



Review Article

The Effect of Salpingectomy on Ovarian Function

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ABSTRACT Tubal surgery is performed for a variety of indications in gynecology. Salpingectomy is the most aggressive form of tubal surgery and may be performed for potential risk reduction for epithelial ovarian cancer, sterilization, and ectopic pregnancy and as a method to enhance fertility in the setting of hydrosalpinx. Depending on the indication, alternatives include conservative therapy alone, tubal occlusion, and salpingostomy. However, aggressive tubal surgery may impact fertility and ovarian reserve because of its effects on adjacent ovarian tissue. Ovarian damage may manifest as alterations in serum and sonographic markers of ovarian function as well as in vitro fertilization (IVF) response and, ultimately, impair outcomes in assisted reproductive and spontaneous conception cycles. We performed a review of articles from PubMed, Cochrane, and MEDLINE from 1946 to 2016 and included 48 relevant publications. For most indications for salpingectomy, ovarian reserve is not impacted. Although there are several conflicting studies suggesting a slight impairment of the parameters of ovarian reserve, these studies were mostly in patients who underwent salpingectomy for an ectopic pregnancy. For patients attempting to conceive naturally, salpingectomy overall does not confer a substantial decrease in conception. Conservative options may increase their risk for persistent trophoblastic disease. In patients planning on IVF, salpingectomy does not appear to significantly affect ovarian stimulation parameters or clinical pregnancy rates. Furthermore, salpingectomy is recommended in cases of hydrosalpinx. Overall, salpingectomy has no significant effects on ovarian reserve. However, the impact on IVF success and spontaneous pregnancy rates must be weighed by the indication for possible salpingectomy. A review of these risks and benefits should aid in choosing between salpingectomy and less aggressive alternatives. *Journal of Minimally Invasive Gynecology* (2017) 24, 563–578 © 2017 AAGL. All rights reserved.

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Salpingectomy (i.e., the removal of all or some of the fallopian tube) is performed for various indications in current gynecologic practice. This includes ectopic pregnancy with rupture, gross hemoperitoneum, or if medical management is unlikely to cause resolution [1]. Patients may undergo salpingectomy as a form of sterilization, in addition to the common alternatives of banding, ligation, and electrocoagulation. Salpingectomy may also be indicated to enhance fertility if any hydrosalpinx has been discovered [1]. More recently, it has been used as a prophylactic measure to reduce the risk for epithelial ovarian cancer, which

appears to derive from the fallopian tube and endometrium rather than the ovary [2–6].

Given the increasing incidence of salpingectomy during gynecologic surgery as well as the availability of less aggressive surgical alternatives for many indications, a comprehensive assessment of its effects on ovarian function is warranted. This question is especially important for younger patients still seeking fertility or those at risk for early menopause. The fallopian tubes derive their blood supply from branches of the uterine and ovarian arteries. Therefore, salpingectomy may potentially diminish collateral blood flow to the ovaries [7]. In addition, lateral thermal spread from electrocoagulation on the tubes as well as surgical manipulation of ovarian tissue may lead to direct ovarian damage. Therefore, we sought to review the current literature on salpingectomy and its effects on ovarian function, which include measures of ovarian reserve and ovulation. The direct consequences of salpingectomy will be assessed in

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the context of both spontaneous conception and assisted reproductive cycles.

Methods

A search was performed in PubMed, the Cochrane Library, and Ovid MEDLINE. Phrases used in the search were suited for each individual database and included “salpingectomy AND ovarian reserve,” “salpingectomy AND AMH,” “salpingectomy AND FSH,” “salpingectomy AND antral follicle count,” “salpingectomy AND fertility,” “salpingectomy AND IVF,” “salpingectomy AND ovarian hyperstimulation,” “salpingectomy AND oocyte,” “salpingectomy AND tubal occlusion,” and “salpingectomy AND menopause.” Our search period spanned from 1946 to 2016. Two hundred forty-nine articles were found. These articles were then assessed for relevance and quality by the authors. Only studies published in English were included. Forty-eight of these articles were included as part of this review. A manual review of the references in each of the cited sources was performed to ensure that any relevant resource was not excluded.

The primary outcome of this review was to determine if salpingectomy performed for any of the aforementioned reasons affected ovarian reserve. Markers for ovarian reserve included serum concentrations of antimüllerian hormone (AMH), basal follicle-stimulating hormone (FSH), and antral follicle count (AFC). Secondary outcomes were indirect measures of ovulatory function and capacity, including pregnancy and live birth rates in natural and ART (assisted reproductive technologies) cycles as well as in vitro fertilization (IVF)-specific parameters (e.g., gonadotropin dose, duration of stimulation, and oocytes retrieved) and timing of menopause.

Articles were selected as relevant if they were (1) prospective or retrospective studies or meta-analyses involving reproductive-age women who underwent bilateral or unilateral salpingectomy for benign indications and (2) reported AMH levels, baseline AFC, FSH levels, IVF cycle characteristics (e.g., number of follicles, oocytes retrieved, and fertilized embryos), and clinical pregnancy or live birth rates. Studies were excluded if they were (1) case reports, systematic reviews, abstracts, or expert opinion articles; (2) did not include an analysis of patients who underwent salpingectomy; (3) included patients who underwent any gonadotoxic therapy such as chemotherapy; (4) included patients who had any active genital or gonadal infectious or inflammatory processes; or (5) did not involve humans or used any animal or in vitro models.

Results

The systematic literature search yielded 249 articles. Only 48 of these articles met the inclusion criteria (Fig). These articles are outlined by author, study type, indications, outcomes, strengths, weaknesses, and findings (Tables 1–3).

Nearly all of the salpingectomies were performed laparoscopically. Over a quarter of the articles were randomized controlled trials. The remainder were retrospective and prospective cohort studies. Two case-control studies were included with 1 case series.

Salpingectomy and Ovarian Reserve

One major concern is that salpingectomy may inadvertently damage the ovarian reserve and affect the hormonal milieu required for normal ovulation and pregnancy maintenance. The purpose of ovarian reserve testing, according to the American Society for Reproductive Medicine, is to determine who is at risk of diminished ovarian reserve. Patients with diminished ovarian reserve are defined as those who have regular menses but produce a limited response to ovarian stimulation and have reduced fecundity [8]. Per the American Society for Reproductive Medicine, the most reliable markers of ovarian reserve are AMH and AFC. Basal FSH, inhibin B, and the clomiphene citrate challenge test have more limited reliability [8]. Coagulation of the blood supply in the mesosalpinx during salpingectomy may impact collateral blood flow to the ovaries or directly damage ovarian tissue by lateral thermal spread [9]. Severing the common blood supply during surgery could decrease ovarian perfusion and negatively impact steroid production and follicular development within the ovary [9].

Although there is no accepted direct measure of “ovarian damage,” several surrogates of ovarian reserve that are known to change with age have also been shown to change after exposure to gonadotoxic surgery or drugs. For example, unilateral salpingo-oophorectomy or cystectomy for ovarian endometrioma significantly decreased AMH (–54% and –66%, respectively; $p = .001$) but not FSH or AFC [10]. Similar findings were observed after endometrioma excision [11].

The potential harm from salpingectomy, if any, is more challenging to detect, in part because the damage is inherently more subtle. The effect of salpingectomy alone was compared with other forms of adnexal surgery in a retrospective cross-sectional cohort of over 3000 women, of whom 138 underwent salpingectomy, 36 underwent unilateral salpingo-oophorectomy, and 40 underwent cystectomy for endometrioma. Using statistical regression, the study found that salpingectomy appears to have no appreciable impact on ovarian reserve compared with untreated women as measured by changes in AMH, AFC, and FSH [12]. Wide excision of the mesosalpinx at the time of prophylactic bilateral salpingectomy also appeared to have no effect on AMH, AFC, or FSH compared with standard salpingectomy [12]. AMH was comparable between patients undergoing IVF who had salpingectomy compared with controls with blocked tubes who did not undergo salpingectomy [13].

Similar findings were observed in a randomized controlled trial (RCT) that evaluated the effect of prophylactic salpingectomy at the time of abdominal hysterectomy.

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