

Role of Falloscopy in the Management of Subfertility

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ABSTRACT

Aim: To review the technique and results of falloscopy and compare it with the conventional methods used in the evaluation of tubal subfertility.

Data source: Electronic library, SpringerLink, PubMed, Google, HighWire, eMedicine and materials from World Laparoscopy Hospital.

Study selection: Studies involving the use of falloscopy in assessing tubal status were reviewed and compared with conventional methods.

Data synthesis: Falloscopy gives an excellent assessment of tubal functional status accurately and provides treatment for minor tubal disease and sorts out patients who need IVF for early referral.

Conclusion: There is no doubt, falloscopy is a gold standard in assessing functional status of the fallopian tube accurately, provides treatment in selected cases and detects patients that needs IVF and refers them in good time but expertise and further training is required to make the procedure routine in the evaluation of subfertility.

Keywords: Falloscopy, Tubal disease, Classification, Subfertility.

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INTRODUCTION

Infertility is an absolute term so for the purpose of this discussion subfertility will be used. This is defined as inability of a couple to get pregnant despite adequate coital exposure (adequate coital exposure is 2 to 3 times per week) for a period of 1 year. However, this definition varies with age of the woman—for a woman that is 35 years and above, subfertility is regarded as inability to conceive despite adequate coital exposure for a period of 4 to 6 months.^{1,2} The prevalence of subfertility ranges between 9 and 35% in the developing countries as compared with 4 to 14% in the developed countries.²

Causes of subfertility include:

- Male factors—35%
- Female factors—35%
- Both male and female factors combined—20%
- Unexplained—10%.

Female factors have several categories such as cervical, uterine, ovarian and tubal factors for which this article will

be emphasizing in a moment. Fallopian tube is lined with epithelial cells which aid in oocyte transport to the fimbria end. Fallopian tube alone accounts for more than 30% of female subfertility.^{3,4} In the evaluation of tubal infertility; the aim should be to ascertain the functional status of the tube not just the patency which more often than not is the case because the tube may be patent but not functional due to damaged cilia and mucosa.⁵ Conventional methods such as hysterosalpingograph or laparoscopic chromotubation provide only an indirect assessment of the tubal patency without the status of the tubal mucosa.⁵ Salpingoscopy visualizes only the fimbrial end, the intramural and isthmic part are not reached, this is very vital as the pathology could be in that region. False-negative results are common since, tubes that appear normal and patent by hysterosalpingograph could have nonobstructive lesions, such as abnormal endotubal vasculature or epithelial atrophy.^{5,6} Falloscopy can be used as both diagnostic and therapeutic in the management of tubal infertility.

FALLOSCOPY

This is sometimes called falloscopy; it is the visual examination of the inside of the fallopian tubes. This procedure involves inserting a tiny flexible catheter through the cervical canal and uterine cavity into the fallopian tube, 0.5 mm flexible fiberoptic endoscope is threaded through the catheter into the fallopian tube. The inside of the tube can then be thoroughly examined on a television monitor via a camera attached to the outer end of the falloscope.

INSTRUMENT

The falloscope is a flexible high resolution microendoscope of 0.5 mm diameter and 1.73 mm length that contains a bundle of 2000 optical fibers and 8 to 12 illuminating fibers. It is capable of magnifying an object up to 50 times of its actual size.

There are two types of falloscopes—coaxial system which was manufactured by Kerin in 1970 and linear everting catheter (LEC) (Figs 1A and B), this consists as of unfurling balloon catheter with an internal endoscope that is used transcervically without a hysteroscope, this confers an advantage of coaxial catheter (Figs 2A and B).

PROCEDURE

Falloscopy is done during the midfollicular phase of the menstrual cycle (from 5-9 days) after menstruation, so that

the tubal ostium can be visualized in the absence of blood and thick endometrium. However, prior to the procedure an informed consent is taken from the patient. The process takes 30 to 40 minutes, but if a minor tubal surgery will be performed it takes an average of 1 to 2 and half hours. It is usually done under conscious sedation but if one is proceeding to tubal surgery then it is converted to general anesthesia. A prophylactic antibiotic is not a prerequisite to the procedure.

The LEC consists of inner and outer catheter bodies of diameters 0.8 and 2.8 mm respectively that are joined circumferentially at their distal tips by a distensible polyethylene membrane. The pressure within the enclosed

space (the balloon space) is controlled by a fluid-filled syringe. The falloposcopy is advanced within the inner catheter and the membrane is introduced into the uterus. Once the ostium is identified, the outer catheter is held in position and pressure is applied to the membrane by using the fluid-filled syringe; the inner catheter is pushed forward, resulting in the linear eversion of the balloon into the fallopian tube.

The balloon and falloposcope are advanced into the fallopian tube in small increments, up to a distance of 10 cm or until resistance is encountered. Imaging of the endotubal surface is then performed in a retrograde manner using the lens-fluid interface.^{10,12} The LEC system confers a few advantages over the coaxial system.

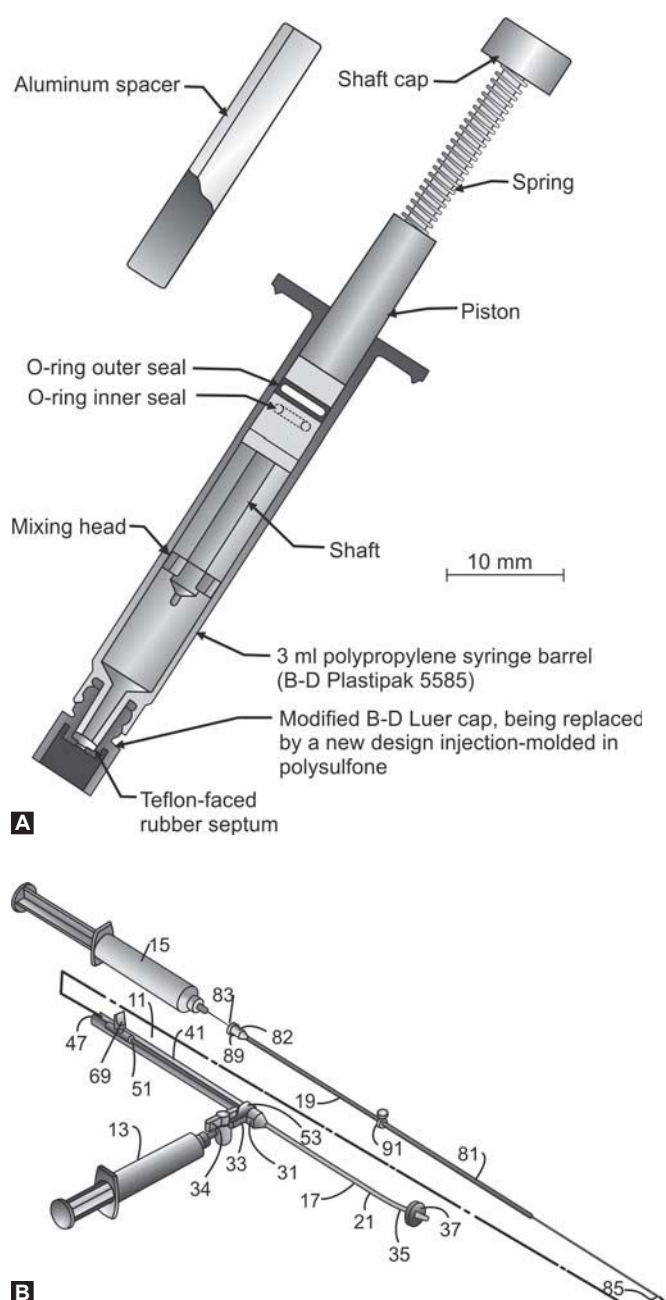
First, the eversion balloon is unrolled into the fallopian tube without exerting any shearing force between the balloon and the tubal epithelium. The everting balloon will seek the path of least resistance and negotiate any tubal tortuosity. This process greatly minimizes the risk of tubal injury, which is associated with guidewire cannulation in the coaxial system. Second, the falloposcope advances automatically during balloon eversion and can be moved independently to optimize visualization.

Third, there is no need for any hysteroscopy or cervical dilatation, and falloposcopy using the LEC system can be accomplished as an outpatient procedure that requires only local anesthesia.

Finally, the falloposcope is well-protected inside the balloon and is kept coaxially aligned along the tubal lumen.

RESULTS FROM FALLOPOSCOPY

Various studies revealed that falloposcopy has been performed in patients with hysterosalpingographic or laparoscopic evidence of tubal disease (Table 1). The success rate of cannulation by falloposcopy in abnormal tubes is more than 90%⁷ in the majority of recent studies. There is usually a poor correlation between hysterosalpingographic studies and falloposcopy since falloposcopy gives a more accurate visual status of the tube and with HSG false positives could be as high as 40%.⁸⁻¹⁰ Eight infertility patients with proximal tubal block by hysterosalpingograph had falloposcopy and patency was established in 9 out of 12 tubes, falloposcopy revealed five tubes with multiple or extensive intratubal lesions that would be unsuitable for unilocular tubal resection with subsequent reanastomosis and recanalization for which five tubes had only minor pathologies, two of which became pregnant and only 2% of the tubes needed tubal surgery. Another randomized controlled study revealed that there is a significant benefit in pregnancy rate when tubes were flushed with oil soluble



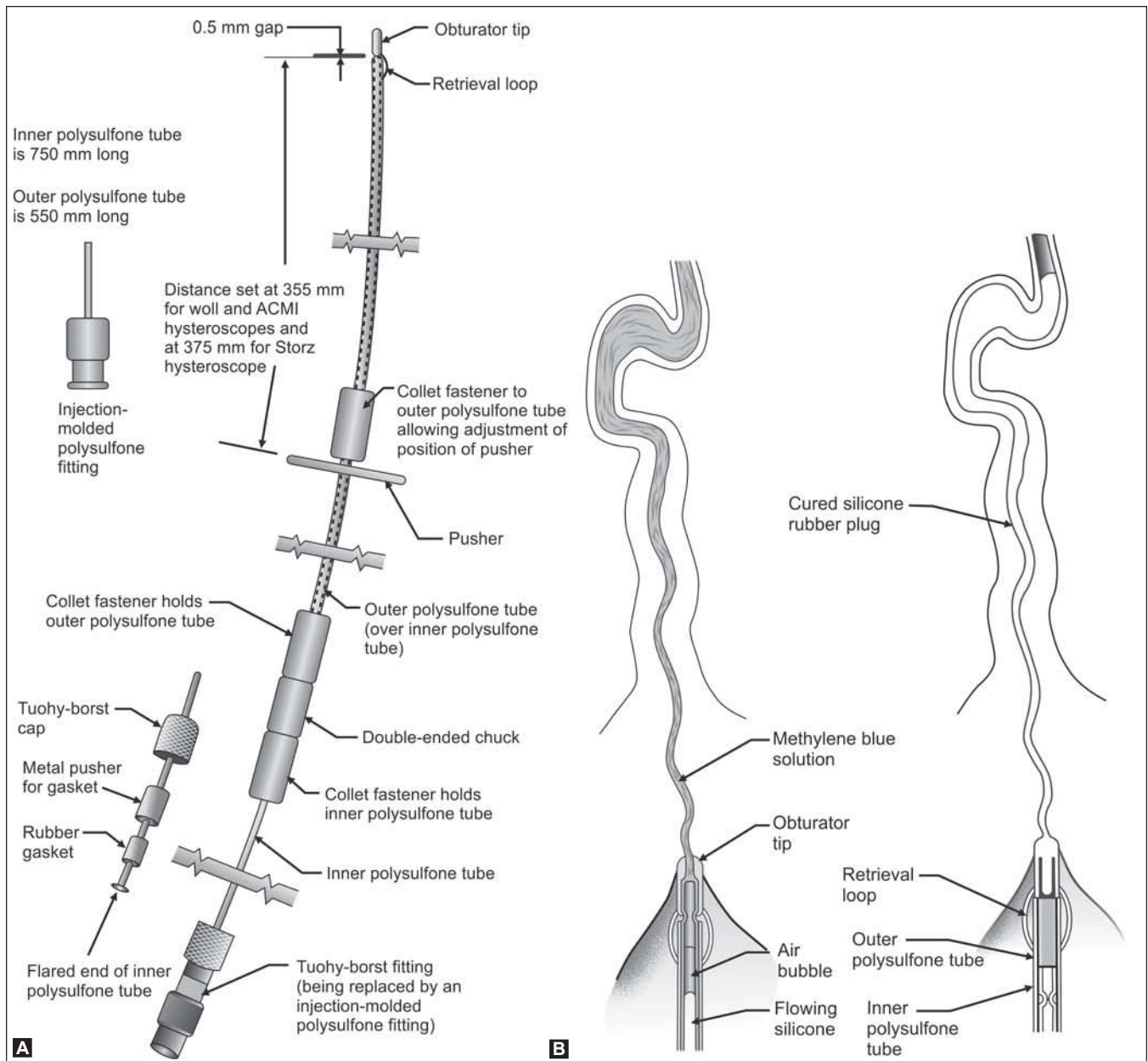
Figs 1A and B: (A) Coaxial catheter with preformed soft obturator tip, (B) linear everting catheter

media and this was supported by falloposcopic procedures.¹⁰⁻¹³

Schille et al revealed in his studies that proximal tubal blockage which is a major cause of subfertility in women could be easily managed with falloposcopy and this yielded good pregnancy outcome.¹⁴ Further studies revealed the importance of falloposcopy in performing tubal cannulation under laparoscopic guidance with both the coaxial and LEC falloposcopes and they achieved 80% success rate.¹⁵ Technical difficulties existed with coaxial falloposcopes more than with LEC during the procedure and this could be attributed to ostial spasm secondary to attempted guidewire cannulation and inability to negotiate the whole tubal lumen

in the absence of obstructive disease. These obstacles could be overcome by using smaller directional guidewire, softer distension-free Teflon catheters, improved microendoscopes and improved surgical skills necessary for a safe and fruitful falloposcopy.¹⁶⁻²⁰ All these studies are revealing the importance and efficacy of falloposcopy in both diagnosing tubal infertility and treating it based on the pathology.

However, falloposcopy has been shown to be a highly useful, minimally invasive procedure in diagnosing and treating patients with proximal, mid and distal tubal disease as a cause of their subfertility. It has also been shown from the aforementioned studies to have a good predictive value for investigation and future fertility.²¹



Figs 2A and B: (A) When methylene blue and silicone (Advanced Medical Grade Silicones BV, The Netherlands) are injected into the fallopian tube, the obturator tip is held in place by the outer catheter, (B) when the silicone has hardened the inner part of the coaxial catheter is then withdrawn and breaks the silicone column (which has extended from the syringe to the ampullary part of the plug) at the junction of the preformed obturator tip (Sieglar AM and Lindeman HJ)

Table 1: Various studies showing various falloposcopic techniques and treatment—women health 2010

Study	Technique	Patients no.	Indication	Recannulation success rate (%)	Preg rate	Follow-up (months)	Ref
Schille et al	Falloposcopy and tubal dilatation under laparoscopic control	42	Unilat/bilat proximal tubal obstruction	61.9	12	3-6	14
Rimbach et al	Falloposcopic catheterization	38		80			15
Surrey et al	Coaxial falloposcopy	16	Proximal tubal obstruction	85			15
Rimbach et al	Falloposcopic hysteroscopic laparoscopic coaxial tubal cannulation	367		69.6			16
Pennehouat et al	Falloposcopic hysteroscopic coaxial tubal cannulation	66	Proximal tubal obstruction	83			17
Kerin et al	Falloposcopic hysteroscopic laparoscopic guidewire annulation and tuboplasty	35	Proximal tubal obstruction	81.4			18
Sueok et al	Falloposcopy with linear everting catheter	50	Proximal, mid and distal tubal obstruction	79.4	22	2-36	19
Dechaud et al	Falloposcopy with a linear everting catheter	75	Tubal and unexplained infertility	94.5	27.6		20
Lee	Falloposcopy with linear everting catheter and laparoscopy	20	Tubal occlusion	93			21

Complications of Falloposcopy

These are rare but when they occur, they are usually minor and can be easily managed. Such complications include bleeding, infection, tubal perforation and technical failures on the instrument side and of course lack of clinical expertise could lead to avoidable complications.

Contraindication to Falloposcopy

- Acute or chronic cervicitis or vaginal infection rule out *Chlamydia* and *N. gonorrhoea*
- Recent tubal surgery or congenital malformation of the genital tract
- Recent history of PID
- Known or suspected case of genital malignancy.

FALLOPOSCOPIC DIAGNOSIS AND CLASSIFICATION OF TUBAL DISEASE

Falloposcopy provides the opportunity to visualize the lumen of the fallopian tube *in vivo* for proper assessment and evaluation of its functional status.²² It has been used to classify normal and abnormal epithelial lesions, such as accumulated debris, nonobstructive intraluminal adhesions, stenosis, polyps, total fibrotic obstruction and also segmental identification of location of tubal pathology with minimal or no complication.²³

In other to effect adequate management of the tubal disease, hence the need for its classification, Kerin et al used a scoring²⁴ system to classify tubal pathology:

- Falloposcopically normal tubes—46%
- Mild-to-moderate tubal disease—29%
- Severe to obstructive tubal disease—25%.

Studies revealed endotubal lesions in 57% of cases and 70% were confined to the medial third of the tube between the uterotubal junction and ampullary isthmic junction.²⁴

Kerin et al further classified tubal disease falloposcopically: Intramural stenosis—five cases, isthmic stenosis—10 cases, isthmic obstructive lesion—five cases, salpingitis isthmic nodosa—two cases, nonobstructive lesion which ranged from intraluminal adhesions, associated devascularization and epithelial atrophy in the intramural, isthmic and ampullary segments—10 cases, hydrosalpinx—two cases and intratubal polyp—one case. In 35 out of 43 falloposcopies performed 18.6% had normal appearance of the fimbrial, ampullary, isthmic and intramural tubal epithelium.²⁵

CONCLUSION

Subfertility is a global problem and with the recent sexual debut among the reproductive age group, the incidence of tubal subfertility is on the increase especially in the developing countries; hence, adequate knowledge about falloposcopy will go a long way in alleviating the burden of subfertility with its psychological and emotional burden of the shoulders of the clinician. Falloposcopy no doubt plays a significant role in accurate and precise diagnosis to patients with tubal pathology and providing them with treatment as the case may be and at the same time sorting out the patient that will benefit from IVF on account of severe tubal disease in good time.

FUTURE CHALLENGES

Despite the diagnostic superiority of falloposcopy over the conventional methods in the evaluation and treatment of

endotubal disease. There are technical shortcomings like 'white-out' due to intense light in close proximity of tissues, kinking leading to catheter damage and obstruction to successful falloposcopic cannulation and lack of personal expertise required in the technique, limits the routine use of this procedure in our day to day clinical practice.

Hence, the need for a robotically-assisted hysteroscopic falloposcopic fluoroscopic fallopian tube recanalization technique under ultrasound-guided cannulation would help guide the catheter path avoiding tubal perforation during guide-wire cannulation.

The micromanipulation should be simulated on a monitor akin to that used in intracytoplasmic sperm injection.

Use of thermally controlled catheters or guidewires may present the possibility of effectively clearing fibrolytic occlusions that might have being missed during cannulation.

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