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Hydrosalpinx – Salpingostomy, salpingectomy or tubal occlusion



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Tubal factors account for approximately 25% of cases of infertility, and the most severe manifestation of tubal disease is hydrosalpinx, accounting for 10–30% of tubal diseases. Hydrosalpinx is a distension or dilatation of the fallopian tube in the presence of a distal tubal occlusion, and the most common cause is pelvic inflammatory disease. Women with hydrosalpinges have lower implantation and pregnancy rates in assisted reproductive technology (ART), due to a combination of mechanical and chemical factors thought to disrupt the endometrial environment. Current guidance is removal of the tube by salpingectomy (preferably laparoscopically) before IVF treatment. Salpingostomy, or distal tubal plastic surgery in the management of hydrosalpinx, is an alternative for women desiring natural conception, although ectopic pregnancy rates as high as 10% have been reported. Proximal tubal occlusion with Essure[®] devices placed hysteroscopically can be considered particularly in cases of distorted pelvic anatomy or pelvic adhesions making abdominal surgery complex. However, low clinical pregnancy and live birth rates have been reported with the use of these devices before IVF. In this review, we discuss salpingostomy, salpingectomy and tubal occlusion as possible management options for the reproductive women with hydrosalpinx.

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Hydrosalpinx

Tubal factors account for approximately 25% of cases of infertility, and the most severe manifestation of tubal disease is hydrosalpinx. Hydrosalpinx, derived from Greek, meaning ‘water tube’, is a distension or dilatation of the fallopian tube in the presence of a distal tubal occlusion, and the disease may affect the proximal, distal or entire tube [1,2]. There are many different causes for the distension of the fallopian tube, which include pelvic inflammatory disease (PID), endometriosis, appendicitis or previous pelvic or abdominal surgery [3]. PID is the most common cause, usually resulting from prior sexually transmitted diseases such as those due to *Chlamydia trachomatis* or *Neisseria gonorrhoeae*, resulting in severe inflammatory processes, obstructing the distal end of the tube [3]. The non-functioning hydrosalpinx fluid occurs as a result of inflammatory processes and natural transitional mucosal production.

The prevalence of hydrosalpinges in patients suffering from tubal disease is common; 10–13% are diagnosed on ultrasound [4,5] (Fig. 1) and up to 30% are diagnosed by hysterosalpingography, laparoscopy or during open surgery [6–8].

Effects of hydrosalpinx on reproductive outcomes

It is now accepted that fluid within a hydrosalpinx plays a causative role in reducing pregnancy rates in assisted reproductive technology (ART); the success of ART for women with hydrosalpinx tubal disease is reduced by 50% compared with women who do not have hydrosalpinx [9–11]. Anderson et al. showed that when hydrosalpinx was present in patients undergoing IVF/ET, there was a lower implantation rate (2.9% than 10% in the group with no hydrosalpinx) and a lower pregnancy rate (22% than 36% in the group with no hydrosalpinx) despite a comparable number of aspirated oocytes and embryos transferred during the IVF cycle [5]. They also have high rates of ectopic pregnancy and miscarriage [2,10].

There are many theories on why women with hydrosalpinges have impaired reproductive outcomes, although the exact cause remains unknown. Mechanical and chemical factors and suboptimal endometrial receptivity have been shown to adversely affect IVF outcomes. It has been thought that leakage of fluid in the uterine cavity disturbs the endometrial receptivity to the developing embryo [5]. Although not fully understood, several candidate genes and proteins involved in implantation may have altered patterns of expression when hydrosalpinges are present. The unfavourable intrauterine



Fig. 1. Left hydrosalpinx seen on ultrasound.

environment may result from toxic substances draining into the cavity and diluting endometrial secretions [6,9,12]. Lavage of the endometrial cavity is consistent with chronic vaginal discharge observed in women with hydrosalpinges [13]. One study showed that none of the women with hydrosalpinx who had uterine cavity distension in the luteal phase had achieved on-going intrauterine pregnancy after IVF treatment [14].

Management of hydrosalpinx

The UK National Institute for Health and Care Excellence (NICE) suggests the management of hydrosalpinx by laparoscopic salpingectomy before commencement of IVF [15]. A further Cochrane review showed that laparoscopic salpingectomy or tubal occlusion before IVF improves the chances of IVF success [16]. Here, we discuss salpingostomy, salpingectomy and proximal tubal occlusion (laparoscopic and hysteroscopic approaches) as possible management options.

Salpingostomy

Salpingostomy is distal tubal plastic surgery to manage hydrosalpinx using scissors, electrosurgery or laser [17,18], with the aim of conserving the fallopian tubes and allowing the woman to attempt natural conception. During surgery, the distal tube is incised and opened in the avascular area, and the newly created ostium is sutured back to the mesosalpinx. Great care is needed to minimise the creation of raw surfaces. However, because of the increased use of IVF/ICSI treatment, sterilising surgery (salpingectomy and tubal occlusion) has been shown to double the chance of IVF success [6,14,16] and is now being performed in preference to ensure that the hydrosalpingeal fluid does not contact or disrupt the endometrial environment.

Sterilising surgery has a major disadvantage in that a patient who has bilateral disease will rely on IVF/ICSI treatment to achieve a future pregnancy. A systematic review of 22 studies (including 2810 patients) showed that women who had undergone salpingostomy for hydrosalpinx had a spontaneous pregnancy rate of 27%, cumulative clinical pregnancy rate of 25.5% at 24 months after salpingostomy and a live birth rate of 25%, suggesting that it is an effective alternative treatment strategy to sterilise tubal procedures [19]. However, there is a high risk of ectopic pregnancy at 10%, and further studies are needed to identify the subpopulation that would benefit the most from tube-conserving surgery, with reasonable chances of subsequent natural conception [19]. For example, in older women or those with substantial damage to tubes secondary to severe hydrosalpinges, proceeding directly to salpingectomy and IVF treatment may be most appropriate, rather than salpingostomy. The necessary expertise for reconstructive tubal surgery needs consideration.

Winston et al. showed that the degree of tubal damage, determined by the degree of mucosal damage and tubal fibrosis, presence of isthmic disease and the quality of tubal and ovarian adhesions, affects prognosis [20]. Amongst those with stage 1 disease, 39% had successful live births after primary salpingostomy [20]. For thin-walled hydrosalpinges with good mucosa, surrounded by few or flimsy adhesions, excellent outcomes have been reported after tubal reconstructive surgery with more than half of the patients achieving an intrauterine pregnancy [21]. Conversely, thick-walled hydrosalpinges with fibrosis of the wall have poor prognosis. Recurrence rate of hydrosalpinx after salpingostomy has been reported to be as high as 70% in the poor prognostic group [22].

There may be a role of salpingoscopy or tubal endoscopy in excluding mucosal adhesions and predicting individuals with more than 50% intrauterine and less than 5% tubal pregnancy rate following reconstructive surgery [23,24]. Salpingoscopy allows direct visualisation of the ampullary mucosa and intraluminal adhesions and may allow better selection of patients most suitable for functional surgery.

Salpingectomy

Current data strongly support laparoscopic salpingectomy in the management of hydrosalpinx in terms of clinical and on-going pregnancy rates, and NICE recommends salpingectomy, preferably by

laparoscopy before IVF treatment [15]. Johnson et al. showed that the on-going clinical pregnancy rates in the intervention group were 31% versus 17.6% in the control group (odds ratio [OR] 2.2, 95% confidence interval [CI] 1.26–3.82) [16].

In salpingectomy, chronically infected tissue is removed, and this limits the chances of subsequent abscess formation or torsion, as well as improved access to the ovaries during egg retrieval in IVF [25]. However, laparoscopy remains an invasive procedure, which, in the presence of dense adhesions, may be very difficult. With laparoscopy, there are risks of damage to major organs or vessels, such as those with previous abdomino-pelvic surgery, severe endometriosis and inflammatory bowel disease.

Salpingectomy also carries an increased risk of interstitial pregnancy (IP) (pregnancy within the part of the fallopian tube that is located in the uterine wall and connects with the remainder of the tube to the endometrial cavity) in cases where the transection of the fallopian tube is at a site too close to the cornua. Wang et al. identified 43 cases of IP, of which 71% had undergone bilateral salpingectomy before IVF [26]. A corneal suture placed at the time of laparoscopic salpingectomy has been shown to reduce the risk of IP, increasing the rate of intrauterine pregnancy, on-going pregnancy and live birth rates compared to those without placement of a corneal suture [27].

Some studies have shown impaired ovarian blood flow following salpingectomy, which adversely impacts on response to ovarian stimulation [28,29]. A meta-analysis of 25 studies showed that the gonadotropin dose required for stimulation in IVF was increased, and the number of oocytes retrieved was decreased in the salpingectomy group compared to that in the control group [30]. Operating close to the fallopian tube and away from the ovarian vessels and suspensory ligament is recommended to minimise devascularisation of the ovary (Fig. 2).

Proximal tubal occlusion

Proximal tubal occlusion is considered as an alternative management option, especially in cases of distorted pelvic anatomy in those with severe pelvic adhesions. Studies have reported comparable

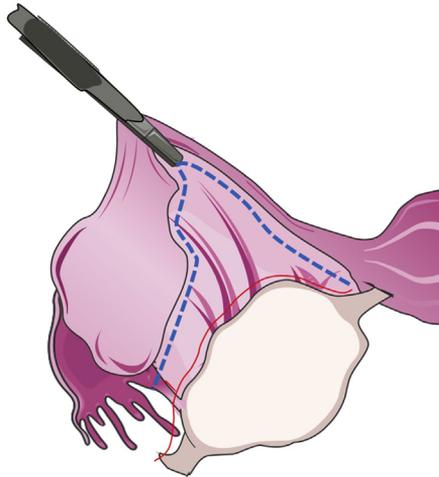


Fig. 2. Salpingectomy in the management of hydrosalpinx. Operating close to the fallopian tube and away from the ovarian vessels and suspensory ligament is recommended to minimise devascularisation of the ovary. In cases of impaired ovarian blood flow following salpingectomy, response to ovarian stimulation in IVF can be poor.

implantation and pregnancy rates in women who had undergone tubal occlusion, salpingectomy and salpingostomy [31,32].

The procedure is less invasive, easier and quicker to perform. The advantages are that the retrograde flow of the hydrosalpingeal fluid, thought to contribute to a perturbed uterine environment, is eliminated and the integrity of the ovarian blood supply is maintained. However, tubal occlusion may be associated with on-going pelvic pain secondary to the pressure and presence of the diseased tube, and risks of adnexal torsion and subsequent need for adnexal surgery [33].

In laparoscopic tubal occlusion, the medial end of the tube can be cauterised and divided or occluded with a clip (Filshie clip or Hulka–Clemens clip). The Filshie clip is a titanium–silicone clip that uses the pressure exerted by the applicator to close the clip. The Hulka–Clemens clip is plastic with a gold-plated stainless steel spring, and the spring mechanism holds the clip closed when applied to the tube. However, there are reported cases of clip migration and chronic pelvic pain post procedure [34].

Essure[®] and Adiana[®] are devices described for hysteroscopic tubal occlusion, but only the former has been used thus far in the management of hydrosalpinx. Essure[®] has been widely used for hysteroscopy tubal sterilisation [35]. It is a microinsert, 4 cm in length and 2 mm in diameter when expanded. Polyethylene terephthalate fibres, which run through the inner coil of the Essure[®] device, cause a tissue reaction and resulting tubal occlusion when inserted.

A systematic review of 11 studies (115 women who received Essure[®]) showed successful placement in 96.5% and tubal occlusion in 98.1% [36]. With subsequent IVF, a reasonable pregnancy rate of 38.6% and live birth rate of 27.9% were achieved, and authors concluded that Essure[®] is an effective option for the management of hydrosalpinx in women before IVF, where operative treatment options are limited by pelvic adhesions [36]. However, a two-centre RCT (involving 85 women) following from this showed that before IVF/ICSI, hysteroscopic tubal occlusion is inferior to laparoscopic salpingectomy; the on-going pregnancy rates per patient following proximal tubal occlusion by intratubal devices was 26.2% compared with 55.8% following laparoscopic salpingectomy ($p = 0.008$) [37]. Furthermore, a systematic review of more than 3000 patients showed that management of hydrosalpinx by hysteroscopic placement of Essure[®] devices before IVF produces lower clinical pregnancy and live birth rates than that by laparoscopic salpingectomy and laparoscopic proximal tubal occlusion [38]. We do not, therefore, recommend Essure[®] as a form of treatment for hydrosalpinges.

Summary

The detrimental effect of hydrosalpinx on the uterine milieu during the implantation window has been well described. Current guidance supports the use of salpingectomy or proximal tubal occlusion in women with hydrosalpinx before IVF or ICSI, as there are higher chances of successful treatment and improved pregnancy rates. However, there remains a role for salpingostomy in the treatment of hydrosalpinx in a subgroup of women, who are reasonable candidates for a trial of natural conception. Individualised care, considering the woman's risk profile and desires, is required to help her make an informed decision, considering the full range of treatment options.

Practice points

- Appropriate management of hydrosalpinx in a woman with reproductive potential needs to consider the risk profile, the woman's desires and the local expertise of reproductive specialists.
- The detrimental impact of hydrosalpinx before ART, such as IVF, has been well documented, and thus, salpingectomy is recommended to optimise chances of successful implantation and pregnancy before IVF.
- Salpingostomy may have a role in a specific cohort of women who have reasonable chances of spontaneous conception.

Research agenda

- Research into how the presence of hydrosalpinx can affect the intrauterine environment would be useful. This would further our understanding of the environment surrounding the embryo during implantation and how disruption to this physiological control may lead to reproductive failures.
- Research into how the hydrosalpinx fluid is toxic to the developing embryo can be studied.
- The role of selective salpingostomy or salpingectomy in the management of hydrosalpinx dependent on the size of the distension has not been explored.

Conflicts of interest

The authors have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bpobgyn.2019.01.011>.

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