INFORMATION BRIEF (RAPID REVIEW)

PROXIMAL FALLOPIAN TUBE SEPARATION FOR THE MANAGEMENT OF HYDROSALPINX

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1.0 PURPOSE

This report aims to assess the effectiveness, safety and cost-effectiveness of proximal fallopian tube separation for the management of hydrosalpinx in women undergoing assisted reproductive techniques, particularly in-vitro fertilisation (IVF). The assessment was conducted in response to a request from the Director, Medical Practice Division, Ministry of Health Malaysia.

2.0 BACKGROUND

Tubal factor infertility is one of the leading causes of female infertility, accounting for approximately 25-30% of cases worldwide.[1] The most severe manifestation of tubal disease is hydrosalpinx, a pathological dilatation of the fallopian tube resulting from occlusion of the proximal, distal, or entire segment, and filled with fluid due to blockage (Figure 1).[2] This condition is commonly associated with pelvic inflammatory disease (PID), endometriosis, or previous pelvic surgery.[3] Globally, hydrosalpinx affects 10-30% of women diagnosed with tubal factor infertility.[4] In Malaysia, infertility affects an estimated 10-15% of couples of reproductive age.[5]

Hydrosalpinx not only impairs natural conception but also significantly reduces the success of assisted reproductive techniques such as in-vitro fertilisation (IVF). The reflux of hydrosalpingeal fluid into the uterine cavity has been shown to adversely affect embryo implantation through both mechanical and biochemical toxicity.[2,3] The management of hydrosalpinx aims to improve reproductive outcomes and relieve associated symptoms. Current treatment options include salpingectomy, proximal tubal occlusion, transvaginal aspiration and salpingostomy, or laparoscopic disconnection of the hydrosalpinx prior to IVF (Figure 2).[1,3] The rationale for surgical intervention is to eliminate the detrimental effects of hydrosalpingeal fluid, either by aspirating it (ultrasound-guided aspiration), by removing the fallopian tubes (salpingectomy) or by isolating them from the uterine cavity through laparoscopic or hysteroscopic proximal occlusion.[4] Among these, laparoscopic salpingectomy and tubal occlusion have demonstrated the most consistent improvement in IVF outcomes.[1,4] However, although effective, salpingectomy is more invasive and may compromise ovarian blood flow, potentially reducing ovarian reserve.[3]

Proximal fallopian tube separation (or proximal tubal occlusion) has emerged as a minimally invasive alternative for the management of hydrosalpinx. The procedure involves mechanical or thermal disconnection of the proximal fallopian tube from the uterus cavity to prevent reflux

of hydrosalpinx fluid while preserving ovarian perfusion. This technique aims to achieve comparable reproductive outcomes with potentially lower surgical risks, shorter operative time, and faster recovery compared to traditional salpingectomy.[2,6]

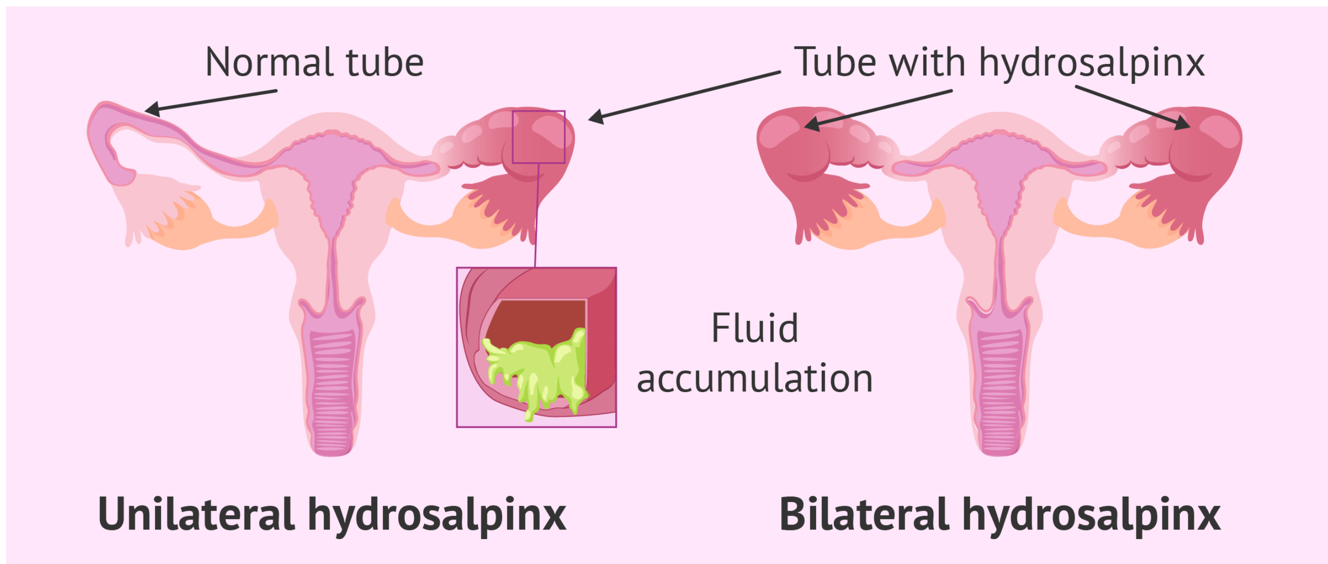

Figure 1: *Types of hydrosalpinx showing accumulation of fluid in one or both of fallopian tubes (unilateral and bilateral hydrosalpinx)*. Source: inviTRA [7]

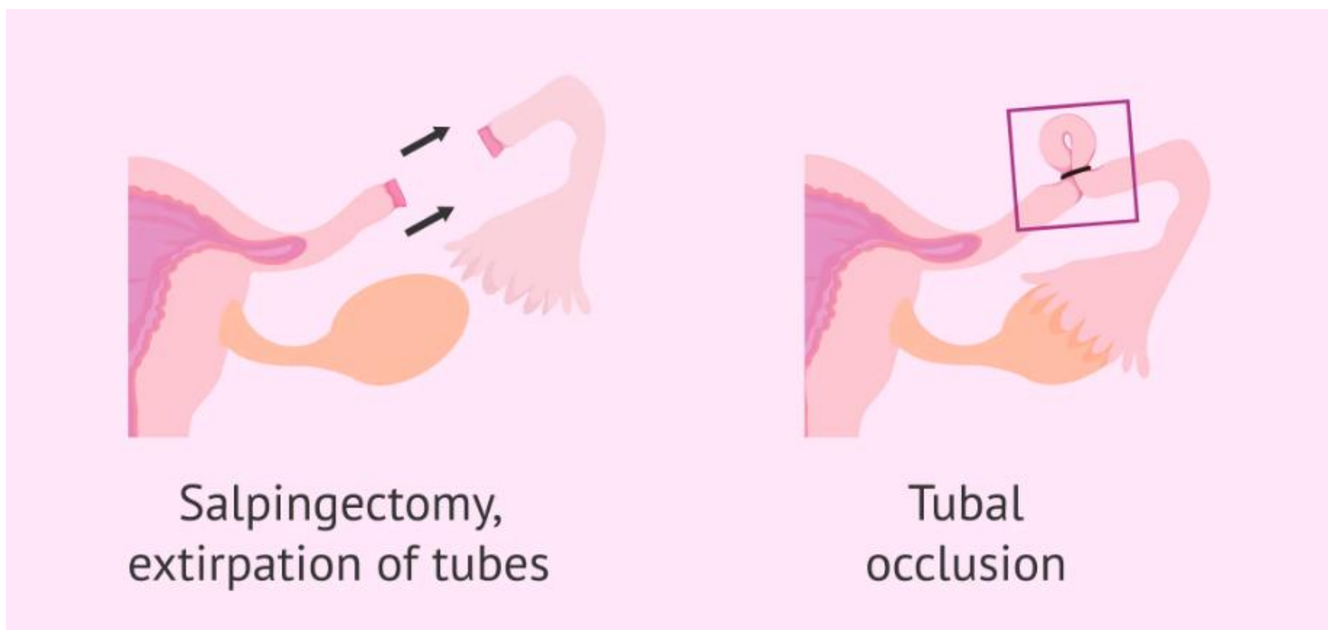

Figure 2: *Surgical treatment options for hydrosalpinx, including salpingectomy and proximal tubal occlusion*. Source: inviTRA [7]

Technical Features

The proximal fallopian tube separation, also referred to as proximal tubal occlusion (PTO), is a minimally invasive laparoscopic procedure performed to isolate the hydrosalpinx from the uterine cavity before IVF. The procedure is conducted under general anaesthesia, where the proximal segment of the fallopian tube is occluded or disconnected to block the reflux of hydrosalpingeal fluid while preserving ovarian perfusion.[2]

Several occlusion techniques have been described, including bipolar electrocoagulation,[2] as well as mechanical clips, rings, or suture ligation, depending on the surgeon's preference and available instruments.[8] In some approaches, the proximal portion of the tube is transected or separated from the uterine cornua to ensure complete disconnection. This effectively prevents the passage of toxic hydrosalpingeal fluid into the endometrial cavity, eliminating its detrimental effects on implantation.

Compared to salpingectomy, which requires complete removal of the fallopian tube, proximal tubal occlusion is technically simpler, less invasive, and associated with shorter operative time. The procedure also preserves the tubal branch of the uterine artery, thereby maintaining ovarian blood supply and potentially reducing the risk of diminished ovarian reserve.[3]

Alternative minimally invasive techniques, such as hysteroscopic proximal occlusion using devices like *Essure*®, have also been explored but are less commonly performed due to regulatory and safety concerns.[4] Overall, laparoscopic proximal tubal occlusion achieves effective isolation of the hydrosalpinx, offering a balance between reproductive efficacy and surgical safety.[2]

Reason for Request

The Medical Practice Division, Ministry of Health Malaysia, received an inquiry regarding the use of proximal fallopian tube separation for the management of hydrosalpinx. The procedure is not listed under *Jadual Ke-13 Perintah Kemudahan Dan Perkhidmatan Jagaan Kesihatan Swasta (Hospital Swasta Dan Kemudahan Jagaan Kesihatan Swasta Lain) (Pindaan) 2013*. Therefore, an assessment is required to review its effectiveness, safety, and cost-effectiveness, and to support policy deliberation and guide decision-making on its potential adoption in clinical practice.

3.0 EVIDENCE SUMMARY

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were used to perform the systematic review. A systematic literature search was conducted across scientific databases, including Medline, EBM Reviews, EMBASE via OVID, PubMed, as well as general search engines such as Google Scholar. The search terms applied were: *hydrosalpinx, salpingitis, proximal fallopian tube separation, and proximal tubal occlusion.* The last search was performed on 15 October 2025.

A total of 197 records were identified, and 10 duplicates were removed prior to screening. The remaining 187 titles and abstracts were screened for relevance, yielding 19 full-text articles retrieved for appraisal. Based on predefined eligibility criteria, six studies were included for the final evidence synthesis. The included studies comprised two systematic reviews (SR) with network meta-analyses (NMA), two meta-analyses (MA), one randomised controlled trial (RCT), and one retrospective cohort study. All were published in English between 2016 and 2025, with three conducted in China, and one each in Greece, Spain and Egypt.

All included studies evaluated women with hydrosalpinx undergoing IVF as the study population, with the primary objective of assessing the effectiveness of proximal fallopian tube separation or occlusion compared with salpingectomy or no intervention. The main outcomes assessed included clinical pregnancy, live birth, ongoing pregnancy, and implantation rates, while secondary outcomes involved miscarriage, ectopic pregnancy, fertilisation rate, and ovarian reserve parameters. Although the studies shared similar populations and objectives, variations were observed in study design, sample size, and intervention techniques, leading to methodological heterogeneity. Common limitations included small sample sizes, difference in surgical methods and timing relative to IVF cycles, and limited reporting on long-term reproductive and safety outcomes, which may affect comparability and the robustness of findings.

4.0 EFFICACY/ EFFECTIVENESS

A systematic review and network meta-analysis by Pérez-Milán F et al. (2025) evaluated various surgical interventions for the management of hydrosalpinx prior to in-vitro fertilisation embryo transfer (IVF-ET), including salpingectomy, laparoscopic tubal occlusion (LTO), hysteroscopic insertion of an intratubal device (ITD), ultrasound-guided aspiration, and ultrasound-guided sclerotherapy. A total of 26 studies were included (nine RCTs, 14 retrospective, and three prospective cohort studies). The study selection process followed the PRISMA extension statement for NMA, ensuring methodological transparency and standardised reporting. Study quality was assessed using the Cochrane RoB 2 tool for RCTs

and the Newcastle-Ottawa Scale for observational studies. The primary outcomes were live birth, clinical pregnancy and ongoing pregnancy rates, while secondary outcomes included miscarriage rate, ectopic pregnancy rate, ovarian response parameters, and procedural complications.

The network meta-analysis of nine RCTs showed that LTO significantly improved clinical pregnancy rates compared with no treatment (OR 2.55, 95% CI: 1.20 to 5.51), although no significant difference was observed for live birth rates. Among the evaluated interventions, LTO ranked highest for clinical pregnancy rate and miscarriage reduction (SUCRA 0.8-0.9). The aggregated analysis of RCTs and cohort studies also supported LTO as an effective option comparable to salpingectomy, offered similar reproductive outcomes with potentially lower surgical risk and shorter operative time. Overall, LTO demonstrated improved pregnancy outcomes without compromising ovarian reserve or increasing complications, supporting its role as a viable alternative to salpingectomy for women with hydrosalpinx undergoing IVF.[9]

Similarly, a NMA by Tsiami A et al. (2016) synthesised evidence from seven RCTs comparing aspiration, salpingectomy, proximal tubal occlusion (PTO), and no intervention. Both PTO (RR 3.22, 95% CI: 1.27 to 8.14) and salpingectomy (RR 2.24, 95% CI 1.27 to 3.95) significantly improved ongoing pregnancy rates compared to no treatment. Although no significant difference was observed between PTO and salpingectomy, PTO ranked highest in relative effectiveness (SUCRA 90-92%). The evidence, rated moderate to low in quality due to small sample sizes, consistently indicated that PTO is an effective surgical strategy for enhancing IVF outcomes in hydrosalpinx management.[4]

A meta-analysis by Ou H et al. (2022) compared the reproductive outcomes between PTO and salpingectomy in women with hydrosalpinx undergoing IVF. The review included eight studies involving 716 patients, of whom 408 underwent salpingectomy and 308 underwent PTO. The pooled analysis found no significant differences between the two procedures in implantation rate (OR 1.17, 95% CI: 0.62 to 2.20, I^2 =68%), clinical pregnancy rate (OR 0.82, 95% CI: 0.59 to 1.15, I^2 = 30%), ongoing pregnancy rate (OR 0.64, 95% CI: 0.36 to 1.13, I^2 = 39%), or live birth rate (OR 0.67, 95% CI: 0.16 to 2.72, I^2 = 83%). However, PTO demonstrated a higher fertilisation rate (SMD 0.35, 95% CI: 0.11 to 0.59, I^2 = 39%) compared with salpingectomy, while similar days of controlled ovarian hyperstimulation (COH) and number of retrieved oocytes. Rates of ectopic pregnancy (OR 1.13, 95% CI: 0.21 to 5.92) and miscarriage (OR 0.88, 95% CI: 0.31 to 2.48) were comparable between the two groups. The authors concluded that PTO offers similar IVF outcomes to salpingectomy in terms of pregnancy and live birth rates, with a potential advantage in fertilisation efficiency, supporting PTO as a fertility-preserving alternative for hydrosalpinx management prior to IVF.[10]

A meta-analysis by Wu S et al. (2020) further compared the effects of salpingectomy and PTO on ovarian reserve in women with hydrosalpinx undergoing IVF. The review included five studies involving 648 patients, comprising two RCTs and three retrospective cohort

studies. Pooled analysis showed no significant difference in serum follicle-stimulating hormone (FSH) levels between the two procedures (WMD 0.46 IU/L, 95% CI: -0.14 to 1.05), indicating comparable gonadotropin responses. However, PTO was associated with significantly higher anti-Müllerian hormone (AMH) (WMD -1.01 IU/L, 95% CI: -1.28 to -0.74) and antral follicle count (AFC) (WMD -0.80 IU/L, 95% CI: -1.46 to -0.14) compared with salpingectomy, suggesting better preservation of ovarian reserve following PTO. The authors concluded that although both procedures improve IVF outcomes, salpingectomy may cause greater short-term reduction in ovarian reserve, and PTO should be considered a preferred option for women with reduced ovarian reserve or at risk of compromised ovarian function.[1]

Emerging clinical evidence continues to support these findings, with recent trials providing further confirmation of the effectiveness and optimal application of PTO in enhancing IVF outcomes among women with hydrosalpinx.

A randomised clinical trial by Hashish RA et al. (2024) compared laparoscopic tubal disconnection (LTD) and hysteroscopic tubal electrocoagulation (HTE) among 100 women with hydrosalpinx undergoing IVF. A total of 51 patients underwent LTD, and 49 patients underwent HTE, with no statistically significant difference in baseline characteristics between the two groups. The study demonstrated that LTD resulted in higher chemical pregnancy (61% vs 41%, p=0.004), clinical pregnancy (57% vs 35%, p=0.046) and live birth rates (41% vs 12%, p<0.001) compared with HTE, while rates of miscarriage and multiple pregnancies were comparable. The operative time was significant shorter in the HTE group compared with the LTD group (6.6±2.1 minutes vs 16.9±4.3 minutes, p<0.001), and the mean duration of hospital stay was also lower (0.81±0.4 days vs 1.32±0.57 days, p=0.012). Although HTE was associated with shorter operative time and hospital stay, the overall IVF outcomes strongly favoured LTD. No major complications were reported in either group, except for one case of uterine perforation in the HTE group. The authors concluded that LTD provides superior reproductive outcomes compared with HTE and may be a more effective approach for the management of hydrosalpinx prior to IVF. However, they emphasised that individual patient factors, surgical expertise, and potential risks should be carefully considered when selecting the optimal treatment modality.[11]

A large-scale retrospective cohort by Li J et al. (2023) examined the optimal timing of PTO in relation to ovarian stimulation among 1,490 women with hydrosalpinx undergoing IVF or intracytoplasmic sperm injection (ICSI) treatment. Patients were divided into two groups: those who underwent Proximal Tubal Occlusion before controlled ovarian hyperstimulation (Ligation-COH; n=976) and those who underwent the procedure after Oocyte Retrieval (COH-Ligation; n=514). All patients received laparoscopic bilateral proximal fallopian tube dissection with distal ostomy. In the Ligation-COH group, the fresh embryo transfer was performed once endometrial thickness reached 7mm, while in the COH-Ligation group, all embryos were cryopreserved by vitrification.

The Ligation-COH group demonstrated significantly higher biochemical pregnancy (60.83% vs 46.27%), clinical pregnancy (55.69% vs 38.5%), multiple pregnancy (26.18% vs 17.74%), live birth (47.08% vs 25.26%), and cumulative live birth rates (69.47% vs 47.47%), along with lower miscarriage rates (10.47% vs 17.2%, $p<0.05$) compared to COH-Ligation group. These findings remained statistically significant after adjustment for age and other confounders ($p<0.001$). For elderly patients, the clinical pregnancy, multiple birth, and live birth rates were also significantly higher in the Ligation-COH group ($p<0.001$). No significant differences were observed in patients with diminished ovarian reserve (DOR). The study demonstrated that the timing of hydrosalpinx treatment significantly influenced ovarian responses, laboratory outcomes, and pregnancy rates. The authors concluded that performing proximal tubal occlusion prior to ovarian stimulation yielded more favourable IVF outcomes, particularly among older women, without adversely affecting ovarian response.[12]

Collectively, these findings reinforce the growing body of evidence that proximal fallopian tube separation (PTO/LTO) achieves reproductive outcomes comparable to salpingectomy, while offering additional benefits of ovarian function preservation, lower invasiveness, and shorter operative time. The consistent results across systematic reviews and recent clinical trials support PTO/LTO as an effective and fertility-preserving surgical option for women with hydrosalpinx undergoing IVF.

5.0 SAFETY

Evidence on the safety of proximal fallopian tube separation or laparoscopic tubal occlusion is limited, as most studies focused on reproductive outcomes rather than adverse events. The systematic review by Pérez-Milán F et al. (2025) listed procedural complications as a secondary outcome but did not report specific comparative rates. The authors noted that LTO may involve lower operative risk and shorter operative time than salpingectomy, reflecting its minimally invasive nature. No major intraoperative or postoperative complications were reported in available studies.

In the randomised trial by Hashish RA et al. (2024), no surgical or procedure-related complications were reported in patients treated with hysteroscopic tubal electrocoagulation, except for a single uterine perforation occurred in the hysteroscopic group. In the laparoscopic tubal disconnection group, one serosal bowel injury and one port site infection were documented. The authors also noted that laparoscopic procedures such as salpingectomy and proximal tubal ligation may have invasive risks related to anaesthesia and technical challenges, particularly in patients with pelvic adhesions.

Overall, current evidence suggests that LTO is a safe and well-tolerated procedure, with no indication of increased surgical complications compared with conventional salpingectomy. However, further studies are needed to strengthen the comparative safety evidence.

6.0 COST-EFFECTIVENESS

No published cost-effectiveness studies were identified for proximal fallopian tube separation or laparoscopic tubal occlusion in the management of hydrosalpinx. Based on procedural characteristics reported in comparative studies, LTO is less invasive and requires shorter operative time than salpingectomy, suggesting potential savings in surgical resources and hospital stay. The preservation of ovarian function may also reduce the need for additional IVF cycles. Nevertheless, formal economic evaluations are needed to substantiate these assumptions and determine the true cost-effectiveness of LTO within the local healthcare context.

7.0 CONCLUSION

Based on the above evidence, proximal fallopian tube separation or laparoscopic tubal occlusion is an effective surgical option for women with hydrosalpinx undergoing in-vitro fertilisation. The procedure provides comparable reproductive outcomes to salpingectomy, with potential advantages in preserving ovarian function, reducing surgical invasiveness, and shortening operative time.

Although direct evidence on safety and cost-effectiveness is limited, available findings indicate that LTO is well-tolerated with low complication and may offer procedural and resource-use efficiencies relative to salpingectomy. Nevertheless, further studies are warranted to establish long-term outcomes and economic value.

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