RESEARCH PAPER

Management of Tubal Factors of Infertility: A Comprehensive Review

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Abstract

Background: Tubal factor infertility (TFI) constitutes a substantial proportion of female infertility cases globally, arising from diverse etiologies including infectious, inflammatory, congenital, and iatrogenic causes. Accurate diagnosis and evidence-based management remain paramount for optimizing reproductive outcomes.

Objective: This review synthesizes current evidence on the epidemiology, etiology, diagnostic modalities, and treatment strategies for tubal factor infertility, with particular emphasis on the comparative roles of surgical reconstruction and assisted reproductive technologies.

Methods: A comprehensive literature search was conducted in PubMed, Scopus, and Cochrane Library databases for studies published between January 2000 and December 2025 (search completed December 2025; no forward search for 2026 articles was performed at the time of writing), focusing on original research, systematic reviews, meta-analyses, and clinical guidelines addressing tubal factor infertility.

Results: Tubal disease causes 25–35% of female infertility, primarily due to *Chlamydia trachomatis*. HSG has moderate diagnostic accuracy (sensitivity 59.5%, specificity 76.9%), while laparoscopy with chromopertubation remains the gold standard. Reconstructive microsurgery achieves pregnancy rates of 43–78% in appropriately selected young women. For hydrosalpinx, laparoscopic salpingectomy before IVF improves pregnancy (OR 1.75) and live birth rates (OR 2.13). IVF outcomes in TFI are comparable to other etiologies, with age as the key determinant of success.

Conclusion: Optimal TFI management requires individualized decisions integrating patient age, tubal pathology, surgical expertise, and reproductive goals. Both reconstructive surgery and ART remain valid treatment pathways.

Keywords: Tubal factor infertility, fallopian tube, hysterosalpingography, laparoscopy, tubal surgery, IVF, hydrosalpinx

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1. Introduction

Infertility affects 10–15% of couples worldwide, with tubal factor infertility (TFI) accounting for 25–35% of female infertility cases [1,2]. The fallopian tube is essential for ovum capture, sperm-egg transport, fertilization, and early embryo development [3].

TFI epidemiology varies globally: tubal pathology causes ~14% of female infertility in high-income settings (NICE) [4] but exceeds 30% in regions with high rates of untreated sexually transmitted infections [5]. Congenital anomalies may contribute more than previously recognized; a single-center study (2020–2023) found that among 220 women with suspected TFI, 51.3% had surgically confirmed tubal pathologies, including 15% with congenital tubal agenesis—though these figures likely reflect referral bias and require confirmation [6].

Pelvic inflammatory disease (PID), most often due to *Chlamydia trachomatis*, is the leading cause of TFI [7]. Many affected women have no history of recognized PID, indicating that asymptomatic salpingitis causes substantial tubal damage [8]. Other causes include pelvic surgery, endometriosis, ectopic pregnancy, and iatrogenic occlusion [9]. In Ayurveda, tubal blockage is understood as *Artavavaha Srotodushti* (obstruction of channels carrying menstrual fluid/ovum) involving Vata and Kapha doshas [10].

Diagnostic modalities for tubal assessment include hysterosalpingography (HSG), hysterosalpingo-contrast sonography (HyCoSy),

magnetic resonance hysterosalpingography (MR-HSG), and laparoscopy with chromopertubation, each with distinct advantages and limitations [11].

Management of TFI has evolved dramatically since the advent of assisted reproductive technology (ART). Before in vitro fertilization (IVF), tubal reconstructive surgery was the primary treatment [12]. Today, the choice between surgical restoration of tubal patency and direct IVF depends on patient age, ovarian reserve, tubal pathology severity, hydrosalpinx presence, male partner status, surgical expertise, and patient preferences [13].

This review provides an evidence-based synthesis of TFI management, covering etiology, diagnosis, surgical and ART strategies, and complementary traditional medicine approaches, with practical clinical recommendations.

2. Methods

A narrative review of the literature was conducted. A structured search was performed in PubMed, Scopus, Cochrane Library, and Ayushdhara databases for articles published between January 2000 and December 2025 (search completed December 2025). The search strategy used the following terms: ("tubal factor infertility" OR "fallopian tube obstruction" OR "hydrosalpinx" OR "salpingitis") AND ("diagnosis" OR "hysterosalpingography" OR "laparoscopy" OR "chromopertubation") AND ("surgery" OR "tubal anastomosis" OR "neosalpingostomy" OR "salpingectomy") AND ("IVF" OR "assisted reproductive technology") AND ("Ayurveda" OR "Uttarabasti" OR "Bandhyatva" OR "Artavavaha Srotas").

Relevant original research, systematic reviews, meta-analyses, RCTs, clinical guidelines, cohort studies, and case series on TFI diagnosis or management were included. Conference abstracts, non-English articles, and animal studies were excluded. The lead author screened titles/abstracts and extracted key data on study design, diagnostic performance, surgical outcomes, IVF success, prognostic factors, and Ayurvedic protocols. Given the narrative nature of this review, no formal quality assessment or quantitative synthesis was performed; findings were synthesized thematically.

3. Results

3.1 Epidemiology and Etiology

3.1.1 Prevalence and Global Burden

Tubal factor infertility represents one of the most common identifiable causes of female infertility. The American Society for Reproductive Medicine (ASRM) reports that tubal disease accounts for 25–35% of female factor infertility, with more than half of cases attributable to salpingitis [2]. A recent observational study spanning 2020–2023 reported that after initial infertility work-up, 21% of women (895 of 4,262) were diagnosed with suspected TFI [6].

The prevalence of TFI demonstrates notable racial disparities. Data from two US clinics revealed that tubal factor infertility prevalence was twofold higher among Black women compared to White women seeking infertility care [14]. This disparity likely reflects differential exposure to sexually transmitted infections and pelvic inflammatory disease, as well as variable access to timely diagnosis and treatment.

3.1.2 Infectious Etiology

Pelvic inflammatory disease constitutes the predominant cause of tubal damage. *Chlamydia trachomatis* represents the most frequently implicated pathogen, with studies demonstrating that 79.1% of women with TFI exhibit chlamydial immunoglobulin G or M antibodies, compared to 34.9% in control populations (relative odds 6.3; 95% CI 2.5–16.8) [7]. A more recent cross-sectional study from Nigeria (2024) reported an overall prevalence of chlamydial seropositivity of 28.0%, with TFI patients demonstrating significantly higher rates than non-TFI controls (33.6% vs. 22.4%; OR 1.75; 95% CI 1.03–2.96; $p = 0.036$) [15].

Critically, a substantial proportion of TFI cases occur in women without a history of clinically recognized PID. Sellors and colleagues reported that 69.2% of women with laparoscopic evidence of tubal damage had no prior history of pelvic inflammatory disease [8]. This observation underscores the concept of "silent salpingitis," wherein chlamydial infection follows an asymptomatic or subclinical course yet produces progressive tubal damage. Salpingitis occurs in an estimated 15% of reproductive-age women, with *C. trachomatis* identified as the major causative agent of tubal factor infertility [16].

Other infectious agents contributing to tubal pathology include *Neisseria gonorrhoeae*, *Mycoplasma genitalium*, and anaerobic vaginal organisms [17]. Untreated PID may progress to chronic salpingitis, peritubal adhesions, tubo-ovarian abscess formation, and hydrosalpinx development [18].

3.1.3 Non-Infectious Causes

Congenital anomalies represent an underappreciated contributor to TFI. In a single-center study of 220 women with suspected TFI undergoing diagnostic laparoscopy (2020–2023), 15% were found to have total or partial tubal agenesis, with 32 of 34 cases accompanied by congenital uterine anomalies [6]. However, these figures are substantially higher than those reported in most other series, likely due to referral bias; careful systemic evaluation for associated anomalies remains essential when congenital tubal pathology is suspected.

Endometriosis may produce tubal factor infertility through several mechanisms, including peritubal adhesions, fimbrial distortion, and impaired tubal motility [19]. Pelvic inflammatory changes associated with endometriosis can generate

adhesions that encase the tubes, preventing ovum capture and transport [20].

Prior pelvic surgery, including cesarean section, myomectomy, and ovarian cystectomy, may generate postoperative adhesions that compromise tubal function. Iatrogenic tubal occlusion following voluntary sterilization represents a distinct category; large studies report that up to 20–30% of women regret having undergone tubal ligation, generating demand for reversal procedures [21].

Salpingitis isthmica nodosa (SIN) classically occludes the intramural and proximal segments of the fallopian tube, with bilateral disease occurring in over 50% of affected women. Although the etiology remains controversial, inflammation and infection are considered the most likely causative factors [22].

3.1.4 Ayurvedic Perspective on Tubal Factor Infertility

In Ayurveda, tubal factor infertility is not described as an independent entity in the classical texts, as the fallopian tube itself is not mentioned directly. However, the condition is understood through the framework of *Artavavaha Srotas* (channels carrying the menstrual fluid/ovum). Tubal blockage is equated to *Sanga Srotodushti* (obstructive deformity in the channels), involving vitiation of Vata and Kapha doshas [10]. Vata dosha is considered responsible for *Samkocha* (contraction/spasm), while Kapha contributes to *Shopha* (swelling/blockage). Ayurvedic management focuses on normalizing these vitiated doshas through *Shodhana* (purification therapies) and *Shamana* (pacifying therapies), with *Uttarabasti* (intrauterine medication) emerging as a key therapeutic procedure [10].

3.2 Diagnostic Evaluation

3.2.1 Clinical Assessment

A comprehensive history should elicit risk factors for tubal disease, including prior pelvic inflammatory disease, sexually transmitted infections, ectopic pregnancy, endometriosis, pelvic surgery, and history of tubal ligation [23]. Physical examination may reveal adnexal tenderness or masses suggestive of hydrosalpinx, though normal examination does not exclude tubal pathology [24].

Chlamydia antibody testing has been evaluated as a screening tool; a negative test indicates less than 15% likelihood of tubal pathology [25]. However, this approach is limited by cross-reactivity with *Chlamydia pneumoniae* immunoglobulin G and inability to distinguish remote from persistent infection or to confirm resultant tubal damage [26].

3.2.2 Hysterosalpingography (HSG)

Hysterosalpingography represents the standard first-line test for tubal patency evaluation. The procedure involves fluoroscopic imaging following contrast medium injection through the cervical canal [27]. A large tertiary referral center study (n = 288) reported HSG sensitivity of 59.5% and specificity of 76.9% compared to laparoscopic gold standard, with positive predictive value of 81.1% and negative predictive value of 53.2% [28]. Meta-analyses generally report slightly higher specificity (approximately 85%) but confirm moderate overall accuracy.

In patients where HSG indicates proximal tubal blockage, repeat HSG one month later demonstrates tubal patency in approximately 60% of cases, likely due to transient tubal spasm or mucus plug dislodgement [29]. A similar percentage of patients with HSG-diagnosed proximal occlusion demonstrate patent tubes on subsequent laparoscopy [30].

HSG may possess therapeutic benefit, with higher fecundity rates reported for several months following the procedure, particularly when oil-based rather than water-based contrast media are employed [31].

3.2.3 Hysterosalpingo-Contrast Sonography (HyCoSy)

HyCoSy represents an ultrasound-based alternative to HSG that avoids ionizing radiation and iodinated contrast exposure [32]. Contrast agent is injected transcervically while transvaginal ultrasound assesses tubal patency by visualizing contrast spillage from the fimbrial ends [33]. Recent data demonstrate HyCoSy sensitivity of 87.5% and specificity of 92.3% in a single study, with a diagnostic accuracy of 90.48%, compared to laparoscopic gold standard [34]. Overall, reported sensitivity ranges from 40–87% while specificity ranges from 84–100% across different studies [35]. The ASRM notes that sensitivity ranges from 76–96% and specificity from 67–100%, with concordance with HSG in 85% of cases [2].

3.2.4 Laparoscopy with Chromopertubation

Laparoscopy with chromopertubation remains the established gold standard for tubal patency assessment [36]. The procedure permits direct visualization of the fallopian tubes and pelvic structures while colored dye (typically methylene blue or indigo carmine) is injected transcervically, allowing direct observation of spillage from the fimbrial ends [37]. This technique combines diagnostic accuracy with simultaneous therapeutic potential for adhesiolysis, endometriosis ablation, and treatment of other pelvic pathology [38].

Table 1 summarizes the diagnostic performance characteristics of available tubal patency assessment modalities. (Note: PPV and NPV vary substantially by population prevalence; illustrative values from a single tertiary study [28] are shown for HSG, and from reference [34] for HyCoSy.)

Table 1. Diagnostic Performance of Tubal Patency Assessment Modalities

Modality	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Advantages	Limitations

HSG	59.5*	76.9*	81.1*	53.2*	Widely available, inexpensive, therapeutic effect	Ionizing radiation, false positives, painful
HyCoSy	76–96†	67–100†	87.5‡	92.3‡	No radiation, real-time, assess adnexa	Operator-dependent, less widely available
Laparoscopy	Gold standard	Gold standard	–	–	Direct visualization, therapeutic potential	Invasive, requires general anesthesia, cost, surgical risks

*Values from Hortu et al. 2020 [28] single tertiary center study; meta-analyses suggest slightly higher specificity (~85%).

†Range from ASRM committee opinion [2]. ‡Values from Maheux-Lacroix et al. 2014 [34] meta-analysis subset; illustrative only.

3.3 Surgical Management of Tubal Infertility

3.3.1 Patient Selection for Tubal Reconstructive Surgery

The decision to pursue tubal reconstructive surgery versus preceding directly to IVF requires careful consideration of multiple factors. The ASRM committee opinion (2021) outlines that restorative tubal surgery remains an acceptable and widely applied treatment option for tubal factor infertility despite the increased utilization of ART [39]. Favorable prognostic factors for surgical success include: patient age <35 years, adequate ovarian reserve, mild to moderate tubal disease, absence of severe peritubal adhesions, normal male partner semen analysis, and surgery performed by experienced reproductive microsurgeons [40]. Age 35–38 years is considered intermediate, with individualization required; age >38 years generally favors IVF.

Tubal reconstructive procedures are generally categorized according to the anatomical site of obstruction: proximal tubal obstruction (interstitial or isthmic segments), distal tubal obstruction (ampullary or fimbrial segments), and peritubal adhesions [41].

3.3.2 Proximal Tubal Obstruction

Proximal obstruction accounts for 10–25% of tubal factor infertility cases [42]. Therapeutic options include fluoroscopic or hysteroscopic tubal cannulation and microsurgical tubotubal anastomosis [43].

Tubal cannulation represents a less invasive alternative, involving guidewire recanalization under fluoroscopic or hysteroscopic guidance [44]. The NICE guideline review specifically addresses this intervention, evaluating the likelihood of spontaneous conception leading to clinical pregnancy or live birth following tubal catheterization for proximal tubal obstruction [45].

Microsurgical tubotubal anastomosis involves resection of the obstructed segment followed by meticulous re-anastomosis under optical magnification [46]. Reported pregnancy rates following proximal tubal surgery are favorable. A Cochrane review identified case series data demonstrating live birth rates of 27%, 47%, and 53% within one, two, and 3.5 years, respectively [47]. Open microsurgical techniques may achieve superior results compared to laparoscopic approaches, particularly in patients with favorable prognostic factors [48].

3.3.3 Distal Tubal Obstruction and Hydrosalpinx

Distal tubal disease represents the most common form of tubal pathology, accounting for approximately 80% of cases [49]. The primary surgical procedures for distal obstruction are fimbrioplasty (reconstruction of the fimbriae) and neosalpingostomy (creation of a new tubal ostium) [50].

A large retrospective series (n = 96) of reconstructive microsurgery for tubal infertility reported an overall tubal reversal rate of 87.56% (84 of 96 patients). The 48-month cumulative pregnancy rate was 78.04% (64 of 82 patients attempting pregnancy), with seven ectopic pregnancies (8.53%) [51]. For women under age 35, the reversal rate was 90.47%, with a birth rate of 73.01% [51].

Organ-preserving microsurgery yields pregnancy and birth rates of 43.4% and 29.2%, respectively, which compare favorably to outcomes after single IVF cycles (abortion rate 6.4%, extrauterine pregnancy rate 7.9%) [52].

3.3.4 Tubal Reversal Following Sterilization

Women requesting reversal of prior tubal ligation constitute a distinct patient population. Reconstructive microsurgery for tubal reversal in young women (under 35 years) achieves 90.47% tubal reversal with a 73.01% birth rate [51]. However, reconstruction at the infundibular segments (ampulla-fimbrial junction) is associated with higher ectopic pregnancy rates (57.14%), compared to ampullary anastomosis (28.57%) or replantation technique (14.28%) [51].

Table 2 summarizes surgical procedures for tubal factor infertility according to pathology type.

Table 2. Surgical Procedures for Tubal Factor Infertility by Pathology Type

Pathology Type	Surgical Procedure	Pregnancy Rate (%)	Ectopic Rate (%)	Key Considerations

Proximal obstruction	Tubal cannulation	27–53 (cumulative)	Low	Less invasive, repeat procedure possible
	Microsurgical anastomosis	43.4	7.9	Requires microsurgical expertise
Distal obstruction (mild)	Fimbrioplasty	Variable	Moderate	Preserves fimbrial function
Distal obstruction (moderate–severe)	Neosalpingostomy	43.4–78.0	8.5	Success declines with severity
Hydrosalpinx (pre-IVF)	Salpingectomy	Improves IVF OR 2.13*	–	Recommended before IVF
	Proximal tubal occlusion	Comparable to salpingectomy	–	Preserves tube for potential reversal
Tubal ligation reversal	Tubotubal anastomosis	73.0 (age <35)	8.5	Higher ectopic with infundibular anastomosis
Peritubal adhesions	Adhesiolysis	Improved	Low	Laparoscopic approach preferred

*OR for live birth vs. no treatment [53].

3.4 Hydrosalpinx: Special Considerations

Hydrosalpinx represents a severe form of tubal disease characterized by fluid accumulation within a distended, occluded fallopian tube. In addition to physically blocking ovum transport, hydrosalpinx fluid exerts deleterious effects on endometrial receptivity and embryo implantation through mechanical interference and embryotoxicity [52].

3.4.1 Pre-IVF Surgical Management of Hydrosalpinx

Robust evidence supports pre-IVF surgical intervention for hydrosalpinx. A 2020 Cochrane review (three RCTs) found that laparoscopic salpingectomy prior to IVF significantly improves pregnancy (OR 1.75, 95% CI 1.07–2.86) and live birth rates (OR 2.13, 95% CI 1.24–3.65) with no increase in complications, concluding that salpingectomy should be considered for all women with hydrosalpinges undergoing IVF [53].

For women in whom salpingectomy is not desired or appropriate (e.g., those who wish to preserve tubal integrity for possible future reversal), proximal tubal occlusion represents an alternative approach [54]. A meta-analysis of randomized controlled trials comparing salpingectomy to proximal tubal occlusion for hydrosalpinx prior to IVF demonstrated similar responses to controlled ovarian hyperstimulation and pregnancy outcomes between the two techniques [55].

Less invasive options, including ultrasound-guided aspiration of hydrosalpinx fluid at the time of oocyte retrieval, have been evaluated. A multi-center randomized controlled trial by Hammadieh et al. (2008) demonstrated that aspiration significantly improved pregnancy outcomes compared to no intervention, though subsequent meta-analyses have suggested that aspiration is inferior to salpingectomy and should not be routinely recommended [56,57]. Current evidence does not support routine aspiration over salpingectomy, though larger randomized controlled trials are needed [57].

3.5 Assisted Reproductive Technology for Tubal Factor Infertility

In vitro fertilization provides an effective treatment pathway for tubal factor infertility by completely bypassing the fallopian tubes [58]. Contemporary IVF outcomes in TFI patients are favorable and comparable to other etiological groups [59].

A prospective observational study (n = 652) compared IVF outcomes between women with severe endometriosis (n = 294) and tubal factor infertility (n = 358). Pregnancy and live birth rates were comparable between younger endometriosis patients and matched TFI controls (pregnancy OR 0.81, 95% CI 0.54–1.22; live birth OR 0.78, 95% CI 0.5–1.2), suggesting that TFI does not inherently impair IVF success beyond any underlying reduction in ovarian reserve [60].

Age represents the dominant determinant of IVF success in TFI patients. A study of 1,180 patients with simple tubal factor infertility undergoing frozen-thawed embryo transfer confirmed that age is a significant independent risk factor affecting clinical pregnancy, live birth, and miscarriage rates [61]. For women >38 years, IVF is generally preferred over surgery.

Comparative studies of IVF versus intracytoplasmic sperm injection (ICSI) in tubal factor infertility have demonstrated significantly higher fertility rates with conventional IVF compared to ICSI ($p = 0.018$) when male factor infertility is absent, supporting the use of standard IVF as the preferred technique in isolated tubal factor infertility [62].

3.6 Complementary Ayurvedic Approaches

Beyond conventional surgical and ART management, preliminary evidence suggests a potential role for Ayurvedic interventions in tubal factor infertility, though current data are limited. Small case series have reported tubal patency restoration following *Uttarabasti* (intrauterine medication) and comprehensive Ayurvedic regimens incorporating *Virechana* (therapeutic purgation) and *Basti* (therapeutic enema) [10,63]. Ayurvedic interventions utilize drugs with *Sukshma* (subtle), *Sara* (penetrating), *Katu* (pungent), *Ushna* (hot), and *Pramathi* (scraping)

properties to address Vata-Kapha mediated obstruction [10].

A case study by Patil et al. further illustrates the potential of local Ayurvedic therapies (*Yoni-pichu*) in influencing pelvic floor and cervical function, which may have relevance to certain types of tubal or pelvic floor dysfunction [64]. Additionally, a case report on lean PCOS by Bharathi and Patil demonstrated the broader applicability of Ayurvedic regimens in improving fertility outcomes, suggesting that individualized Ayurvedic approaches may support reproductive health through systemic and local actions [65].

However, the available evidence consists primarily of case series and small observational studies; large randomized controlled trials are needed to establish definitive efficacy. The inclusion of traditional medicine perspectives acknowledges the global diversity in healthcare seeking behavior and treatment preferences, but clinicians should counsel patients that current evidence is preliminary.

3.7 Clinical Decision-Making: Surgery Versus IVF

The choice between tubal reconstructive surgery and IVF requires careful individualization. The ASRM committee opinion outlines several key considerations [39]:

Factors favoring tubal reconstructive surgery: young patient age (<35 years), mild to moderate tubal disease, normal ovarian reserve, normal male partner semen analysis, desire for multiple children (as surgery may permit repeated natural conceptions), availability of experienced reproductive microsurgeon, and patient preference for natural conception without ART.

Factors favoring IVF: advanced patient age (>38 years), severe tubal disease (bilateral hydrosalpinx with extensive adhesions), diminished ovarian reserve, concurrent male factor infertility, prior failed tubal surgery, desire for single child with avoidance of surgery, and immediate availability of IVF services with acceptable success rates.

Age 35–38 years: Individualized decision based on specific tubal pathology, ovarian reserve testing, and patient preferences.

Cost-effectiveness analyses generally favor surgery for patients with favorable prognostic factors, whereas IVF may be more cost-effective for those with poor surgical prognosis [66].

3.8 Management Algorithm

Figure 1 presents a clinical algorithm for management of tubal factor infertility based on current evidence.

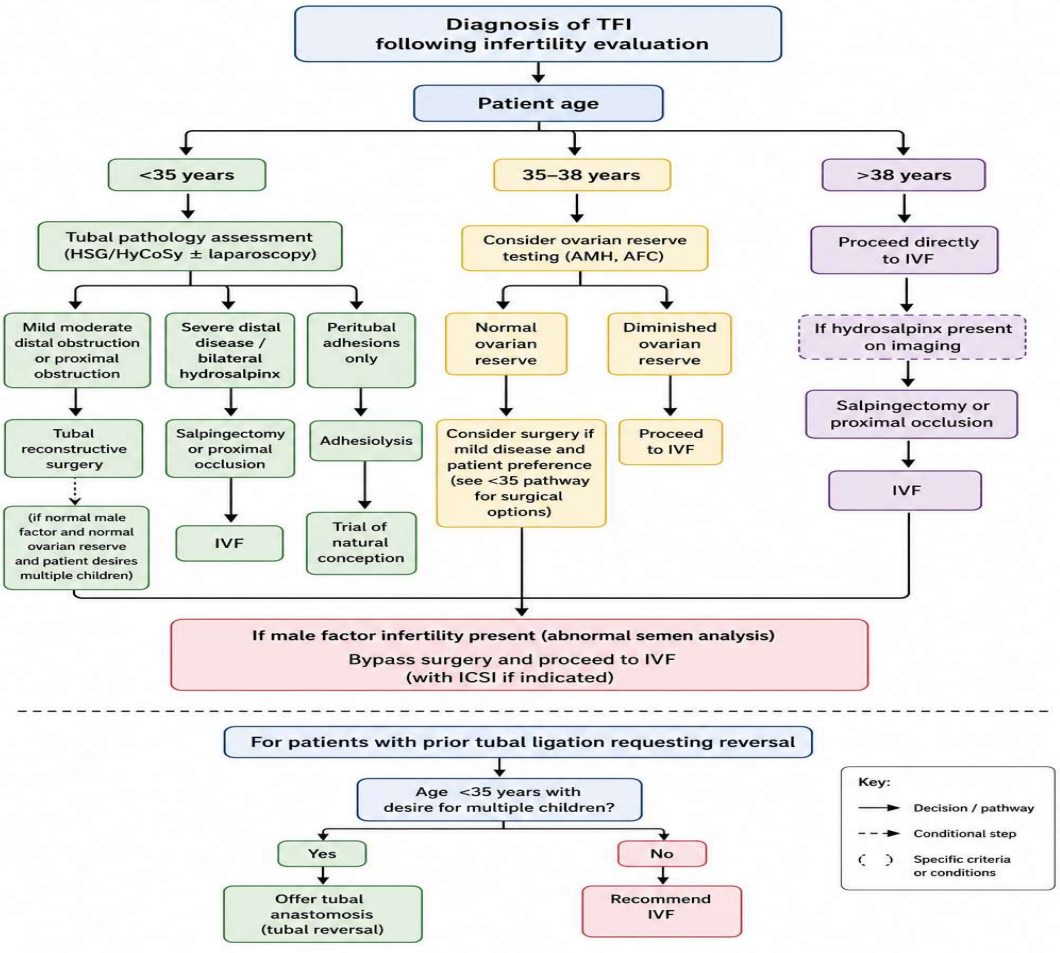

Figure 1: *Clinical Management Algorithm for Tubal Factor Infertility*

4. Discussion

This review confirms that despite advances in ART, tubal reconstructive surgery remains valuable in selected patients. TFI accounts for 25–35% of female infertility, with *Chlamydia trachomatis* as the predominant infectious agent, often without clinically recognized PID [7,8]. This highlights the need for routine chlamydia screening and early treatment to prevent irreversible tubal damage.

Diagnostic accuracy varies across modalities. Laparoscopy with chromopertubation remains the gold standard but is invasive and costly for first-line use [36]. HSG has moderate sensitivity (59–70%) and specificity (77–85%) [28], leading to substantial misclassification. HyCoSy offers comparable or better accuracy without radiation [34,35], though operator-dependent.

Reconstructive microsurgery achieves favorable outcomes in young women with mild-to-moderate distal disease or after sterilization reversal. The 48-month cumulative pregnancy rate of 78% [51] compares well with multiple IVF cycles, though direct comparison is limited by selection bias. Surgical success depends heavily on expertise; referral to specialized reproductive microsurgeons is essential.

Pre-IVF hydrosalpinx management is well-established. Laparoscopic salpingectomy improves live birth rates (OR 2.13) [53] – level I evidence. Proximal tubal occlusion is a comparable alternative but less studied. Hydrosalpinx aspiration at oocyte retrieval is not recommended [56,57].

IVF outcomes in TFI are similar to other etiologies when age and ovarian reserve are considered [60]. Age is the dominant prognostic factor [61]; timely referral is critical for women >38 years or with diminished reserve. Conventional IVF is superior to ICSI in isolated TFI without male factor [62], supporting cost-effective practice.

The surgery-versus-IVF decision requires individualization. Young women with favorable prognosis who desire multiple children may benefit from reconstructive surgery. Those with advanced age, severe tubal disease, or male factor are better served by IVF.

Preliminary evidence suggests Ayurvedic interventions (e.g., *Yoni-pichu*) may benefit some patients declining or unsuitable for surgery [64,65]. However, evidence is limited to case reports and small series; rigorous trials are needed. Clinicians should counsel patients on the preliminary nature of these data.

Limitations: Evidence quality varies (robust RCTs for hydrosalpinx, mostly observational for surgery). Publication bias may inflate success rates. Findings may not generalize to low-resource settings. Ayurvedic evidence has small samples and no standardization. The high congenital anomaly rate from a single study [6] requires confirmation.

Future research: Randomized trials of tubal cannulation vs. anastomosis [67]; office-based hysteroscopic cannulation; novel hydrosalpinx treatments (sclerotherapy, occlusion devices) [68]; management of unilateral obstruction; AI for HSG/HyCoSy interpretation [69]; and rigorous Ayurvedic trials.

Clinical implications: Stepwise diagnosis starting with HSG/HyCoSy, laparoscopy when uncertainty or surgery planned. For hydrosalpinx, perform salpingectomy before IVF. For young women with mild-to-moderate tubal disease and normal male partner, offer reconstructive surgery as an alternative to IVF.

5. Conclusion

Tubal factor infertility (TFI)remains a major global burden, predominantly infectious but with congenital/iatrogenic causes. Diagnosis: clinical history → first-line HSG → laparoscopy if uncertain or surgery planned. Individualize management by age, ovarian reserve, tubal pathology, male factor, and reproductive goals. Both reconstructive surgery and ART are evidence-based. For hydrosalpinx, laparoscopic salpingectomy before IVF improves outcomes. Tubal surgery retains a role, especially for young women desiring multiple natural conceptions. Ayurvedic interventions (*Uttarabasti*, *Yoni-pichu*) require rigorous research. Future comparative effectiveness trials should refine patient selection.

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