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Transurethral Seminal Vesiculoscopy for Refractory Hematospermia: Access Strategies, Clinical Outcomes, and Evidence Gaps

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Abstract

Hematospermia is often benign and self-limiting, but persistent or recurrent episodes may warrant evaluation for treatable causes, including inflammation, infection, calculi, cysts, ejaculatory duct obstruction, and vascular abnormalities. Transurethral seminal vesiculoscopy (TSV) permits direct inspection of the distal seminal tract and may allow irrigation, clot or calculus removal, and treatment of selected obstructive lesions. Observational studies from specialist centres report high technical success and frequent symptom improvement; however, the evidence is constrained by non-randomized designs, heterogeneous patient selection and outcome definitions, and variable follow-up. Described access strategies include cannulation through a native ejaculatory duct orifice, controlled incision or resection of the duct, and transutricular access when native access is not feasible. These approaches are not directly interchangeable, and apparent differences in recurrence may reflect anatomical complexity and confounding by indication rather than a causal effect of route. Potential complications include infection, epididymitis, bleeding, injury to adjacent structures, restenosis, and altered ejaculation. Fertility and long-term reproductive outcomes remain insufficiently characterized. This narrative review summarizes patient selection, preoperative evaluation, access techniques, clinical outcomes, safety, and priorities for future research. TSV may be considered for carefully selected patients with bothersome persistent or recurrent hematospermia after appropriate evaluation and conservative management, with shared decision-making about uncertain comparative benefits and reproductive risks.

Keywords

Hematospermia, Seminal Vesiculoscopy, Ejaculatory Duct Obstruction, Seminal Vesicle Calculi, Endourology, Male Reproductive Health

1. Introduction

Hematospermia is the presence of blood in semen and is a symptom rather than a diagnosis. Although it can be alarming, a single episode in a younger man without associated symptoms commonly resolves without invasive investigation. Recurrent or persistent hematospermia, older age, hematuria, pelvic or ejaculatory pain, abnormal examination findings, or concerning laboratory or imaging results should prompt a more structured assessment [1]-[4]. Causes include inflammation or infection, calculi, cysts, ejaculatory duct obstruction, vascular lesions, trauma or instrumentation, systemic bleeding disorders, and rarely malignancy [1]-[11].

For men whose symptoms continue despite appropriate conservative treatment, identifying the bleeding source can be challenging. Transrectal ultrasonography (TRUS) and magnetic resonance imaging (MRI) can reveal seminal-vesicle dilatation, blood products, cysts, and some calculi, but may not demonstrate subtle mucosal abnormalities or small intraluminal clots. TSV was developed as a natural-orifice endoscopic technique to inspect the ejaculatory ducts and seminal vesicles and, where feasible, treat abnormalities during the same procedure [8] [12]-[16].

Review Approach

This narrative review synthesizes literature relevant to patient evaluation and selection, TSV access techniques, clinical outcomes, complications, and reproductive considerations. The cited evidence comprises clinical guidance, reviews, anatomical studies, and observational cohorts identified by the authors as relevant to these themes. No prespecified protocol, reproducible database search, formal risk-of-bias assessment, or PRISMA-compliant selection process was undertaken. Accordingly, this article should be interpreted as a qualitative narrative synthesis rather than a systematic review or meta-analysis. The cited studies may not represent all available evidence, and the reported percentages are study-specific results, not pooled estimates.

The review focuses on the clinical role of TSV in refractory hematospermia, particularly access routes, recurrence, procedural safety, and reproductive uncertainty. Given the limited comparative evidence, associations reported in individual studies are distinguished from evidence of comparative effectiveness or causality.

2. Clinical Evaluation and Patient Selection

2.1. Establishing the Cause and Excluding Important Disease

Evaluation should begin with a history of symptom duration and frequency, ejaculatory or pelvic pain, hematuria, urinary symptoms, fever, sexually transmitted infection risk, recent procedures or trauma, anticoagulant use, bleeding history, and reproductive plans. Examination may include blood pressure, genital examination, and digital rectal examination according to age and clinical context. Uri-

nalysis and culture, sexually transmitted infection testing, semen analysis, coagulation studies, and prostate-specific antigen (PSA) testing should be selected according to the presentation rather than ordered indiscriminately [1]-[4] [8]-[11] [17] [18].

Persistent or recurrent hematospermia and symptoms in men aged 40 years or older merit a lower threshold for further evaluation. TRUS is commonly used to assess the prostate, seminal vesicles, and ejaculatory ducts; pelvic MRI can be useful when ultrasound is inconclusive or when complex cystic, hemorrhagic, or suspicious lesions are suspected. Imaging recommendations should be individualized, as not every patient with hematospermia requires imaging [3] [4] [8] [17] [18]. A suspicious lesion must be evaluated through an appropriate oncological pathway; endoscopic inspection or a limited biopsy should not be regarded as sufficient to exclude malignancy.

2.2. When to Consider TSV

There is no universally accepted definition of refractory hematospermia or a single evidence-based duration of conservative treatment. Published studies have commonly enrolled patients with symptoms persisting for at least three months despite medical treatment, while other clinical settings may use longer observation depending on symptom burden and findings [8] [13]-[15] [19]-[21]. Before considering TSV, clinicians should confirm that blood is originating from the ejaculate, assess treatable infection or systemic causes, review relevant imaging, and discuss the generally benign natural history alongside the patient's symptom burden and preferences.

The preoperative conservative regimen is described in some, but not all, of the major TSV cohorts. In the 419-patient series by Chen *et al.* [13], all patients received oral antibiotics for at least 4 weeks before surgery; the report did not specify a particular antibiotic agent or provide a standardized regimen beyond this duration. In the 144-patient cohort by Chen *et al.* [14], the authors described the patients as having recurrent/intractable hematospermia for which conservative management had been ineffective, but did not clearly detail the specific preoperative drugs, treatment duration, or a uniform conservative-treatment protocol. Antibiotics and lifestyle improvement were mentioned for patients dissatisfied with postoperative outcomes, and should not be interpreted as a fully documented preoperative regimen. Accordingly, the available reports support noting prior conservative treatment, but do not permit a precise cross-cohort comparison of its components or adequacy.

TSV is most defensible when symptoms are persistent or recurrent and the evaluation suggests a seminal-tract source, such as intraluminal blood products, calculi, cysts, or ejaculatory duct obstruction. In selected patients with severe symptoms and unrevealing imaging, endoscopy may still identify pathology, but the probability of finding a treatable lesion and the risk-benefit balance should be discussed explicitly. Patients seeking future fertility require particular counselling be-

cause the effects of ductal incision, fenestration, or thermal treatment on semen delivery and reproductive outcomes are not well established.

3. Technical Approaches and Procedural Principles

TSV is performed through the urethra using a small-calibre rigid or flexible endoscope. Access is guided by the anatomy around the verumontanum, ejaculatory duct orifices, and prostatic utricle. The literature uses somewhat different terminology for individual routes; anatomical variation around the verumontanum and ejaculatory duct orifices can complicate access, so operative reports should describe the actual entry point, any incision or fenestration, laterality, and pathology treated rather than relying on labels alone [13]-[16] [19]-[27]. Published experience also includes day-surgery pathways using caudal block anesthesia, although anesthetic choice should remain individualized to the patient and local expertise [28].

3.1. Natural Ejaculatory-Duct Access

When a native ejaculatory duct orifice can be identified and safely cannulated, the endoscope can enter the seminal tract without creating a new opening. This route preserves native anatomy and avoids an additional incision, but cannulation may be difficult when the orifice is tiny, stenotic, obscured, or anatomically variable. Forceful cannulation should be avoided, and the attempt should be abandoned if the route cannot be identified safely. Anatomical studies demonstrate variation in the seminal-vesicle system and support careful, anatomy-informed instrumentation [23]. In a retrospective study of 68 patients comparing three approaches, natural-orifice access had a numerically lower recurrence rate than ductal incision/resection or utricle fenestration, but the difference was not statistically significant; the small sample does not establish superiority [19].

3.2. Ejaculatory-Duct Incision or Resection

When obstruction or stenosis prevents safe access through the native opening, controlled incision or transurethral resection of the ejaculatory duct may establish access to the seminal tract. This approach may be reasonable when obstruction is a clinically important component of the disease, but it creates additional tissue injury and changes ductal anatomy. The incision should be limited to what is required for safe access and drainage. Potential concerns include postoperative scarring or restenosis, reflux, reduced ejaculate volume, and ejaculatory dysfunction; their incidence and long-term consequences after TSV remain uncertain [15] [24]-[27] [29]-[32].

3.3. Transutricular Access

When the ejaculatory duct orifice cannot be identified or traversed safely, a transutricular route may be considered in selected cases. This approach has been described in clinical series and may provide access when native-route access is not

feasible [12] [14] [20] [21]. Fenestration creates an artificial channel and requires careful orientation and depth control because the seminal tract lies close to the rectum. Blind puncture and excessive posterior-wall incision should be avoided. Selection should reflect the individual anatomy, operator experience, and availability of a safer alternative.

3.4. Intracavitary Treatment and Technical Safeguards

Once the seminal tract is entered, gentle irrigation can remove old blood and small clots. Larger calculi may be extracted with suitable forceps or fragmented using an appropriate lithotripsy device [24]-[27] [33]-[35]. Focal bleeding or suspicious mucosal lesions require careful assessment; energy-based treatment should be conservative because the seminal-vesicle lumen is narrow and its wall is delicate. Tissue sampling may be considered for atypical lesions, but negative sampling does not reliably exclude all neoplasia. Perioperative antibiotic use should be based on local protocols, patient risk, cultures, and antimicrobial stewardship principles. The procedure should be performed by clinicians familiar with distal seminal-tract anatomy and prepared to abandon unsafe access rather than persist with traumatic instrumentation.

3.5. Practical Comparison of Access Strategies

Table 1 summarizes the indications, potential advantages, and limitations of the available access strategies for transurethral seminal vesiculoscopy.

Table 1. Practical considerations when selecting a transurethral seminal vesiculoscopy access strategy.

Access strategy	When it may be considered	Potential advantage	Key limitations/cautions
Native ejaculatory-duct orifice	The orifice is identifiable and can be safely cannulated.	Preserves native anatomy and avoids creating an additional opening.	Cannulation may fail with stenosis, a tiny or obscured orifice, or anatomical variation; avoid forceful instrumentation.
Ductal incision or resection	Native access is not feasible and clinically relevant ductal obstruction or stenosis is suspected.	May establish access and improve drainage in selected obstructive cases.	Additional tissue injury; possible scarring/restenosis, reflux, altered ejaculate volume, or ejaculatory dysfunction; long-term risks are uncertain.
Transutricular access/ fenestration	The native ductal route cannot be identified or traversed safely and an alternative route is judged appropriate.	May provide access when native-route access is not feasible.	Creates an artificial channel; requires precise orientation and depth control because of adjacent rectal anatomy; avoid blind puncture.

4. Efficacy and Recurrence

The published evidence is encouraging but should be interpreted cautiously. In a 419-patient case series, technical access was achieved in 381 patients (90.9%); among those in whom access was achieved, 324 (85.0%) had improvement or resolution of hematospermia at three months [13]. In a separate retrospective cohort

of 144 patients, TSV was completed in 139 (96.5%). Symptoms improved or resolved in 116 of the 144 patients (80.6%) within six months [14]. Wang *et al.* [36] prospectively enrolled 281 patients. TSV was completed in 272 (96.8%). By 12 months after surgery, 56/272 (20.6%) had improved and 188/272 (69.1%) had symptom resolution, for a combined response of 244/272 (89.7%). During follow-up, 15/272 (5.5%) experienced recurrence. Median time to recurrence was 7.5 months (range, 2.0 - 18.5). The abstract reports a median follow-up of 36.5 months (range, 8.0 - 97.5), while the Results section labels the same value as a mean [36]. These outcomes should not be conflated: successful completion of the endoscopic procedure is a technical endpoint, whereas symptom improvement, complete resolution, and recurrence are clinical endpoints. The study design and patient selection do not establish comparative effectiveness against non-operative management [36].

A prospective comparison involving 106 patients with persistent hematospermia found a higher diagnostic yield for TSV than for transrectal ultrasonography (TRUS) alone (74.5% versus 45.3%). Combining the two methods yielded more diagnoses than either test alone, supporting complementary rather than interchangeable roles for imaging and endoscopy [37]. These findings come from selected patients assessed in specialist settings and should not be generalized to men with a single, uncomplicated episode of hematospermia. In this study, "diagnostic yield" refers to the proportion of patients in whom the examination identified findings considered diagnostically relevant; the 74.5% figure should therefore not be interpreted as a validated measure of diagnostic accuracy or as proof that every detected abnormality caused the bleeding. The authors also reported disappearance of hematospermia in 83 of 85 patients who received TSV therapy during follow-up, which provides supportive clinical concordance between treatment and symptom resolution. However, this overall post-treatment response does not establish the causal role of each individual finding: the report does not demonstrate lesion-specific response or provide an independent reference standard capable of confirming that each detected calculus, stricture, cyst, or mucosal abnormality was the bleeding source. Accordingly, the findings should be interpreted as an increased ability to detect potentially relevant seminal-tract abnormalities, rather than definitive proof of diagnostic accuracy or of a treatable cause in every case [37].

Recurrence is clinically important, and reported rates vary with case mix, follow-up duration, access route, and the definition of recurrence. In a retrospective cohort of 48 successfully treated patients, intraoperative calculi were associated with a higher risk of recurrence; blood or clot was also associated with lower disease-free survival [38]. In the univariate Cox analysis, intraoperative calculi were associated with recurrence (HR 2.94, 95% CI 1.05 - 8.21; P = 0.040), whereas intraoperative hemorrhage or blood clot showed a weaker, statistically non-significant association (HR 2.63, 95% CI 0.93 - 7.43; P = 0.068). In the multivariable Cox analysis, the association for calculi was attenuated and no longer reached conven-

tional statistical significance (adjusted HR 2.80, 95% CI 1.00 - 7.90; P = 0.051). The published report therefore provides an unadjusted estimate for hemorrhage/blood clot but does not report a corresponding adjusted effect estimate for this finding. The estimates are imprecise, as reflected by the wide confidence intervals, and should be interpreted cautiously given the small cohort (n = 48) and the limited number of recurrence events (n = 16). In the 68-patient comparative study, recurrence within one year was 24.4% after native-orifice access, 50.0% after ductal incision/resection, and 44.4% after utricle fenestration; the between-group difference was not statistically significant (P = 0.144) [19]. These findings do not establish that one route is superior, particularly because route selection may be influenced by baseline anatomy and disease complexity.

Calculi, cysts, retained clots, persistent obstruction, and ongoing inflammation may indicate more complex disease or act as continuing sources of irritation. Complete clearance of treatable pathology is a reasonable procedural goal, but excessive tissue removal should be avoided. If symptoms recur, clinicians should reassess the diagnosis and exclude infection, systemic contributors, and suspicious lesions before considering repeat endoscopy. Repeat TSV should be reserved for selected patients with substantial ongoing symptoms and a plausible endoscopically treatable cause. A summary of representative studies is provided in **Table 2**.

Table 2. Representative clinical studies of transurethral seminal vesiculoscopy for hematospermia.

Study/design	Population/comparison	Key findings	Main limitation
Chen *et al.* [13], observational case series	419 patients with persistent hemospermia	Technical success: 381/419 (90.9%); improvement/resolution by 3 months: 324/381 (85.0%).	No non-operative comparator; specialist-centre population.
Chen *et al.* [14], retrospective cohort	144 patients with intractable hematospermia	Successful TSV: 139/144 (96.5%); improvement/resolution: 116/144 (80.6%) within 6 months after surgery.	Retrospective, single-centre study. Median follow-up: 1021.5 d.
Wang *et al.* [36], prospective observational study	281 patients; TSV with or without real-time TRUS	Technical success (TSV successfully performed): 272/281 (96.8%). By 12 months: 56/272 (20.6%) improved; 188/272 (69.1%) resolved; combined response: 244/272 (89.7%). Recurrence during follow-up: 15/272 (5.5%); median time to recurrence: 7.5 months. Reported follow-up: 36.5 months (8.0 - 97.5).	Single-centre observational evidence; no comparative control.
Xing *et al.* [37], prospective comparison	106 patients; paired TRUS and TSV	Diagnostic yield: TSV 79/106 (74.5%); TRUS 48/106 (45.3%); combined final diagnoses: 93/106 (87.7%).	Diagnostic yield is not equivalent to treatment benefit. Diagnostic yield reflects detected findings, not proof of causation or validated accuracy.
Yao *et al.* [19], retrospective comparative cohort	68 patients: native duct access (n = 45), duct incision/resection (n = 14), utricle fenestration (n = 9)	One-year recurrence: 11/45 (24.4%), 7/14 (50.0%) and 4/9 (44.4%), respectively (Fisher P = 0.144).	Small groups; confounding by anatomy and indication.

These studies differ in patient selection, access technique, outcome definitions, and follow-up. Their percentages should be interpreted individually rather than compared as if derived from a common protocol.

5. Safety and Reproductive Considerations

Reported complications include transient dysuria, hematuria, perineal discomfort, infection, and epididymitis. More serious potential events include seminal-tract perforation, rectal injury, and ejaculatory dysfunction. In the 419-patient series, one case of retrograde ejaculation was reported in association with resection of the verumontanum, and two cases of epididymitis were treated with antibiotics [13]. The 144-patient cohort reported a low rate of major complications, but retrospective studies may under-record events and are not large enough to exclude rare serious harms [14].

Anatomically, the risk of injury is influenced by the route of access and the depth and direction of incision. Avoidance of blind or forceful manipulation, conservative use of energy, culture-directed treatment when infection is suspected, and careful postoperative review are central safety measures. Patients should be counselled that transient hematospermia may continue for several ejaculations after treatment and does not necessarily indicate procedural failure.

Reproductive outcomes remain a major evidence gap. Although some reports describe semen-parameter changes or treatment in men with ejaculatory duct obstruction, the available studies are heterogeneous and do not provide robust estimates of natural conception or live-birth outcomes after TSV. Potential consequences—including altered ejaculate volume, ductal scarring, reflux, or injury to reproductive structures—should be discussed before intervention, particularly with men actively pursuing conception. Baseline and follow-up semen analysis may be appropriate when fertility is a principal concern, and referral to reproductive urology or andrology should be considered. Evidence from ejaculatory duct obstruction surgery is relevant to counselling but cannot be assumed to quantify risks specific to TSV [24]-[27] [30] [31].

The available clinical data illustrate why the operative technique must be specified when discussing reproductive effects. In a retrospective series of 103 men with ejaculatory duct obstruction treated with transurethral resection of the ejaculatory duct (TURED) combined with seminal vesiculoscopy, paired semen analyses were available for 90 patients: mean ejaculate volume increased from 1.76 ± 0.69 to 2.06 ± 0.68 mL ($P = 0.004$), and sperm motility increased from 59.71% ± 27.32% to 67.48% ± 23.32% ($P = 0.020$); semen pH (7.22 ± 0.08 vs 7.32 ± 0.05; $P = 0.209$) and sperm concentration (62.52 ± 58.16 vs 67.32 ± 49.16 × 10^9/mL; $P = 0.060$) did not change significantly [29]. These findings concern a combined duct-resection-plus-vesiculoscopy procedure in patients with diagnosed obstruction, not isolated TSV, and therefore cannot establish the effect of TSV alone on semen quality. The cited pure-TSV cohorts do not provide sufficiently consistent, comparable pre- and postoperative semen-parameter data to quantify a procedure-specific reproductive effect; nor do these reports establish natural-conception or

live-birth rates. Accordingly, the observed changes after combined surgery should be interpreted as evidence in an obstruction-selected population rather than as proof that TSV improves fertility or that its reproductive risks are negligible. Prospective studies should report baseline and serial semen volume, concentration, motility, semen pH, pregnancy outcomes, and live birth separately for isolated TSV and procedures that include ejaculatory-duct incision or resection.

6. Limitations of the Current Evidence and Research Priorities

Most evidence on TSV comes from retrospective cohorts and specialist centres, with substantial geographic concentration in East Asia. Few prospective comparative studies are available, and robust randomized trials have not established when TSV should be preferred over observation, targeted medical therapy, or other interventions. Definitions of refractory disease, treatment success, recurrence, complications, and follow-up schedules differ across studies. Comparisons between access routes are particularly vulnerable to confounding by indication: patients requiring incision or fenestration may have more severe obstruction or more complex anatomy at baseline. Publication bias and incomplete adverse-event reporting are also possible.

Future studies should use a consensus definition of refractory hematospermia and report patient-reported symptom burden, technical success, time to resolution, recurrence at prespecified intervals, adverse events, semen parameters, fertility outcomes, and reintervention. Prospective multicentre registries could clarify the learning curve, patient selection, and real-world complication rates. Comparative studies should stratify by underlying pathology and access route and adjust for baseline disease severity. Cost-effectiveness, quality of life, and the role of MRI in selecting candidates also require evaluation.

7. A Pragmatic Clinical Pathway

A pragmatic approach is to: 1) confirm that blood is present in the ejaculate and assess symptom duration, associated features, medication use, and fertility goals; 2) investigate infection, bleeding disorders, and malignancy risk as clinically indicated; 3) use TRUS and/or pelvic MRI for persistent or recurrent symptoms or when clinical findings raise concern; 4) offer reassurance and targeted conservative treatment when appropriate; 5) discuss TSV for persistent, bothersome symptoms when seminal-tract pathology is suspected, using shared decision-making; 6) choose the least traumatic route that permits safe access, preferring a native orifice when feasible; and 7) follow symptoms, infection, ejaculatory function, and fertility-related outcomes according to the patient's goals. This pathway is a pragmatic synthesis of the available literature, not a validated guideline.

8. Conclusion

TSV is a minimally invasive diagnostic and therapeutic option for carefully se-

lected patients with persistent or recurrent hematospermia. Observational studies report high technical success and frequent symptom improvement, and endoscopy may identify calculi, obstruction, clots, and mucosal abnormalities that are not always apparent on imaging. Nevertheless, current evidence does not establish the optimal timing of intervention or the superiority of any access route. Native-orifice access is reasonable when it can be achieved safely; ductal incision or resection and transutricular fenestration may be required in selected patients when native access is not feasible. Recurrence, procedural injury, and uncertain reproductive outcomes should be addressed during counselling. Standardized outcome reporting and prospective multicentre comparative research are needed before firm recommendations can be made.

Declaration of AI-Assisted Technologies

During the preparation of this manuscript, the authors used ChatGPT (OpenAI, USA) as an AI-assisted writing tool to support manuscript development and language refinement. Specifically, ChatGPT was used to assist with English language polishing, grammar correction, sentence restructuring, improvement of academic expression, enhancement of readability, and refinement of the overall organization and logical flow of the manuscript.

The AI tool was also used to assist in improving the clarity and consistency of medical terminology and scientific descriptions related to transurethral seminal vesiculoscopy (TSV) for the treatment of refractory hematospermia.

Importantly, AI tools were not used to generate or fabricate clinical data, patient information, statistical results, or research findings. All clinical data, statistical analyses, interpretation of results, and scientific conclusions were reviewed and verified by the authors. The authors carefully examined and revised all AI-assisted content and accept full responsibility for the accuracy, integrity, originality, and final content of this manuscript.

The use of AI tools did not replace the authors' scientific judgment, clinical expertise, or responsibility for the research.

Author Contributions

Conceptualization: Cong Zhang; Writing—original draft: Cong Zhang; Writing—review & editing: Guangjun Zhong; Supervision: Guangjun Zhong. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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