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Original Research

Ultrasonography-guided hysteroscopic tubal catheterization of proximally occluded tubes - reproductive outcomes

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Summary

Objective: To evaluate the reproductive outcomes of infertile patients suffering from proximal tubal occlusion (PTO) following ultrasonography-guided hysteroscopic tubal catheterization (HTC). *Materials and Methods:* A retrospective cohort study of infertile patients who underwent ultrasonography-guided HTC in a tertiary hospital, between 2010 and 2016. All patients included were diagnosed with unilateral/bilateral PTO on hysterosalpingograpy (HSG). HTC was performed using a modified Novy cornual cannulation set which was inserted through a 5F working cannel during an office operative hysteroscopy, followed by fallopian tube irrigation with saline-air mixture under ultrasonographic imaging. Patients who did not conceive in the following 6-12 months were referred to IVF treatment. *Results:* Sixty-one patients were included. Tubal recanalization rate was achieved in 25/25 of unilaterally occluded tubes (100%), and in 63/72 of bilaterally occluded tubes (87.5%). Median duration of follow up after catheterization was 40.57 months. In a median of 3.5 months following the procedure, 16 (26.2%) patients conceived spontaneously (n=14) or following intrauterine insemination (n=2), 12 (19.6%) of them delivered . Twenty-two additional patients underwent IVF after a median of 11 months following HTC. Sixteen of them conceived following a median of two cycles, of whom 75% failed IVF treatment prior to HTC. *Conclusion:* Ultrasonography-guided HTC may form an acceptable treatment modality in cases of PTO. Further research is needed to investigate the role of HTC in cases of PTO and repeated implantation failure.

Key words: Reproductive outcomes; Proximal tubal occlusion (PTO; Ultrasound-guided hysteroscopy.

Introduction

Fallopian tube disease represents a common etiology for infertility. About 15% of cases can be attributed to proximal tubal occlusion [1], which may occur secondary to PID, previous pelvic surgery, endometriosis, and isthmic polyps. The reversibility of proximal tubal occlusion was shown to be attainable by various techniques of tubal recanalization performed under the guidance of fluoroscopy [2], ultrasonography [3], laparoscopy [4] or hysteroscopy [5]. However, with the advent of IVF treatment, the use of tubal catheterization is quite diminished. This is well-reflected in the current literature, demonstrating scarce data on tubal catheterization, its applicability, and accompanied outcomes. Yet, a recent meta-analysis of studies evaluating the outcomes of different catheterization techniques showed a pooled clinical pregnancy rate of 27%, a figure that is comparable to clinical pregnancy rate obtained following IVF [6]. In a recent study [7], the present authors presented an office procedure of hysteroscopic tubal catheterization under sonographic surveillance, which by itself allows the evaluation of both uterine cavity and tubal patency. In this study, they further report their experience with the procedure and its outcomes.

Materials and Methods

The study group consisted of infertile patients who underwent hysteroscopic tubal catheterization (HTC) in the outpatient clinic of Sheba Medical Center between January 2010 to June 2016. All patients demonstrated a minimum of 12-months-long infertility and were found to have unilateral/bilateral proximal tubal occlusion on HSG. Following the completion of HTC, patients attempted to spontaneously conceive for a minimum of six months. Patient over the age of 40 who did not conceive after six months were referred to ovarian stimulation or IVF. Younger patients were referred to infertility treatment in case no spontaneous conception occurred within one year. Patients with hydrosalpinx, distal tubal occlusion, acute pelvic inflammatory disease, or vaginal bleeding of unknown origin were excluded.

The procedure was carried out as per routine clinical care. Patients were scheduled to undergo the procedure during the early follicular phase of their cycle. They were thoroughly explained on the procedure, its course, and possible risks and signed on designated consent form. The procedure was performed by the same single surgeon in all cases. A transvaginal ultrasound scan was initially performed to ascertain thin endometrial thickness, identify unrecognized evolving hydrosaplinx, and document free fluid within the pouch of douglas, if present. Hysteroscopy was then performed with the patient in the lithotomy position, using a hysteroscope. Isotonic saline was used as a distention medium. The uterine cavity was first surveyed to detect any pathologies other

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Table 1. — *Patients characteristics.*

Patients characteristics (n=61)	
Age (years)	35.12 ± 4.75
Primary infertility	22 (36.07%)
Secondary infertility	39 (63.93%)
ART prior to catheterization	
None	34 (55.7%)
IVF	18 (29.5%)
IUI	6 (9.8%)
Clomiphene	3 (4.9%)
Tubal occlusion	
Unilateral	25 (40.98%)
Bilateral	36 (59.01%)

Table 2. — *Reproductive outcomes (only first pregnancies are presented).*

Pregnancy outcomes				
Method of conception	n (patients)	Live births	Ongoing	Miscarriages
Spontaneous/IUI	16	12	2	2
IVF	16	12	0	4
Total	32	24	2	6

Following HTC, 32 patients conceived at least once. Sixteen patients conceived spontaneously or via IUI (see text) and 16 additional patients conceived following IVF. For each patient, only the first pregnancy after the procedure is counted and presented in this table.

than tubal occlusion and visualize the proximal ostia. Once the proximal ostia were cannulated, a transvaginal ultrasound probe was introduced. Irrigation pressure was then increased gradually, using an admixture of saline and air, to allow perfusion of the tubes and determine the type of tubal occlusion. Proximal occlusion was confirmed in case the uterine cavity was filled with saline without it passing into the tube at all. If a proximal occlusion was observed, tubal catheterization was attempted, as previously described in detail [7]. In brief, restoration of tubal patency was performed by inserting a 5F catheter into the tubal ostium and through the intramural part of the tube. To confirm the establishment of tubal patency, mixture of saline and air was injected through the catheter. Restoration of patency was confirmed by demonstrating saline passage through the tube. If still occluded, additional attempts to catheterize the tube were performed using a narrower 3F catheter or if needed a metal guide wire. Once catheterization was completed, other intrauterine pathologies, if present, were treated on a "see and treat" basis, as possible.

Hysteroscopic findings and immediate outcomes (patency of tubes following catheterization) were extracted from operation reports. Demographic, obstetric, and assisted reproduction treatment (ART) was retrospectively collected and analyzed as well. The normality of distribution of continuous variables was tested by histogram and Q-Q plots. Continuous variables with normal distribution were presented as mean and standard deviation (SD); non-normal distributed continuous variables were presented as median and interquartile range (IQR). Categorical variables were reported as number and percentage.

Results

Between January 2010 and June 2016, a total of 78 patients underwent HTC. Data was accessible for 61 of these patients, for whom proximal tubal occlusion was confirmed by hysteroscopy, using saline for tubal irrigation as previously described. Patients' characteristics are presented in Table 1. On hysteroscopy, 25twenty-five patients were found to have unilateral tubal occlusion, while 36 had bilateral tubal occlusion. Tubal recanalization was achieved in 25/25 (100%) of unilaterally occluded tubes, and in 63/72 (87.5%) of bilaterally occluded tubes. In total, patency was restored in 88 of the 97 (90.7%) occluded tubes and all patients completed the procedure having at least one patent tube. Intrauterine pathologies were detected in nine patients. Three patients were shown to have cesarean scar defect, three had endometrial polyps, two had submucosal fibroids, and an additional patient was found to have septate uterus. Endometrial polyps and uterine septum were successfully removed during the procedure in all cases, however, none of these patients conceived following HTC. None of the patients suffered from procedure related complications.

Following HTC, during a median follow-up period of 40.57 (28.3-67.6) months, 32 patients conceived and 24 gave birth at least once. Number of pregnancies obtained by method of conception is presented in Table 2, where only the first conception is considered for each patient. Sixteen (26.2%) patients conceived spontaneously (n=14) or following intrauterine insemination (n=2), 12 (19.6%) of them delivered. All 16 patients conceived during the immediate 12 months that followed HTC, in a median of 3.5 (2-8) months. Four women conceived spontaneously more than once following HTC. In total, 22 non-IVF pregnancies were obtained, resulting in 13 live births, seven miscarriages, and two ongoing mid-trimester pregnancies.

Of the 61 patients included in study, 22 who did not conceive spontaneously following HTC, underwent ovarian stimulation and IVF in a median of 11 (5-22) months after HTC. Sixteen (72.72%) patients became pregnant following a median of two (1-2.25) cycles, with 75% necessitating up to two IVF cycles to conceive. Eleven of these 22 IVF patients had already attempted a failed IVF treatment prior to HTC. Eight (72.72%) of which became pregnant after HTC and a median of two (1-2.25) subsequent IVF cycles

Discussion

This study presents pregnancy rates following ultrasonography-guided hysteroscopic tubal catherization, whether obtained spontaneously or when combined with subsequent IVF. An observed spontaneous clinical pregnancy of 26.16% corresponds with the data presented in current literature [6], establishing HTC as an effective fertility restoration modality in those suffering from proximal tubal occlusion. Since patients suffering from tubal factor infertility are especially prone to ectopic pregnancies, the absence of ectopic pregnancies in this series is intriguing, and is not in line with a pooled ectopic pregnancy rate of 4%, presented in a recently published meta-analysis [6].

By its own nature, not only does HTC serve as a therapeutic procedure, it also serves as a diagnostic tool- allowing both uterine cavity inspection and tubal patency evaluation. Other than being a combined diagnostic-therapeutic modality, HTC offers additional advantages. It forms a simple office procedure, not requiring operative or radiologic facilities. The procedure itself is relatively pain-free, proving to be tolerable without anesthesia. Is also avoids unnecessary exposure to radiation and provides an alternative for patients with known iodine hypersensitivity who cannot undergo HSG.

When it comes to choosing between tubal catheterization and IVF, it seems that nowadays, owing to increasing availability and ongoing growing live-birth rates, the latter forms a straightforward choice. Yet, IVF is not without its drawbacks, both financially and medically, with ovarian hyperstimulation and multiple-pregnancies being major associated risks. Even when singleton pregnancy is obtained, there might still be a potential increased risk for preterm delivery, low birth weight, and perinatal mortality [8]. As for the economic aspect, depends on whether national funding is offered or not, the cost of treatment forms a burden on healthcare systems, or a major financial individual challenge. In a study evaluating the economic impact of assisted reproductive technology in developed countries, the cost of a standard IVF cycle ranged from $12,513 in the United States to $3,956 in Japan. The cost per live birth in the United States and United Kingdom was $41,132 and $40,364, respectively, and lowest in Scandinavia and Japan ($24,485 and $24,329, respectively) [9]. In terms of cost comparisons, office hysteroscopy is by far less costly, with an estimated procedure charge of $1,356 in the United states [10].

The role of routine office hysteroscopy prior to commencement of IVF treatments or following recurrent IVF failure is debatable. While some studies showed improved IVF pregnancy rates once antecedent hysteroscopy is employed [11, 12], more recent studies could not demonstrate such beneficial effect [13, 14]. Nonetheless, for whatever indication performed and whether justified or not, hysteroscopy continues to form an integral aspect in the management of infertile patients in clinical practice. As such, hysteroscopic tubal patency evaluation and recanalization of proximally occluded tubes can be performed in the same occasion, with concomitant correction of detected intrauterine lesions. This may be of special relevance for young patients who contemplate IVF but are still debating over the idea of artificial reproductive treatments, whether for economic or social reasons.

Interestingly, the present data suggest that HTC may also have a role in patients who have failed IVF, as over 70% of patients who had attempted IVF and failed, conceived following a median of two additional cycles, once performed following HTC. These findings question the idea of the fallopian tube being a mere conduit for gamete transport, suggesting that exposure to the tubal milieu, even if not taking place in the tube itself (as in patients with patent tubes who are undergoing IVF), has a role in early embryonal development and implantation [15]. Alternatively, these findings may be attributed to hysteroscopy itself. Indeed, several mechanisms have been suggested to account for the possible increase in IVF pregnancy rates following hystero-scopy: detection and surgical removal of uterine cavity abnormalities [16], cervical canal dilatation to allow future embryo transfer [12], or induction of endometrial inflammatory reaction [17]. Thus, HTC may be offered to patients suffering from repeated implantation failure, who are scheduled for hysteroscopy to begin with. Yet, before any recommendations can be made, further studies with a much larger sample size are required to investigate the role of combined HTC and IVF and the mechanism behind it.

Several limitations of the current study should be acknowledged. First, the study is retrospective in design and further validation in a multicentric, prospective study should be performed to confirm the role of HTC as an option for patients who have abnormal HSG findings. Second, the study is limited by its sample size, thus subgroup analysis (outcomes of patients with unilateral versus bilateral occlusion) could not be properly assessed. Third, while the use of a single surgeon lend consistency to the procedure, the observed success rates of this procedure may not be generalizable.

Conclusion

For patients with proximal tubal occlusion who cannot afford IVF treatment, HTC may comprise an acceptable alternative. HTC may also serve as a "bridging" procedure for patients undergoing infertility work-up, once proximal tubal occlusion is diagnosed, to maximize chances for spontaneous conception while IVF treatment is awaited. Further, preferably larger prospective studies, are required to investigate the potential utility of HTC in cases of repeated implantation failure.

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