies listed.

These studies strengthen biological and clinical coherence without resolving the central causal limitations. Primary reports cited inside meta-analyses are contextual evidence and are not additional independent participants in this review.

4.5 Confounding and measurement bias

The major threat to a before-after endocrine estimate is the absence of an equivalent untreated trajectory. Men are often selected for treatment after an abnormal test or a symptomatic interval. Subsequent measurements can improve because of regression to the mean, differences in sampling conditions, health changes, or the operation itself. A low baseline value can predict a larger observed rise even when part of that relationship is statistical rather than biological.

Assay and sampling variation also matter. A standardized repeat assessment is more informative than comparing isolated results obtained under different conditions. Studies that pool postoperative values from several intervals may describe overall change while concealing whether improvement is early, sustained, or inconsistent. Total testosterone can also change through variation in binding proteins rather than through a proportional change in biologically available hormone.

Pain studies face a related problem. Retrospective recall, categorical definitions, incomplete follow-up, and assessment by the treating team may all influence reported success. Participants who return for follow-up can differ from those lost to observation. A high success rate among assessed patients is not necessarily the success rate among everyone originally offered treatment.

Quality-of-life studies require additional protection against selective reporting. A multidomain instrument can generate several comparisons, and emphasizing only statistically significant domains risks exaggerating a coherent global response. Domain-level data, prespecified scoring, missing-data handling, and confidence intervals would support more reliable interpretation of postoperative well-being.

The available meta-analyses reduce random error by combining studies, but aggregation does not remove biases already present in those studies. Consistent direction should therefore increase interest in a treatment mechanism while leaving the strength of causal claims proportional to the underlying designs (Tian et al., 2023; Cannarella et al., 2025; Aboukhshaba et al., 2026).

4.6 Clinical assessment organized around the presenting problem

An evidence-informed assessment starts with the outcome that matters to the patient. For endocrine symptoms, the relevant question concerns confirmed androgen deficiency and its possible causes. For persistent discomfort, the question concerns whether the varicocele plausibly explains the symptom. For impaired well-being, the question concerns which domains are affected and which changes would represent meaningful improvement.

Table 3. Translating evidence into outcome focused assessment

Presentation	Assessment priority	Outcome to follow
Low testosterone with compatible symptoms	Repeat standardized hormonal assessment and competing causes	Hormones together with symptom and function change
Persistent scrotal discomfort	Clinical attribution and exclusion of other pain sources	Pain intensity, pain-free status, activity interference
Infertility with concern about hormones	Separate reproductive and endocrine objectives	Semen outcomes and hormonal status assessed independently
Reduced global well-being	Identify affected physical and psychological domains	Validated quality-of-life domain scores
Persistent pain after repair	Reassess recurrent and nonvenous causes	Patient-reported pain and functional recovery

Source: Clinical interpretation of the cited endocrine, pain, and quality-of-life literature; this table is not a treatment guideline.

A surgical decision is stronger when the preoperative problem and the follow-up endpoint match. If the aim is pain relief, a semen improvement does not establish success. If the aim is endocrine recovery, a

satisfaction response alone does not establish biochemical restoration. If the aim is global well-being, neither outcome fully captures the stated objective.

This approach also reduces the risk of interpreting an incidental anatomical finding as a mandate for repair. The evidence supports individualized discussion of expected benefits and uncertainties rather than a universal operation for adults with a detected varicocele.

4.7 Technique and the meaning of comparative effectiveness

Published pain reviews generally favor microsurgical approaches in selected comparisons, and the broader review by Lundy et al. (2018) associates microsurgical subinguinal repair with favorable complication and fertility profiles. The clinical interpretation must account for the fact that a surgical technique is delivered within a system: surgeon experience, case selection, postoperative care, and assessment methods accompany the named procedure.

An apparent advantage of one technique can therefore contain both a procedural effect and a practice effect. Studies from experienced centers may not represent outcomes during early adoption or in settings with different access to magnification and follow-up. The available comparisons do not justify treating the largest odds ratio as a transportable prediction for every institution.

Wang et al. (2021) reported favorable pain and procedural outcomes in a clinical series using microsurgical subinguinal repair within an enhanced-recovery pathway. The report supports feasibility, but its overall enrolled population and the subgroup presenting with pain should not be conflated. A percentage without its outcome-specific denominator can be misleading when counseling an individual patient.

Persistent discomfort also remains clinically relevant after an anatomically successful repair. Tuan et al. (2025) studied a selected group with chronic scrotal pain after unsuccessful symptomatic response to varicocelectomy. Their work on spermatic-cord denervation is outside the primary treatment comparison here, but it demonstrates that postoperative pain can require a new diagnostic and therapeutic framework. It should not be converted into an estimate of varicocelectomy failure in unselected patients.

Comparative effectiveness research would be strengthened by standardized baseline symptoms, a common pain endpoint, complete follow-up, and explicit reporting of surgeon experience. Without these elements, technique-specific pooled results should guide discussion of probable advantages while preserving uncertainty about absolute benefit and procedural risk in a particular clinical setting.

4.8 Reconciling the endocrine literature

The association between varicocele and low testosterone supports a biologically coherent hypothesis, but it is not equivalent to proof that repair reverses symptomatic hypogonadism. Gonzalez-Daza et al. (2024) found an association with hypogonadism, while Ziouziou et al. (2026) reported lower total testosterone in men with varicocele than in comparison groups. These exposure comparisons address disease association rather than treatment response.

The postoperative literature addresses a different contrast and more consistently reports higher total testosterone after repair. Disagreement about the magnitude is unsurprising because studies differ in baseline status, eligibility, follow-up, and the handling of uncontrolled measurements. A meta-analysis limited to hypogonadal men can reasonably produce a different estimate from a broader review of clinical varicocele repair.

The early review by Li et al. (2012) and the more recent synthesis by Cannarella et al. (2025) agree in direction, but their participant sets cannot be assumed to be independent. Tian et al. (2023) additionally considered inhibin B and pituitary hormones. Differences across endocrine outcomes illustrate that testicular recovery is not a single interchangeable measure and that a favorable testosterone result need not imply equally consistent changes in every hormonal pathway.

Clinical interpretation should emphasize the achieved state as well as the average change. A sizeable increase may leave a patient below an appropriate biochemical range, whereas a smaller increase may accompany symptom improvement. Neither interpretation can be established from a group mean alone. Distributional results, normalization proportions with denominators, and symptom-linked outcomes are therefore important complements to the mean difference.

The literature supports considering endogenous androgen recovery as a plausible benefit in selected adults. It remains insufficient to define surgery as a general strategy for optimizing testosterone in otherwise asymptomatic eugonadal men. The language of optimization should be anchored to a documented clinical problem rather than to an assumption that a higher concentration is necessarily better.

4.9 Global quality of life as a distinct endpoint

Pain relief and sexual-function improvement can contribute to well-being, but a global quality-of-life claim requires direct measurement. Instruments assessing erectile function concern a specific domain. A person can report improved erections while remaining distressed by infertility, work limitations, chronic

pain, or other health conditions. Conversely, reduced discomfort may improve daily function without a measurable hormonal change.

The direct WHOQOL-BREF report by Özmez and Özgür (2026) advances the literature because it evaluates a broader patient-reported construct. However, the verified summary's presentation of a total score requires caution: WHOQOL-BREF is conventionally interpreted through domains, and scoring conventions should be explicit before results are compared across studies. A raw difference cannot be presumed to equal a validated minimum important difference.

Future quality-of-life reporting should describe the baseline burden, scoring transformation, domain structure, missing items, and the reference interval used for follow-up. A comparator should receive equivalent attention and counseling so that the estimated difference better separates the procedure from contextual effects. Longer observation is necessary because early satisfaction and durable functional recovery are different outcomes.

A multidomain approach would also allow examination of whether hormonal improvement mediates well-being, whether pain relief contributes independently, or whether both are linked through another factor. Such mediation cannot be inferred from separate studies reporting separate outcomes. It requires repeated measurements in the same patients and an appropriate longitudinal analysis.

For counseling, the most defensible message is that selected adults may experience endocrine and symptomatic improvement, while global quality-of-life benefit is promising but less securely established. The distinction is substantive rather than semantic: it affects the expectations attached to an elective intervention and the outcomes used to judge whether treatment has achieved the patient's original goal.

4.10 Research priorities

The next generation of studies should evaluate the same outcome domains within comparable adult populations. Recruitment based on infertility alone cannot answer every question concerning pain or symptomatic androgen deficiency. Eligibility and analysis should distinguish the primary indication and define important coexisting problems before treatment.

Table 4. Research priorities for adult varicocelectomy

Evidence gap	Recommended design feature	Result needed
Endocrine causality	Controlled prospective comparison with repeat baseline measurements	Between-group hormonal change and symptom response
Pain attribution	Standard diagnostic work-up and prespecified pain phenotype	Resolution and activity-interference outcomes
Quality-of-life durability	Validated domain reporting at repeated intervals	Sustained improvement beyond early follow-up
Subgroup benefit	Prespecified hypogonadal and eugonadal strata	Absolute responses with uncertainty
Technique comparison	Comparable populations and documented expertise	Benefit and harm under common definitions
Missing outcomes	Transparent follow-up and missing-data strategy	Results applicable to all enrolled patients

Source: Research implications of the selected PubMed-indexed evidence.

Trials should distinguish an early biological response from a durable clinical response. Reporting only statistical significance leaves the reader without the information needed to weigh the expected magnitude of improvement. Estimates with confidence intervals, absolute outcome frequencies, and adverse events are more useful than a sequence of within-group P values.

A core outcome set spanning hormones, pain, sexual function, quality of life, and complications would permit more coherent synthesis. This would also reduce selective emphasis on whichever outcome happens to improve in a small cohort. The purpose is to align the research question with the patient's reason for treatment and to make future meta-analysis less dependent on incompatible definitions.

4.11 Limitations of this review

This review has important methodological boundaries. Retrieval was targeted and topic-based rather than an exhaustive, independently screened systematic search. The broad query count cannot be interpreted as a PRISMA identification-to-inclusion pathway. Relevant studies may have been missed, especially when terminology differs from the selected title and abstract terms.

The extraction basis was verified PubMed records and available published summaries. This allowed checking the existence of each article and its reported principal findings, but it did not establish complete access to every primary dataset or full methodological appendix. Detailed formal appraisal of allocation, missing-data handling, measurement timing, and review-level overlap was therefore not performed.

The review-level estimates are not independent because several meta-analyses may share primary studies. Their agreement should be interpreted as consistency across published syntheses, not as multiple independent treatment experiments. No new heterogeneity statistic, funnel plot, certainty grade, or pooled estimate was generated. The confidence intervals displayed belong to the source analyses.

Adult applicability varies across the selected evidence. Several reports originate from infertility settings, and some review-level populations or primary age distributions are not confined to the specific adult symptomatic population addressed in the title. Technique, baseline hormonal status, outcome definitions, and follow-up also differ. These factors restrict extrapolation beyond the studied settings.

The direct quality-of-life evidence is especially limited. A small prospective before-after study can identify a signal, but it cannot establish comparative benefit, durability, or a causal pathway through testosterone. The manuscript consequently presents quality-of-life improvement as an area of emerging evidence rather than as a settled consequence of repair.

These limitations affect the strength of inference, not the verification of the cited publications. The review provides an organized interpretation of real indexed evidence while identifying the additional work required for a definitive adult-specific systematic review and original meta-analysis.

5 CONCLUSION

Adult varicocelectomy is associated with increased total testosterone in published clinical syntheses, with particularly relevant evidence in men selected for hypogonadism. Pain-focused reviews support symptomatic benefit in carefully evaluated patients and favor microsurgical approaches in several comparisons. The precision of these estimates does not remove the limitations created by nonrandomized treatment selection, inconsistent symptom definitions, and overlapping evidence bases.

Global health-related quality of life should be assessed directly rather than inferred from laboratory improvement, fertility outcomes, or erectile-function scores. A recent prospective WHOQOL-BREF study provides a relevant signal, but its uncontrolled short-term design does not establish durable comparative benefit. These three outcome domains should remain distinct in interpretation and follow-up.

The most defensible clinical position is individualized consideration of repair for a documented problem, with explicit agreement on what successful treatment would mean. The evidence does not support a universal testosterone-optimization strategy for every adult with a varicocele. Controlled studies

combining repeated hormones, standardized pain assessment, and validated quality-of-life domains are needed to establish the magnitude and durability of patient-centered benefit.

Data and methodological transparency

All cited evidence is traceable to PubMed-indexed publications through the PMID and DOI information in the reference list. Figures were created from the numerical results reported in those publications. The manuscript contains no patient-level dataset and no new pooled treatment estimate. No research-registration number, ethics approval, funding declaration, or author conflict-of-interest statement is claimed for this review.

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