



Comparison of salpingectomy and tubal occlusion for hydrosalpinx in in-vitro fertilization outcome

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Abstract

The occurrence of hydrosalpinx can reduce the success rate of assisted reproductive technology. The laparoscopic salpingectomy and tubal occlusion have been shown to improve in-vitro fertilization (IVF) outcomes in this disease. The primary goal of this review was to assess and compare the IVF outcome following salpingectomy or tubal occlusion in the published literature. The authors included studies with at least one of the following outcomes: days of controlled ovarian hyperstimulation, retrieved oocyte number, fertilization rates, clinical pregnancy rate, miscarriage rate, or ectopic pregnancy rate. In conclusion, proximal tubal occlusion outperforms salpingectomy in terms of fertilization rate while offering no evident advantages in terms of days of controlled ovarian hyperstimulation, retrieved oocytes number, IVF results, or problems in treating hydrosalpinx patients prior to IVF. These data may help clinicians choose the best therapy for patients with hydrosalpinx prior to IVF.

Keywords: hydrosalpinx, IVF, salpingectomy, tubal occlusion

Introduction

Subfertility is one of the health problems that commonly occur in society today, in line with the WHO statement^[1]. The definition of subfertility according to the American College of Obstetricians and Gynecologists is the inability to conceive, maintain a pregnancy, and deliver a live birth for a married couple after 12 months or more of unprotected sexual intercourse^[2,3]. The average prevalence of subfertility in developed countries is 3.5–16.7%, and in developing countries, it is 6.9–9.3%^[4].

A recent study conducted on 1200 married couples who were experiencing subfertility found that 834 cases were primary subfertility, while the remaining 366 cases were secondary subfertility^[5]. Subfertility is caused by a variety of factors including anatomical, physiological, genetic, environmental, and acquired factors. In 88.9% of cases, women-related factors were responsible for subfertility, while male-related factors caused 66% of cases. Occasionally, subfertility can be attributed to both

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HIGHLIGHTS

- The occurrence of hydrosalpinx can reduce success rate of assisted reproductive technology.
- The primary goal of this review was to assess and compare the in-vitro fertilization (IVF) outcome following salpingectomy or tubal occlusion in the published literature.
- Proximal tubal occlusion outperforms salpingectomy in terms of fertilization rate while offering no evident advantages in terms of days of controlled ovarian hyperstimulation, retrieved oocytes number, IVF results, or problems in treating hydrosalpinx patients prior to IVF.

partners or remain unknown. Female subfertility can arise from a range of factors, such as menstrual disorders, obesity, thyroid disease, diabetes, ovulation disorders, uterine causes, tubal factors, and cervical causes. Tubal factors, in particular, contribute to 15–35% of female subfertility cases, and the severity of the tubal disease can affect either the proximal, distal, or entire tube^[3,5,6].

The classification by Hull and Rutherford (2002) divides infertile women based on the degree of tubal damage: grade I, grade II, and grade III^[7]. The diagnosis was confirmed by hysterosalpingography (HSG) or laparoscopy. Tubal disorders such as hydrosalpinx are associated with poorer in-vitro fertilization (IVF)-embryo transfer (ET) outcomes. Implantation and pregnancy rates are lower in patients with hydrosalpinx than in other tubal disorders, also increasing spontaneous miscarriage and ectopic pregnancy incidence^[8]. The negative effect of hydrosalpinx on IVF-ET is caused by several theories: a direct toxic effect of fluid accumulation in the embryo transfer process through endometrial cavity leakage, implantation inhibition by changes in endometrial receptivity, and impairment of embryo development due to nutritional and energy deficiency of hydrosalpinges fluid.

Hydrosalpinx is a common cause of tubal factors, accounting for 10–30% of cases. Hydrosalpinx occurs when the fallopian tube becomes distended or dilated with a blockage at the distal end. The most frequent cause of hydrosalpinx is pelvic inflammatory disease (PID), which is responsible for more than half of all cases of tubal disease. PID can damage the fallopian tube tissue, causing inflammation, scar tissue formation, and fluid accumulation within the tube. This blockage can prevent the normal movement of eggs from the ovaries to the uterus, leading to difficulties with fertilization.

The negative impact of hydrosalpinx on IVF-ET is caused by several theories. These theories include the direct toxic effect of fluid accumulation in the embryo transfer process through endometrial cavity leakage, implantation inhibition due to changes in endometrial receptivity, and the impairment of embryo development due to nutritional and energy deficiency caused by hydrosalpingeal fluid^[9].

In order to gather research publications related to the topics of “hydrosalpinx,” “salpingectomy,” “tubal occlusion,” and “In Vitro Fertilization,” a comprehensive literature search was conducted across multiple databases, including PubMed, Medline, Scopus, Web of Science, and Google Scholar. The primary aim of the search was to identify relevant articles that discuss the relationship between these factors in the context of assisted reproductive technologies.

Treatment-related to hydrosalpinx is needed before carrying out assisted reproductive technology such as IVF-ET to increase the success rate. Studies have shown that salpingectomy before IVF can have positive benefits for patients with hydrosalpinx^[10]. However, surgery may negatively affect ovarian blood flow, which can reduce the effectiveness of ovarian stimulation^[11]. On the other hand, proximal tubal occlusion (PTO) can block the junction between the fallopian tube and uterus, eliminating the retrograde flow of hydrosalpinx fluid while maintaining ovarian blood supply. PTO has a higher fertilization rate compared to salpingectomy before IVF. Therefore, it is important to compare and evaluate the effectiveness of salpingectomy and PTO procedures before IVF-ET in cases of hydrosalpinx^[12–15].

Management

Surgical management in hydrosalpinx cases is salpingostomy, salpingectomy, proximal tubal ligation, and transvaginal hydrosalpingeal fluid suctioning^[16]. Salpingectomy is a surgical method that removes chronically diseased fallopian tubes and hydrosalpinx fluid, but it can potentially impair ovarian blood supply and decrease ovarian reserve function. PTO is a less invasive method that eliminates retrograde flow of hydrosalpingeal fluid into the endometrial cavity, helping to maintain blood supply to the ovaries before IVF. However, the presence of damaged fallopian tubes can lead to increased levels of inflammatory mediators, which can still interfere with the follicle maturation process^[12].

Both salpingectomy and PTO can eliminate retrograde flow of toxic hydrosalpinx fluid in the uterine cavity, improve conditions for optimizing oocyte retrieval, increase endometrial receptivity, and facilitate fertilization and pregnancy. Both procedures have shown similar results in terms of controlled ovarian hyperstimulation (COH) days, retrieved oocyte numbers, implantation, clinical pregnancy, and live birth rates. Multiple studies have

confirmed that there are no significant differences between PTO and salpingectomy in terms of these outcomes^[12,13,17,18]. Proximal tubal occlusion is a surgical technique used to manage hydrosalpinx. The aim is to block the proximal part of the fallopian tube to prevent leaked fluid from entering the uterus and causing damage to the embryo. Bipolar diathermy is used on a portion of the fallopian tube to create a permanent blockage^[19].

A common issue in hydrosalpinx cases is the presence of solid adhesions, interstitial pregnancy, and damage to the urinary tract^[12]. However, in Malhotra *et al.*^[20] study found no difference in conception, clinical pregnancy, continuing pregnancy, or rate of loss between salpingectomy and PTO in hydrosalpinx patients before IVF. On the other hand, Vignarajan *et al.*^[21] showed that the fertilization rate was higher in hydrosalpinx patients who underwent PTO treatment compared to those who underwent salpingectomy before IVF. Therefore, a review of published data that compares ovarian stimulation response, IVF outcome, and complications between salpingectomy and PTO in treating hydrosalpinx patients before IVF is necessary to explain the increased abnormalities.

PTO, although considered as an alternative treatment for hydrosalpinx before IVF, has negative effects such as pelvic discomfort^[13]. Studies have shown that patients who underwent salpingectomy or PTO before IVF had a similar incidence of ectopic pregnancy^[22]. The presence of micro insertions in the endometrial cavity is associated with the low ability of the endometrium in the embryo attachment process. There was no significant difference in the rates of ectopic pregnancy and injury in hydrosalpinx patients who were treated with salpingectomy and PTO before IVF^[17,23,24].

PTO vs. salpingectomy

The findings of previous studies on the impact of hydrosalpinx on ovarian response, IVF treatment outcome, and the effectiveness of salpingectomy versus PTO have been inconsistent. A meta-analysis was conducted on eight trials, which included 716 hydrosalpinx patients before IVF. Among them, 408 patients received salpingectomy, while 308 patients received PTO. The results of the meta-analysis revealed that the fertilization rate was higher in salpingectomy patients than in PTO-treated hydrosalpinx patients before IVF. However, the number of days of COH, retrieved oocytes number, implantation, clinical pregnancy, ongoing pregnancy, and live birth rate were similar in both groups^[22]. For more information, please refer to Table 1 for a detailed comparison of each variable in IVF outcome.

Days of COH

COH is a crucial component of IVF and intracytoplasmic sperm injection (ICSI) treatments. The primary goal of COH is to stimulate the ovaries to produce multiple mature follicles, each containing an egg, which increases the chances of successful fertilization and embryo development. The approach to COH may vary depending on the patient’s specific circumstances, including factors like whether the patient has undergone a salpingectomy or tubal occlusion prior to IVF. Research study by Antonius and colleagues, Malhotra and colleagues, and Surrey and colleagues, the days of COH in patients undergoing tubal occlusion are 12.3 ± 2.4 , 10.4 ± 1.5 , and 10.1 ± 0.4 (respectively), whereas in salpingectomy the days of COH are 11.9 ± 2.5 , 11.1 ± 1.6 , and

Table 1
Comparison of IVF outcomes based on tubal occlusion procedure and salpingectomy

Variable	References	Management		P
		Tubal occlusion	Salpingectomy	
Days of controlled ovarian hyperstimulation	Kontoravdis <i>et al.</i> ^[19]	12.3 ± 2.4	11.9 ± 2.5	0.45
	Malhotra <i>et al.</i> ^[25]	10.4 ± 1.5	11.1 ± 1.6	0.13
	Surrey <i>et al.</i> ^[23]	10.1 ± 0.4	9.5 ± 0.2	P value not significant
	Vignarajan <i>et al.</i> ^[21]	10.2 ± 1.7	11.3 ± 1.6	< 0.001
Oocyte number	Kontoravdis <i>et al.</i> ^[19]	12.3 ± 2.4	11.9 ± 2.5	0.61
	Malhotra <i>et al.</i> ^[25]	8.6 ± 4.8	8.4 ± 4.1	0.97
	Surrey <i>et al.</i> ^[23]	14.1 ± 1.8	16.2 ± 1.2	P value not significant
	Vignarajan <i>et al.</i> ^[21]	9.3 ± 4.9	8.5 ± 3.4	0.79
Cinical pregnancy rate	Surrey <i>et al.</i> ^[23]	57.1%	46.7	P value not significant
	Kontoravdis <i>et al.</i> ^[19]	44.4%	55.3%	0.2
	Vignarajan <i>et al.</i> ^[21]	33.7%	25.6%	0.25
	Dreyer <i>et al.</i> ^[16]	31.0%	58.1%	0.016
	Yang <i>et al.</i> ^[28]	54.8%	68.1%	0.537
	Sagoskin <i>et al.</i> ^[29]	88.9%	85.7%	< 0.01
	Malhotra <i>et al.</i> ^[25]	24.3%	17.1%	0.25
Ongoing pregnancy	Kontoravdis <i>et al.</i> ^[19]	37.8%	48.9%	0.2
	Dreyer <i>et al.</i> ^[16]	26.2%	55.8%	0.008
	Yang <i>et al.</i> ^[28]	47.6%	61.9%	0.537
Live birth rate	Vignarajan <i>et al.</i> ^[21]	32.5%	26.8%	0.42
	Dreyer <i>et al.</i> ^[16]	21.4%	46.5%	0.002
Miscarriage rate	Kontoravdis <i>et al.</i> ^[19]	4.4%	6.4%	0.5
	Dreyer <i>et al.</i> ^[16]	2.3%	4.8%	0.616
	Yang <i>et al.</i> ^[28]	4.8%	2.7%	0.882
Ectopic pregnancy rate	Kontoravdis <i>et al.</i> ^[19]	2.2%	0%	0.5
	Dreyer <i>et al.</i> ^[16]	0%	0%	0
	Yang <i>et al.</i> ^[28]	2.4%	3.5%	0.537

IVF, in-vitro fertilization.

9.5 ± 0.2. In the case of salpingectomy, the days of COH are longer in the research conducted by Antonius and Malhotra, but in the study conducted by Surrey, patients with tubal occlusion have a longer duration of COH^[19,21,23,25].

Retrieved oocytes number

One of the routine procedures carried out during IVF or assisted reproductive technology is oocyte retrieval. Cohort studies indicate that the number of oocytes that can be harvested is a positive predictor for live birth. A study has shown that the procedure of salpingectomy is considered to have a negative effect on AMH levels but not on the number of oocytes retrieved^[26]. Chen study compared ovarian reserve levels before and after tubal occlusion and concluded that there was no significant difference in ovarian reserve^[27]. However, the electrocauterization procedure during salpingectomy is considered to potentially damage periovarian vascular perfusion. This could contribute to ovarian response impairment. Based on four studies comparing the number of harvested oocytes in cases of tubal disease undergoing tubal occlusion and salpingectomy, all four of them indicate that there is no significant difference between the two procedures^[19,21,23,25].

Clinical pregnancy

IVF involves retrieving eggs from the ovaries and fertilizing them with sperm in a laboratory. After fertilization, the resulting embryos are cultured for a few days before being transferred back into the woman's uterus. The definition of clinical pregnancy may vary between studies. In the study conducted by Surrey, clinical pregnancy is defined as successful fertilization and embryo development, which is confirmed by the presence of a gestational sac and foetal pole at 4 weeks of gestation after embryo transfer. ang and Sagoskin, on the other hand, define clinical pregnancy as the presence of a foetal heartbeat at 10 weeks of gestation^[28,29]. It can be concluded that clinical pregnancy refers to the occurrence of pregnancy as confirmed by clinical or ultrasound evidence following the completion of an IVF procedure. Based on six studies, five of them state that there is no significant difference between tubal occlusion and salpingectomy procedures performed before IVF^[16,19,21,23,25,28,29]. However, the study conducted by Sagoskin found that clinical pregnancy rates were higher in patients who underwent tubal occlusion compared to salpingectomy^[29].

Ongoing pregnancy and live birth rate

Ongoing pregnancy refers to a pregnancy that continues to develop and progress until the end of the first trimester (trimester 1). This first trimester typically covers a period of about 0 to 12 weeks after conception (fertilization). The Live Birth Rate is the percentage of all cycles or attempts in a reproductive program that result in the live birth of a baby. This reflects the ultimate desired outcome in the reproductive process, which is the birth of a healthy and live baby.

Based on three studies that assessed the variable of ongoing pregnancy, the group undergoing salpingectomy had a higher percentage of ongoing pregnancies compared to tubal occlusion^[16,19,28]. However, only the study by Dreyer showed a significant difference^[16]. On the other hand, regarding the variable of live birth rate, the Vignarajan study concluded that tubal occlusion had a higher percentage compared to salpingectomy, which contradicted the findings of the study conducted by Dreyer^[16,21].

Miscarriage and ectopic pregnancy rate

Losing a pregnancy before the foetus is able to survive outside the womb is known as a miscarriage or spontaneous miscarriage. This can happen naturally due to a variety of factors, such as genetic abnormalities, hormonal imbalances, or medical conditions. The miscarriage rate refers to the percentage of pregnancies that end in a miscarriage.

The ectopic pregnancy rate refers to the percentage or frequency of ectopic pregnancies within a specific study or population. An ectopic pregnancy is a condition where a fertilized egg implants outside the uterus, most commonly in the fallopian tubes. There is no significant difference in either the miscarriage rate or ectopic pregnancy variable (P value > 0.05)^[16,19,28]. However, in the study conducted by Török *et al.*^[30], concluded that salpingectomy can reduce a patient's chances of achieving natural conception. Therefore, it is preferable to preserve the fallopian tubes if possible. The patient should make a medical decision after careful consideration and consultation with their treating doctor.

The limitations of this study include the potential dissimilarity in the characteristics of the study subjects. Preserving ovarian function before the procedure could affect the post-procedure outcomes in ovarian reserves. Furthermore, reproductive organ infections, which is one of the risk factor of hydrosalpinx is not well-defined. However, the strength of this study shows these procedures are the most commonly performed for tubal disorders. Consequently, the findings of this study will be valuable in clinical practice.

The author's recommendation is to perform these procedures with caution, as they can impact the fertility prognosis of the patients. The implication of this study is that clinicians can make valuable decisions regarding the most suitable procedures based on their evaluation of the fertility function.

Conclusion

In summary, PTO has a higher fertilization rate than salpingectomy. However, there are no significant advantages of PTO in terms of days of COH, retrieved oocytes number, clinical pregnancy rate, ongoing pregnancy, live birth rate, miscarriage

rate, and ectopic pregnancy rate prior to IVF. These review could be valuable for clinicians in selecting the best therapy for patients with hydrosalpinx before IVF.

Ethical approval

The institutional review board has determined that our study is exempt from ethical approval as it is a review.

Consent

No consent was required as this study is a review.

Sources of funding

The authors declare that this study did not receive external funding.

Author contribution

D.T., B.R., I.P., W.P., T.D. and T.C.L. conceived the study. D.T. and B.R. recruited the studies from the database and reviewed the studies. D.T., B.R. and K.D.T. drafted the manuscript. All authors agreed on this final version to be published.

Conflicts of interest disclosure

The authors declare that we have no conflicts of interests.

Research registration unique identifying number (UIN)

Not applicable as this study is a review and does not involve human participants.

Guarantor

The guarantor of this research is Dian Tjahyadi.

Data availability statement

Available upon reasonable request.

Provenance and peer review

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