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Spontaneous pregnancy rate after fallopian tube recanalization for unilateral obstruction with a patent contralateral tube

Jehad Fataftah^{1*}, Raed Tayyem², Firas Al Rshoud³ and Mamoon Al-Omari⁴

Abstract

Background: Infertility is a common sociomedical problem worldwide, affecting up to 15% of couples. Tubal obstruction is currently one of the most important causes of female infertility. This study was designed to determine the spontaneous pregnancy rate in patients undergoing unilateral transcervical fallopian tube recanalization, performed by an interventional radiologist, for proximal fallopian tube obstruction with a patent contralateral tube. The secondary objective was to analyze pregnancy rates in relation to the type and duration of infertility, patient age, and body mass index.

Results: Thirty-eight patients with unilateral tube obstruction were included in this study. Transcervical fallopian tube recanalization was successfully performed in all cohorts. At the one-year follow-up; 13 women (34.2%) had become pregnant, nine (23.7%) delivered healthy babies, and four (10.5%) had miscarriages. The time interval between the application of the technique and spontaneous pregnancy was 1–12 months, with a mean of approximately 4 months. Multivariate analysis showed a significantly higher pregnancy rate in young (< 35 years), nonobese (BMI < 30 kg/m²) females with a history of primary infertility for < 5 years. Minor complications were noted in 27 patients (71%). No major complications were noted.

Conclusions: Our study showed that transcervical fallopian tube recanalization of proximal fallopian tube obstruction with a patent contralateral tube increased the spontaneous pregnancy rate in cases of tubal factor infertility. Moreover, transcervical fallopian tube recanalization is recommended as a first-line treatment for women with unilateral proximal fallopian tube obstruction and a patent contralateral tube owing to the low risks associated.

Keywords: Fallopian tube, Infertility, Hysterosalpingography, Fluoroscopy, Interventional Radiology

Background

Infertility is defined as the inability to conceive after 1–2 years of unprotected sexual intercourse. Approximately 10–15% of couples may experience problems conceiving. Infertility can result from a wide variety of etiologies [1]. Female factors account for 40% of cases of infertility [2]. Further, in 20–25% of all cases, infertility

is caused by tubal factors, including bilateral proximal fallopian tube blockage, bilateral partial fallopian tube blockage, unilateral tube blockage, unilateral or bilateral hydrosalpinx, tubal scarring, or damage [2, 3]. These abnormalities are often caused by pelvic inflammatory disease (PID), endometriosis, congenital malformations, or adhesions after pelvic surgery [4, 5].

Tubal obstruction can occur anywhere along the tube length and can be partial or complete. Proximal tube blockage prevents spermatozoa from reaching the fertilization area distally, whereas distal tubal pathology stops ovum movement [6].

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A hysterosalpingogram (HSG) is commonly used for initial screening for tubal patency and the presence of any tubal abnormality, as it is a noninvasive and inexpensive work-up [7]. An HSG is radiographic examination involving dye, wherein contrast is instilled via the cervix and into the uterus [6]. Patent tubes allow contrast to easily flow through and spill out into the peritoneum. However, patent tubes are not guaranteed to function normally; the lining inside the tube can be damaged [4], which may cause difficulties in conception, even if the tubes are patent. In such cases where conception occurs, there is an increased risk of ectopic pregnancy [8]. If abnormalities are detected on an HSG or if the findings are inconclusive, laparoscopy is used to definitively diagnose and treat tubal disease [9]. HSGs are associated with a false positive rate for diagnosis of tubal blockage of 50%, along with specificity and sensitivity rates of 83% and 65%, respectively, for tubal patency [10, 11].

Approximately 10–25% of tube diseases worldwide occur due to proximal tubal obstruction [4, 12]. Recent developments in the field of assisted reproduction have led to renewed interest in managing proximal tube pathologies under fluoroscopic guidance, which is a non-surgical approach that may increase the chance of spontaneous pregnancy [13]. Transcervical fallopian tube recanalization (T-FTR) is an established procedure that potentially provides enhanced diagnosis and treatment [14].

T-FTR is a low-risk procedure mainly used to release tubal blockage. It is useful as an initial approach for managing proximal tubal obstruction, and for confirming tubal patency, potentially reducing the need for further invasive interventions [15]. The T-FTR technical success rate for catheterization of the proximal tube is 85–95% [4].

T-FTR is performed to release proximal tubal obstruction using the Seldinger wire technique [16, 17]. Based on an initial HSG, patients with tubal obstruction are indicated for this procedure, which is performed at around day 10 of the menstrual cycle (follicular phase) [18].

This study aimed to determine the efficacy and conception rate of unilateral T-FTR for proximal fallopian tube obstruction (PFTO) with a patent contralateral tube. Secondly, the study aimed to analyze pregnancy rates in relation to the type and duration of infertility, patient age, and body mass index.

Methods

This retrospective, observational study included women with infertility presenting to the Interventional Radiology Department of the Jordan University of Science and Technology in Jordan. Unilateral proximal fallopian tube blockage was confirmed using an HSG. T-FTR was

performed according to the institutional protocol, and hystosalpingographic abnormalities and the outcomes and complications of T-FTR were recorded. This study was approved by the local institutional review board (IRB).

Participants

Patients who were referred from an infertility clinic between February 2012 and January 2018 after the diagnosis of proximal tubal obstruction with a contralateral patent tube as the only apparent cause of infertility were considered for inclusion.

The inclusion criteria for this study were: two HSGs showing proximal tubal obstruction and a contralateral patent tube confirmed evidence of ovulation, and partner's test results indicating healthy sperm. Exclusion criteria were active uterine bleeding or recent curettage, PID, allergy to contrast media, and male-related infertility factors.

Procedure for T-FTR

All T-FTR procedures were performed as outpatient procedures in the Radiology department. Recanalization was performed with patients in the lithotomy position under conscious sedation. Foam padding beneath the pelvis allowed for easy manipulation of the metal speculum.

Following sterile preparation and draping, a metal retractor was gently inserted intravaginally to visualize and stabilize the cervix. An intrauterine access balloon catheter was used to inject nonionic, water-soluble contrast (ISOVIST300; Bayer Schering Pharma AG, Berlin, Germany) into the endometrial cavity. Routine HSG was first performed as a part of the T-FTR procedure to evaluate the uterus and fallopian tubes.

If one of the fallopian tubes could not be visualized, selective salpingography was performed. A catheter was placed in the tubal ostia, and a guidewire was passed through the catheter and directed toward the cornual region. The guidewire was then inserted deep into the obstructed tube until it coiled into the peritoneal cavity. Selective salpingography was repeated to confirm tubal patency. The T-FTR endpoint was tubal patency with free intraperitoneal contrast spillage.

Statistical analyses

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 17 (SPSS Inc., Chicago, IL, USA). Pearson's Chi-squared test was used to compare the T-FTR pregnancy rates. Multivariate logistic regression analysis was used to determine the predictors of successful conception after T-FTR for women aged < 35 and > 35 years. Statistical significance was set at $P < 0.05$.

Results

Thirty-eight patients with primary or secondary infertility who had undergone HSG and unilateral fallopian tube blockage were identified (Figs. 1, 2, 3). The baseline characteristics and T-FTR conception rates of the patients are presented in Table 1. Most of the participants were <35 years old (55.3%) and were obese, with a body mass index (BMI) of >30 kg/m² (71.1%). Most participants had primary infertility (60.5%), whereas only 39.5% suffered from secondary infertility. Additionally, 68.4% suffered from infertility for less than 5 years. It also shows that 65.8% had right tubal blockage. The conception rates were 21.1% for patients with primary infertility, and 13.1% for secondary infertility.

All the recanalization procedures were successful. Post-procedural mild pelvic cramping and vaginal spotting were observed. However, all patients went home on the same day as the procedure was performed. No serious complications (tubal perforation or active pelvic bleeding) were reported.

At the 1-year follow-up, 13 patients were observed to have been able to conceive (34.2%): nine patients had healthy deliveries (23.7%), and four had miscarriages (10.5%). The conception rates were shown to be better among young (21.1%), nonobese patients (23.7%), primary infertility (21.1%), and infertility for <5 years (26.3%).

As shown in Table 2, patients were stratified by age; multivariate logistic regression analysis revealed that

BMI, infertility type, and duration were considerably associated with conception in patients aged <35 years. The most common complaints after the procedure were mild cramping, lower abdominal pain (71%), and mild vaginal spotting (51%). These symptoms usually occur due to the passage of the contrast medium into the peritoneum, or due to the insertion and manipulation of the guidewire.

None of our patients had infections, as all procedures were performed under sterile conditions. Additionally, postprocedural antibiotic courses (oral doxycycline and metronidazole) were prescribed. Major complications such as fallopian tube perforation or continuous bleeding were not observed. Table 3 summarizes the complications reported following the procedure; most patients reported mild pelvic discomfort (71%) and vaginal spotting (51%). Perforation, major continuous bleeding, and infection were not observed (0%). The time interval between the application of the technique and spontaneous pregnancy was 1–12 months (mean, 4 months).

Discussion

The best treatment for infertility depends on several factors, the most important of which are recanalization success rate, severity of tube injury, ovarian reserve, patient age, and male fertility [19]. Patient preference, religious beliefs, cost and insurance issues, and time off work may also be considered of essence in infertility treatment [10].

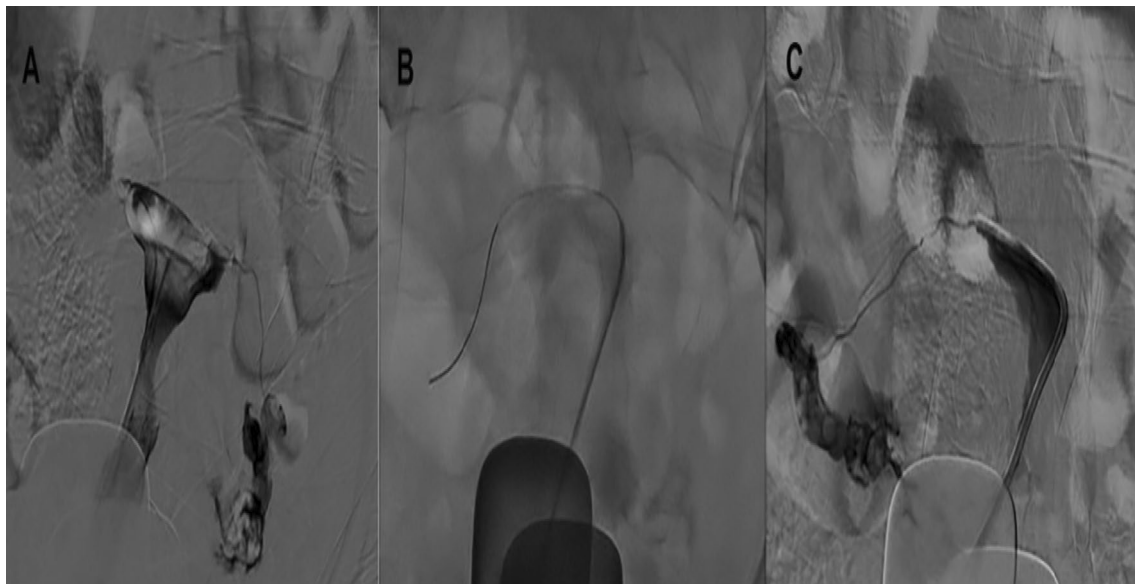
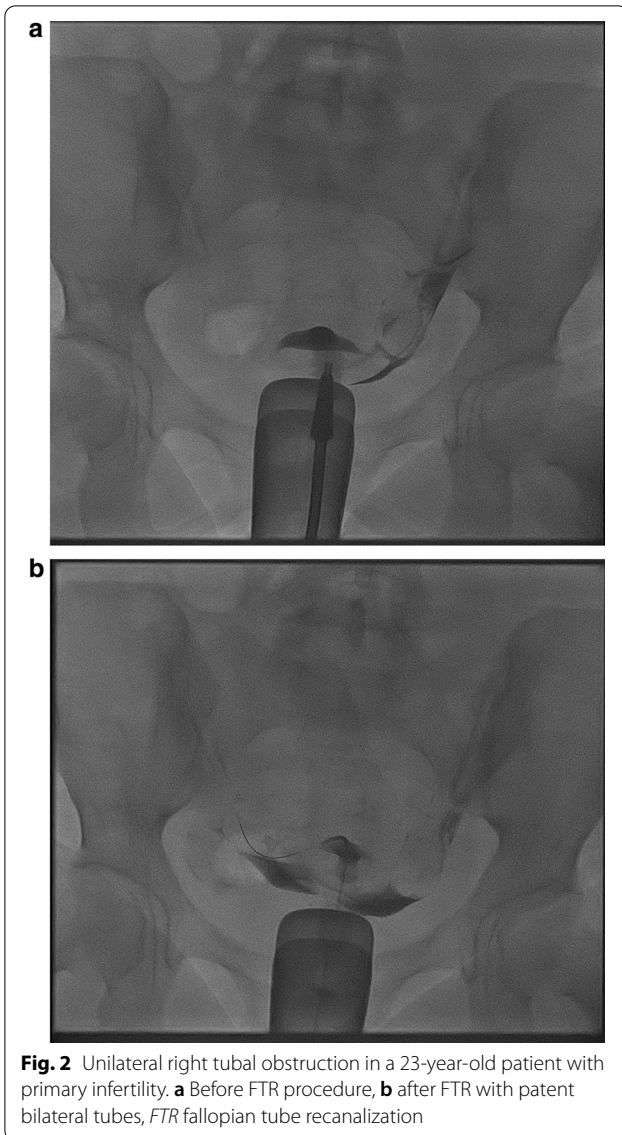


Fig. 1 Hysterosalpingogram before and after FTR for a 28-year-old patient. **A** Hysterosalpingogram showing left tubal patency and proximal right tubal obstruction. **B** Right tube recanalization using catheter-wire technique. **C** Selective right salpingogram following recanalization showing patent tube with free peritoneal spillage. *FTR* fallopian tube recanalization



Our study aimed to evaluate the conception rate in patients undergoing unilateral transcervical fallopian tube recanalization (T-FTR) for PFTO with a patent contralateral tube. To the best of our knowledge, only one published study has concluded that T-FTR is an appropriate treatment for unilateral PFTO and patent contralateral tube. Hayashi et al. studied 11 patients undergoing T-FTR with a technical success rate and pregnancy rate of 100% and 55%, respectively [20].

Our study was conducted to address the same issue with a larger sample size, with comparable technical success (100%), and pregnancy rates (34.2%). All women in this study had documentation of unilateral proximal tube blockage and a patent contralateral tube based on at least two HSGs.

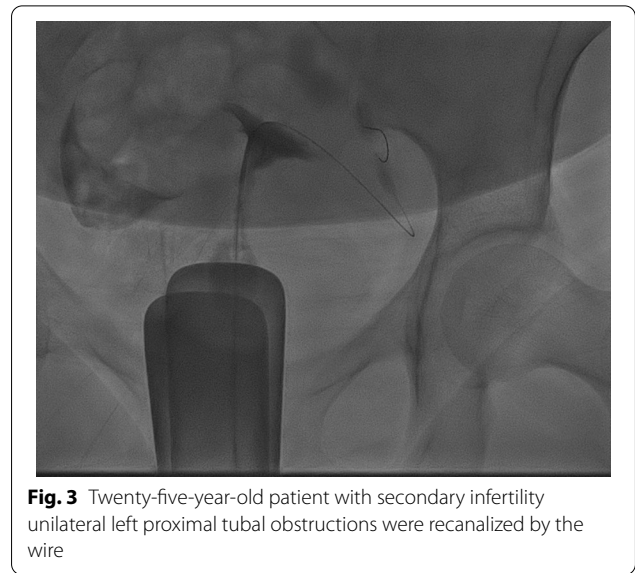


Table 1 Transcervical fallopian tube recanalization (T-FTR) conception rates

Variables	Spontaneous pregnancy		Total	p value*
	Yes	No		
Infertility type				0.21
Primary	8 (21.1%)	15 (39.5%)	23 (60.5%)	
Secondary	5 (13.1%)	10 (26.3%)	15 (39.5%)	
Total	13 (34.2%)	25 (65.8%)	38 (100%)	
Duration of infertility				0.05
< 5 years	10 (26.3%)	16 (42.1%)	26 (68.4%)	
> 5 years	3 (7.9%)	9 (23.7%)	12 (31.6%)	
Age at T-FTR				0.13
< 35 years	8 (21.1%)	13 (34.2%)	21 (55.3%)	
> 35 years	5 (13.1%)	12 (31.6%)	17 (44.7%)	
BMI				0.04
< 30	9 (23.7%)	2 (5.3%)	11 (28.9%)	
> 30	4 (10.5%)	23 (60.5%)	27 (71.1%)	
Tube obstruction				0.11
Right	7 (18.4%)	18 (47.4%)	25 (65.8%)	
Left	6 (15.8%)	7 (18.4%)	13 (34.2%)	

* Pearson's Chi-squared test

Most cases of in vitro fertilization (IVF) and embryo transfer, which bypass blocked tubes without the need for repair, can be managed at fertility clinics. Recent data have shown that “the take-home baby rate” for IVF is higher than that for surgical intervention [12]. Furthermore, the incidence of ectopic pregnancy is considerably higher after tubal surgery than after IVF. Consequently, IVF has become the treatment of choice for most cases

Table 2 Transcervical fallopian tube recanalization (T-FTR) conception rates based on age

Characteristic	Age at T-FTR					
	< 35 years			> 35 years		
	Spontaneous pregnancy			Spontaneous pregnancy		
	Yes	No	p value*	Yes	No	p value*
Infertility type			0.03			0.53
Primary	3	4		1	4	
Secondary	5	9		4	8	
Total	8	13		5	12	
Duration of infertility			0.01			0.79
< 5 years	7	6		3	7	
> 5 years	1	7		2	5	
BMI			0.02			0.79
< 30	6	5		2	5	
> 30	2	8		3	7	

BMI body mass index

* Multivariate logistic regression analysis

Table 3 Complications of transcervical fallopian tube recanalization

	Pelvic pain	Vaginal spotting	Major bleeding	Perforation	Infection
Number of patients	27 (71%)	20 (52.6%)	0	0	0

of tubal factor infertility, especially for couples with other fertility factors (i.e., age or male factors) [21]. However, IVF is invasive, expensive, and time-consuming, and involves hormonal manipulation that may be associated with health risks for women [13, 22].

Uemura et al. divided 515 women with infertility into two groups based on HSG findings. The pregnancy rate in patients with a normal HSG was 42.3%, whereas that in patients with unilateral tube occlusion was 38.8%. The difference between the two groups was not statistically significant. The authors concluded that assisted reproductive treatment should not be provided as the primary treatment route, allowing for natural fertilization [22].

The use of FTR to manage PFTO is gaining popularity, with recent developments in the field of assisted reproduction renewing interest in fluoroscopy-guided proximal tube pathology management. Fertility clinics should be aware that FTR is a low-cost, fast, low-risk procedure and an effective treatment option for such cases [23].

Most patients undergoing T-FTR are concerned about radiation risk and the development of cancer or genetic defects. Papaioannou et al. reviewed 366 cases of selective salpingography to calculate the median effective

doses for various combinations of procedures. Radiation doses ranged from 0.087 mSv for unilateral selective salpingography to 0.271 mSv for bilateral salpingography. The study concluded that the overall risks associated with radiation doses observed in selective salpingography (T-FTR) were low [24].

Previous studies have reported the safety and usefulness of tubal recanalization. A meta-analysis of studies in patients undergoing FTR for bilateral tube blockage showed an 85–95% success rate in overcoming the obstruction, leading to a conception rate of 50% [4, 7]. Al-Omari et al. reviewed 62 cases of blockage of one or both fallopian tubes. The conception rate was 41% within one year of T-FTR [23]. Recanalization was successful in all patients (100%) because these procedures were performed by an experienced interventional radiologist, and water-soluble contrast medium was used to lower the risk of lymphatic or vascular intravasation [6].

These findings showed that a patent contralateral tube can be functionally abnormal or have an organic disease that prevents natural fertilization and that an occluded tube can function well once recanalized [20]. Furthermore, no ectopic pregnancy was reported in the two studies, mainly owing to recent refinement of recanalization equipment, techniques, and instruments. These results establish a reasonable rationale for considering T-FTR as a relevant candidate for treatment of tube infertility.

While the risk of ectopic pregnancy is higher in patients who have undergone T-FTR, this is believed to be primarily due to underlying tubal abnormalities rather than the procedure itself. Thus, T-FTR can be therapeutically

beneficial as a safe and effective approach in patients with unilateral obstruction of the proximal fallopian tube with a patent contralateral tube, before attempting other treatments for proximal tubal obstruction and after excluding other infertility factors [25].

Our study evaluated the conception rate after T-FTR in relation to several variables that have the potential to affect pregnancy, including patient age, infertility type, duration of infertility, and BMI. There was a significant association between the pregnancy rate and examined variables. Spontaneous pregnancy rates were higher in patients with primary infertility compared to those with secondary infertility (60.5% vs. 39.5%). In addition, spontaneous pregnancy rates were higher in patients with a short (<5 years) history of infertility, compared to those with a longer (>5 years) history (68.4% vs. 31.6%). A longer duration of infertility may indicate long-term tubal inflammation, which may damage the tube mucosa and cilia [10]. BMI was observed to be another factor related to the success of conception. Conception rates were higher in patients without obesity (BMI<30) than with obesity (23.7% vs. 10.5%). The correlation between obesity and infertility has been well-documented in other studies [26, 27].

Bivariate analysis showed that pregnancy rates varied according to the examined parameters. Interestingly, these variations were not statistically significant, probably due to the small sample size or the presence of confounding factors within the same patient. Therefore, a multivariate analysis was performed. The most significant variable affecting pregnancy rate was age. Female fertility peaked at 25 years and subsequently declined, with a major fall after the age of 35 [28]. Additionally, infertility type and duration, along with BMI, were notably associated with higher conception rates in patients aged <35 years. The increase in spontaneous pregnancy rate after the procedure in all groups may theoretically have resulted from endometrial injury caused by instrumentation of the uterus, as any injury to the endometrium may induce growth of new endometrial cells, which can increase the chances of pregnancy [29].

The limitations of this study include a lack of randomization and recruitment of a relatively small sample size, which may have confounded the findings. To obtain more conclusive results, further studies are required to validate the results of this procedure.

Conclusions

Our study demonstrated the benefit of unilateral T-FTR in the presence of a patent contralateral tube as a safe and effective treatment option. Another important finding of our study was that in such cases, a patent contralateral tube

may have a functional obstruction preventing pregnancy that requires early intervention.

Multivariate analysis indicated that young (<35 years), nonobese (BMI<30) patients with a relatively short history of primary infertility (<5 years) had a higher chance of conception following T-FTR.

Thus, we recommend that T-FTR be performed in patients with infertility due to a unilateral tube blockage, after excluding other causes of infertility, as it is a noninvasive option to treat female tubal factor infertility. Infertility clinicians can liaise with interventional radiologists to discuss offering this type of treatment for eligible patients. Future randomized controlled trials with larger sample sizes are required for more robust results.

Abbreviations

T-FTR: Transcervical fallopian tube recanalization; PFTO: Proximal fallopian tube obstruction; BMI: Body mass index; HSG: Hysterosalpingography; PID: Pelvic inflammatory disease; IVF: In vitro fertilization.

Acknowledgments

We would like to thank Editage (www.editage.com) for English language editing.

Author contributions

J.F, M.A.; Contributed extensively to study design, data collection and evaluation. J.F., R.T.; Participated in study drafting and statistical analysis. J.F., M.A.; Performed T-FTR pertaining to this component of the study. J.F., R.T., M.A.; Participated extensively in data analysis and the conclusion. J.F., M.A.; Were responsible for overall supervision, F.A has reviewed and edited the final draft of the manuscript. All authors contributed extensively to editing the paper's final draft. All authors read and approved the final manuscript.

Funding

No funding was obtained for this study.

Availability of data and materials

All data and materials are available.

Declarations

Ethics approval and consent to participate

The study was approved by our institution review board (IRB) at Jordan University of Science and Technology. Written informed consent was obtained from all patients.

Consent for publication

Not applicable.

Competing interests

The Authors declare that there are no competing interests.

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Received: 27 April 2022 Accepted: 25 October 2022

Published online: 31 October 2022

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