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From Sterilization to Ovarian Cancer Prevention: Global Trends, Safety, and Socioeconomic Factors of Opportunistic Salpingectomy During Cesarean Section

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Abstract

Background: Opportunistic salpingectomy (OS) has rapidly replaced traditional bilateral tubal ligation (BTL) as the highly effective and preferred modality for permanent sterilization but also a concurrent ovarian cancer prophylaxis - as many serous epithelial ovarian cancers are believed to originate in the fallopian tubes rather than the ovaries. However, questions

remain regarding safety profiles, racial disparities in procedural access, the long-term preservation of the ovarian endocrine reserve and cost-effectiveness implications

Aim: To synthesize current global trends, oncological benefits, perioperative risks, and socioeconomic factors surrounding OS.

Material and methods: A literature search was conducted in the PubMed and Google Scholar database to identify and aggregate studies evaluating the clinical implementation, adverse effects, and complications of OS performed concurrently with Cesarean section, for studies published up to 2026.

Results: Total bilateral salpingectomy (TBS) demonstrates up to a 90% risk reduction for Type II high-grade serous carcinomas. The procedure adds 4 to 10 minutes to total operative duration. Furthermore, TBS shows promise for permanent contraception without acutely compromising ovarian reserve, though evidence remains inconclusive. However, a disparity in procedure utilization was observed, with Black patients being approximately 50% less likely than non-Black patients to undergo bilateral salpingectomy for permanent sterilization. At the macroeconomic level, a decision-analytic model of universal OS projected a total healthcare cost-savings of up to \$445 million annually within the United States.

Conclusions: Opportunistic salpingectomy is a highly cost-effective, oncologically superior, and surgically favorable intervention. To maximize its public health impact, systemic disparities in procedural access must be addressed, and multi-decade prospective tracking is required to confirm lifelong ovarian reserve preservation

Key words: opportunistic salpingectomy, Cesarean section, complications, permanent contraception

1. Introduction

Surgical female sterilization remains one of the most widely utilized methods of permanent contraception globally, with a recent major shift in surgical practice from traditional tubal ligation (TL) toward total salpingectomy. This transition is reflected in the study executed in 2010–2017 involving over 48 million claims, which demonstrates a nearly 18-fold increase in the incidence of opportunistic salpingectomy (OS) for sterilization (Karia et al., 2021). A primary benefit of opportunistic salpingectomy is reducing the incidence of ovarian cancer. Given the current lack of effective screening methods, this procedure remains a highly valuable preventative tool. According to Nezhat & Martinelli, 2019 obstetrics and gynecology practitioners should consider performing an opportunistic salpingectomy during all pelvic surgeries to optimize patient health, maximize cancer protection, and reduce unintended pregnancies.

Despite the overall increase, these variations suggest that access to OS remains inequitable across different populations (Walheim et al., 2024). Furthermore, while the term "opportunistic salpingectomy" traditionally encompasses the removal of the fallopian tubes during a pelvic surgery, its implementation has expanded rapidly as a primary modality for permanent sterilization. Given these shifting patterns in clinical practice, we wanted to further evaluate the surgical field regarding the specific benefits, risks, and long-term oncological outcomes associated with salpingectomy.

2. Data collection and analysis

A literature search was conducted in the PubMed database to identify and aggregate studies evaluating the clinical implementation, adverse effects, and complications of opportunistic salpingectomy performed concurrently with Cesarean section for studies published up to 2026. The search strategy utilized a combination of Medical Subject Headings (MeSH) and Title/Abstract keywords. Specifically, the search targeted indexed terms for surgical adverse effects and complications of salpingectomy. These terms were intersected with keywords for permanent contraception or sterilization, and restricted to the setting of cesarean deliveries. Surgical interventions for ectopic pregnancies were explicitly excluded, and the search was limited to human subjects.

3. Procedural Landscape & Patient Selection

3.1. Surgical Access Modalities and Technological Transitions

There is a significant increase in the concurrent bilateral salpingectomy during cesarean delivery (Mandelbaum et al., 2021). An evaluation of a multi-year cohort spanning 2015 and 2018 obtained data in which utilization rates of opportunistic salpingectomy rose from 4.6% to 13.2% (OR 2.69; 95% CI, 2.63–2.75) while the trend for traditional bilateral tubal ligation declined, both in a group of women aged above 35 years and those under 35. The same trend was observed by Karia et al., 2021, which study shows an almost 18-fold increase in the incidence of opportunistic salpingectomy for sterilization. In a study by Duncan et al., 2017 the evaluation of the tissue extraction parameters showed an average specimen length of 8.3 ± 1.5 cm of the fallopian tube was excised during bilateral salpingectomy.

The technical execution of a bilateral salpingectomy traditionally relies on the total surgical removal of both fallopian tubes extending to the tubal corner of the uterus by an abdominal access via laparoscopy, minilaparotomy, or concurrently during a cesarean delivery. However, the paradigm of minimally invasive reproductive surgery has expanded to include novel natural orifice transluminal endoscopic pathways, most notably transvaginal natural orifice transluminal endoscopic surgery (vNOTES) (Hui et al., 2022). Emerging clinical evidence demonstrates that vNOTES offers statistically significant advantages over conventional laparoscopy, particularly regarding heightened patient satisfaction, reduced postoperative pain, accelerated functional recovery times, and superior cosmetic outcomes when performing bilateral salpingectomies for permanent sterilization.

Furthermore, a growing body of literature substantiates the clinical safety and structural ease of this transvaginal approach; by utilizing a natural anatomic pathway, vNOTES successfully bypasses the anterior abdominal wall entirely (Hui et al., 2022). This fundamentally eliminates common open and laparoscopic entry site complications. Ultimately, selecting the optimal surgical entrance requires a tailored approach that balances the patient's individual anatomical history, the immediate delivery setting, and the evolving landscape of minimally invasive endoscopic techniques.

3.2. Demographic and Clinical Selection Profiles

The type of patient who undergoes the procedure of bilateral salpingectomy often varies depending on the study methods and design. Across the evaluated literature, the age of patients undergoing the procedure was around 35 years or older (Castellano et al., 2017; Ferrari et al., 2019; Mandelbaum et al., 2021; McAlpine et al., 2014). This demographic trend strongly correlates with higher parity and completed family planning, particularly when weighing the absolute irreversibility of a total salpingectomy, which entirely precludes the possibility of future tubal reanastomosis.

Data gathered from open-ended survey questions further revealed that the primary motivators driving the preference for opportunistic bilateral salpingectomy over traditional tubal ligation were its superior efficacy in preventing unintended pregnancies and its protective effect against ovarian cancer. Pregnant women undergoing a cesarean section demonstrated a 93.5% acceptance rate (n=43/46) for opportunistic bilateral salpingectomy, compared to a 75% acceptance rate (n=6/8) among non-pregnant individuals undergoing elective procedures (Yassa & Pulatoğlu, 2020).

Conversely, younger cohorts demonstrate a higher propensity to utilize alternative contraceptive modalities, including traditional tubal ligation and intrauterine contraception (IUC) (Schwarz et al., 2022). These may be favored due to a lower baseline parity or the preservation of a theoretical potential for surgical reversal. Beyond patient preference, clinical decision-making is heavily dictated by the distinct oncological advantages offered by complete tissue excision over simple mechanical tubal occlusion.

4. Oncological and Prophylactic Benefits

4.1. Pathophysiological Paradigms

Ovarian cancer remains one of the most lethal gynecologic malignancies, while there's persistent lack of effective early screening tools. According to US Cancer statistics from 2023 (Siegel et al., 2023), there were approximately 19,710 newly diagnosed cases of ovarian cancer and 13,270 deaths attributed to the disease. Because the majority of these cases are discovered at an advanced stage, the high mortality rate highlights a critical need for proactive intervention. Beyond its clinical severity, an ovarian cancer diagnosis carries a profound

psychosocial burden (Arden-Close et al., 2008). The onset of the disease frequently induces acute distress for both patients and their families, with subsequent therapeutic interventions further compounding this psychological strain

Epithelial ovarian cancer (EOC) is characterized by late-stage detection, with roughly 70% of patients diagnosed only after the disease has reached an advanced phase (Dahm-Kähler et al., 2017). While the risk of malignancy increases with age in the general population, younger individuals with BRCA1 or BRCA2 mutations require early-onset surveillance protocols and proactive risk-reducing interventions. Ovarian cancer was thought to arise from the ovarian surface mesothelium, but modern paradigms challenge the historical view, demonstrating that a significant proportion of pelvic malignancies originate within the fallopian tubes and endometrium. This is highly apparent in hereditary risk cohorts, where precursor lesions, primarily serous tubal intraepithelial carcinomas (STICs), develop in the tubal lumen and subsequently exfoliate to colonize the ovaries (Subramaniam et al., 2019).

However, according to the American College of Obstetricians and Gynecologists (“ACOG Committee Opinion No. 774,” 2019) certain epithelial ovarian cancer variants still develop natively within intra-ovarian structures, while nonepithelial pelvic malignancies- such as germ cell and sex-cord stromal tumors originate strictly from ovarian parenchymal compartments independent of the fallopian tubes.

4.2. Subtype-Specific Protective Efficacy

Given the distinct clinical characteristics and divergent developmental pathways of Type I and Type II malignancies, it is logical to anticipate that the degree of oncological protection afforded by salpingectomy, tubal ligation, and hysterectomy would vary significantly between these two ovarian cancer subtypes. Empirical data confirm this hypothesis, revealing that the efficacy of each surgical intervention is indeed contingent upon the specific pathological subtype it aims to prevent.

In the study conducted by Darelus et al., 2021, it was demonstrated that in Type I EOC, both hysterectomy and tubal ligation were associated with a decreased risk profile; however, the clinical significance varied by procedure. Hysterectomy demonstrated a statistically reliable protective effect, evidenced by a fully adjusted OR of 0.71 (95% CI: 0.52–0.99). Conversely, while tubal ligation suggested a 34% risk reduction (OR 0.66), this finding did not reach

statistical significance. The procedure of previous salpingectomy did not demonstrate a reduced risk of EOC Type I. Consequently, these data do not provide definitive evidence that mechanical tubal ligation offers a reliable prophylactic benefit against Type I EOC subtypes. For standard-risk populations, the preventative efficacy of altering tubal anatomy was documented by epidemiological data from the Nurses' Health Studies, which showed that traditional tubal ligation reduced ovarian cancer incidence by 24% compared to non-sterilized controls - a protective trend strongly mirrored in broad Swedish population cohorts (Mongiovi et al., 2025). This discrepancy implies that while disrupting the mechanical conduit of the fallopian tube may mitigate risk, the comprehensive removal of the uterine endometrium via hysterectomy provides a far more robust safeguard against the retrograde ascension of endometrial cells or inflammatory debris.

In the prevention of Type II EOC, total salpingectomy demonstrates clear clinical superiority over traditional tubal ligation (Darelius et al., 2021). While tubal ligation showed only a non-significant 20% risk reduction, bilateral salpingectomy achieved a profound 90% reduction in risk. Even when adjusted for confounding factors like endometriosis and PID, the complete removal of both fallopian tubes remained a robust protective factor, whereas the data for mechanical ligation failed to reach statistical significance. These findings strongly reinforce the contemporary pathophysiological paradigm that high-grade serous malignancies can arise from serous tubal intraepithelial carcinomas located within the distal fimbriae. Because mechanical occlusion or ligation leaves this tissue intact within the peritoneal cavity, it fails to deliver the definitive risk reduction achieved only through complete surgical resection of the tubal structures.

These anatomical insights carry critical prophylactic implications for both hereditary risk cohorts and the general population undergoing routine pelvic surgery. The ACOG Committee Opinion No. 774," 2019 states that in BRCA mutation carriers undergoing risk-reducing surgeries, histopathological reviews reveal occult, early-stage tubal malignancies in 1% to 5% of patients, with the vast majority localized specifically to the fimbriated end of the fallopian tube. These findings reinforce the clinical mandate to prioritize complete tissue resection over simple mechanical disruption whenever pelvic surgery presents an opportunity for ovarian cancer risk reduction.

4.3. Mechanistic Models of Risk Reduction

While the clinical superiority of resection over occlusion is becoming increasingly evident, the underlying mechanisms driving the protective nature of these tubal interventions require further investigation. Bilateral salpingectomy, defined as the total surgical removal of both fallopian tubes, excises the entire tissue structure where early malignancies could possibly originate. Conversely, tubal ligation and tubal occlusion establish a physical barrier. Consequently, several physiological models have been proposed to explain how these distinct anatomical modifications translate into reduced oncogenic risk.

Evidence from meta-analysis (Cibula et al., 2011) demonstrates a substantial decrease in ovarian cancer incidence among women who have undergone tubal ligation, a protective effect that may be explained by the physiological theories proposed by Hakverdi et al., 1994. This author hypothesizes that the surgical interruption of ovarian blood flow serves as a primary preventive mechanism; this vascular disruption is thought to subsequently lower the concentration of sex steroid hormones synthesized within the ovaries, thereby potentially mitigating oncogenic stimulation.

These theoretical models find strong support in recent epidemiological data, which further quantify the impact of surgical technique on overall risk reduction across larger patient populations. Another large-scale study, which analyzed 16,822 cases of epithelial ovarian cancer (Duus et al., 2023) provides robust evidence for the protective benefits of salpingectomy. The data reveal a significant decrease in overall EOC risk following both unilateral (OR = 0.73; 95% CI: 0.60–0.87) and bilateral salpingectomy (OR = 0.46; 95% CI: 0.31–0.67), while tubal ligation offered only a marginal risk reduction (OR = 0.91; 95% CI: 0.83–0.99). Notably, the protective efficacy of salpingectomy was most pronounced in women who underwent the procedure before age 50.

The transition toward salpingectomy as a standard of care represents a highly targeted prophylactic strategy that significantly reduces ovarian cancer mortality. However, implementing this complete tissue resection requires a balanced assessment of its impacts on long-term reproductive and endocrine health.

5. Physiological Impact and Surgical Safety

5.1. Operative Efficiency and Technical Feasibility

An evaluation of operative efficiency across the literature reveals a highly consistent trend regarding surgical duration: the transition from traditional tubal occlusion to total bilateral salpingectomy results in a statistically significant, yet clinically marginal, increase in operative time. Specifically, multiple studies demonstrate a narrow, predictable increase in operative duration of 4.3 and 10.0 minutes when total salpingectomy is utilized (Castellano et al., 2017; Ferrari et al., 2019; Yang et al., 2021). When evaluating traditional tubal ligation against bilateral salpingectomy, specifically during cesarean delivery, the latter is consistently associated with only a slight prolongation of overall surgical time, exhibiting a pooled mean difference of just 5.81 minutes (95% CI: 0.85–10.77) in meta-analytic data evaluating direct comparative trials (Levy et al., 2021). Crucially, as highlighted in the clinical review by Castellano et al., 2017, this modest temporal extension depends heavily on the specific surgical approach and technique employed, yet it does not adversely affect immediate clinical outcomes. Their analysis confirms that the additional operative time does not lead to significant escalations in hospital length of stay, postoperative readmission rates, or the requirement for blood transfusions, thereby reinforcing the position that salpingectomy represents a safe and viable alternative to traditional ligation within the cesarean setting. This minor temporal extension is further contextualized by the choice of surgical equipment; utilizing a bipolar electrocautery device can drastically optimize efficiency, reducing the isolated sterilization phase to just 5.0 ± 3.6 minutes compared to 18.5 ± 8.3 minutes when no device is used (Ostby et al., 2024).

However, when analyzing total global operating room time rather than isolated procedural increments, institutional variables play a confounding role. For example, total operative times for total versus partial salpingectomy varied significantly at academic institutions (90 vs. 68 minutes), whereas no statistical difference was observed in community hospital settings (55 vs. 54 minutes) (Desravines et al., 2021). Another study by Shinar et al., 2017 demonstrated slightly different outcomes of the measured operational time- the total operative duration, from initial incision to skin closure, was slightly shorter for a bilateral total salpingectomy compared to a partial salpingectomy (61.0 versus 71.2 minutes).

This suggests that while the mechanical addition of a total salpingectomy inherently adds less than 10 minutes of active surgical work, global operating room times are heavily influenced by the clinical environment, teaching requirements, and institutional workflows.

Multi-year datasets further justify the real-world feasibility of bilateral salpingectomy, demonstrating that the procedure remains highly practicable despite these institutional and structural variations. In a study analyzing the period between 2014 and 2020 involving 414 women, bilateral salpingectomy demonstrated an exceptionally high technical feasibility rate, showing no statistically significant difference in completion success when compared to traditional tubal occlusion (Baltus et al., 2022). Although this specific cohort recorded a more substantial increase in operative duration of approximately 23 minutes, alongside a higher utilization of additional surgical ports, it crucially documented zero intraoperative complications, underscoring the intrinsic safety of the procedure despite extended surgical exposure.

Despite the marginal time variance, safety profiles across the literature remain highly comparable. No significant differences have been observed regarding acute intraoperative complications, overall postoperative morbidity, or estimated blood loss, providing conclusive evidence that the slight temporal cost of total salpingectomy does not compromise immediate maternal safety.

5.2. Analysis of Acute Perioperative Risks

While bilateral salpingectomy is an increasingly favored method for permanent sterilization, it introduces specific theoretical and clinical complexities. Castellano et al., 2017 emphasize that the procedure necessitates a higher degree of surgical proficiency and specialized equipment, which theoretically increases operative risk. This risk is particularly pronounced in restricted settings, such as small minilaparotomy incisions; however, the broader operative exposure inherent to a cesarean delivery is thought to mitigate these technical challenges.

The safety profile of performing an opportunistic salpingectomy during a cesarean delivery remains a subject of ongoing clinical discussion, primarily due to the profound physiological alterations of the pregnant uterus. In particular, the marked increase in uterine vascularity raises concerns regarding heightened risks of intraoperative hemorrhage and vascular injury. In a study conducted by (Rufin et al., 2024) patients undergoing a cesarean section were divided into two distinct cohorts: those receiving an opportunistic salpingectomy and those undergoing conventional bilateral tubal ligation. These findings provide the evidence supporting the safety and feasibility of this prophylactic intervention, even in the face of the unique anatomical challenges presented by the gravid state.

In patients undergoing bilateral tubal ligation compared to total bilateral salpingectomy the studies show no significant difference in estimated blood loss (Garcia et al., 2018; Subramaniam et al., 2018), as well as no significant difference in patient's hematocrit in the second study.

Empirical evaluation of these risks has yielded nuanced results. Utilizing a propensity score-matched model, a large-scale analysis spanning 2015 to 2018 identified a modest but statistically significant increase in specific perioperative risks for the bilateral salpingectomy cohort compared to those undergoing traditional tubal ligation (Mandelbaum et al., 2021). Specifically, patients undergoing salpingectomy experienced higher rates of hemorrhage (3.8% vs. 3.1%) and blood product transfusion (2.1% vs. 1.8%). While the study also noted higher relative risks for peripartum hysterectomy and oophorectomy in the salpingectomy group, the absolute incidence of these severe interventions remained exceptionally low across both cohorts (under 1%). However, these findings must be contextualized: while the relative risk for certain severe outcomes is approximately doubled, the absolute risk of these complications remains minimal due to the exceptionally low baseline percentages.

In contrast, more recent data (Rufin et al., 2024) demonstrated an overall decrease in perioperative complications among patients undergoing opportunistic salpingectomy, although this research noted an increased likelihood of patients filling analgesic prescriptions (opioids and NSAIDs) post-discharge, the authors suggest this be interpreted with caution due to the lack of data on over-the-counter medication use. This favorable safety profile is further supported by a localized retrospective chart review of 363 subjects (Levy et al., 2021), which found that patients undergoing total salpingectomy actually experienced significantly lower rates of both postoperative symptomatic anemia (0.9% vs. 5.7%) and surgical site infection (1.7% vs. 6.9%) compared to those receiving mechanical tubal occlusions.

This clinical safety profile is further reinforced when evaluating technical variations and the urgency of the delivery setting. Evidence demonstrates that the presentation of an unscheduled cesarean delivery does not significantly influence the surgical selection of the postpartum permanent contraception technique (Ferrari et al., 2019). Furthermore, when comparing bilateral total salpingectomy to partial salpingectomy, the incidence of contraception-related intraoperative hemorrhage remains low and statistically indistinguishable between the cohorts and postoperative complication rates similarly show no significant variance between the total and partial excision groups (Ferrari et al., 2019).

Crucially, targeted subgroup analyses confirm that these equitable safety profiles persist without divergence during unscheduled, urgent cesarean deliveries.

5.3. Postoperative Ovarian Reserve and Endocrine Function

Beyond immediate surgical complications, a critical concern for surgeons is the potential impact on long-term endocrine function and surgery-induced menopause. This premature hormonal decline significantly elevates the risk for subsequent morbidities such as neurological deficits, bone density deterioration, cardiovascular disease, and metabolic disorders. To address concerns that complete tubal excision might compromise the delicate vascular supply to the ovaries, recent physiological data has been established. In a prospective observational study, adnexal physiology was evaluated in 71 women who underwent laparoscopic hysterectomy with concurrent opportunistic bilateral salpingectomy over a post-operative follow-up period of 3 to 5 years (McAlpine et al., 2014). To objectively quantify ovarian reserve and parenchymal perfusion, the authors measured serum follicle-stimulating hormone (FSH) and anti-Müllerian hormone (AMH) levels, alongside ultrasonographic assessments of antral follicle count (AFC), vascular index, flow index, and vascular flow index. The comparative analysis revealed robust reassurance that long-term ovarian function and vascular perfusion are successfully preserved following opportunistic bilateral salpingectomy.

Conversely, a retrospective cohort study conducted by Collins et al., 2019 raised similar concerns. Among a cohort of 4,906 patients undergoing hysterectomy for benign indications, those who received a concurrent bilateral salpingectomy exhibited a significantly higher risk of developing menopausal symptoms one year post-operatively compared to patients whose fallopian tubes were preserved (crude relative risk 1.29, 95% CI 1.04–1.60; adjusted relative risk 1.33, 95% CI 1.04–1.69).

An assessment of ovarian reserve 6 months post-salpingectomy provided significant reassurance in this regard. The surgical intervention did not result in statistically significant shifts in mean AMH or basal estradiol (E2) levels; furthermore, the median AFC remained consistent with basal FSH values post-operatively in 80 women with a previous unilateral or bilateral hydrosalpinx and indicated for salpingectomy or tubal ligation (Behery et al., 2025). In another study involving 20 patients who underwent a cesarean section concurrent with

bilateral salpingectomy, AMH levels increased across a six-month follow-up period (Ida et al., 2021).

Collectively, these findings suggest that while the intermediate safety profile of opportunistic salpingectomy remains generally robust, the contrasting evidence regarding post-operative menopausal symptoms underscores the need for continued clinical vigilance. The current data demonstrates that the procedure offers a viable pathway for permanent contraception without acutely compromising ovarian reserve; however, as these baseline clinical metrics become validated, the research focus must naturally expand to evaluate systemic imbalances and inequities in how these preventative interventions are offered to patients

6. Socioeconomic and Systemic Factors

6.1. Healthcare Equity and Racial Disparities in Procedural Access

Beyond immediate clinical safety and physiological outcomes, ensuring equitable healthcare delivery across diverse populations is a critical imperative in modern obstetric practice. Walheim et al., 2024 addressed a gap in equity when evaluating procedural selection at the time of cesarean delivery. They revealed a profound racial disparity: Black patients were nearly 50% less likely than non-Black patients to undergo bilateral salpingectomy relative to traditional bilateral tubal ligation for permanent sterilization at the time of Cesarean delivery. Prior to the procedure, Black patients presented with a significantly higher prevalence of preexisting comorbidities: elevated rates of hypertension (10.8% vs. 5.3%, $p < 0.01$), bleeding disorders (3.9% vs. 1.3%, $p < 0.01$), and preoperative anemia (36.9% vs. 21.3%, $p < 0.01$), but also a greater proportion of Black patients were classified as American Society of Anesthesiologists (ASA) physical status class 3 or higher (29.4% vs. 22.5%, $p = 0.01$).

These findings underscore a critical systemic inequity- restricting populations from accessing the superior, long-term oncological benefits of ovarian cancer risk reduction associated with salpingectomy.

6.2. Cost-Effectiveness and Macroeconomic Implications

When evaluating the optimal approach to permanent sterilization during a Cesarean delivery, balancing immediate procedural costs against long-term oncological and reproductive advantages is essential for clinical decision-making.

Although bilateral salpingectomy was recognized as the most effective method for permanent contraception during a cesarean delivery, only 62% of surveyed practitioners Fellows of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) actually offer the procedure for this indication (Noori et al., 2024). The procedure was most frequently proposed to individuals at a high risk for gynecological oncogenesis, while the remaining recommendations were primarily indicated for permanent contraception.

Current economic evaluations demonstrate that while traditional tubal ligation presents lower initial procedural expenditures, opportunistic salpingectomy provides a highly favorable economic profile due to its superior clinical efficacy in reducing epithelial ovarian cancer rates (Subramaniam et al., 2019; Venkatesh et al., 2019). Additionally, by removing the complete anatomical tract, salpingectomy eliminates the long-term risk of recanalization or fistulization, thereby yielding significantly lower contraceptive failure rates over time compared to traditional mechanical occlusion.

In base-case cost-utility analyses of women undergoing sterilization at the time of Cesarean delivery, opportunistic salpingectomy demonstrates robust cost-effectiveness relative to tubal ligation, yielding an incremental cost-effectiveness ratio (ICER) ranging tightly between \$23,189.88 per QALY (Quality-Adjusted Life Year) (Venkatesh et al., 2019) and \$26,616.00 per QALY (Subramaniam et al., 2019). Conversely, non-surgical alternatives, such as postpartum long-acting reversible contraception, have been shown to be both costlier and less effective within this surgical population, rendering them economically dominated (Venkatesh et al., 2019).

On a cohort scale, substituting traditional ligation with salpingectomy introduces a predictable trade-off: it results in a marginal increase in baseline procedural costs and minor perioperative complications, but dramatically curtails long-term morbidity and downstream expenditures (Subramaniam et al., 2019; Venkatesh et al., 2019). For instance, within a standard cohort of 10,000 patients, implementing opportunistic salpingectomy prevents an estimated 17 ovarian cancer diagnoses, 13 cancer-related fatalities, and 25 unintended pregnancies, balancing out a multi-million dollar initial surgical expenditure with a \$3.3 million cost savings in cancer

treatment alone (Subramaniam et al., 2019). Furthermore, life-course economic modeling confirms that opportunistic salpingectomy remains highly cost-effective across various surgical touchpoints, exhibiting an ICER of \$5,469 per QALY when performed alongside standard tubal disruption and \$1,667 per QALY when integrated into concurrent hysterectomies (Naumann et al., 2021).

Sensitivity analyses confirm that these economic conclusions remain highly durable across wide clinical parameters. The cost-effectiveness of salpingectomy is primarily sensitive to the absolute risk reduction of ovarian cancer and the incremental cost margins over tubal ligation. The technique remains the economically optimal choice unless its absolute oncological risk reduction falls below a threshold of 41% to 52% (Subramaniam et al., 2019; Venkatesh et al., 2019). Crucially, in high-risk patient populations, such as carriers of BRCA1 or BRCA2 mutations or Lynch syndrome, salpingectomy completely dominates all alternative options, serving as a directly cost-saving mechanism (Castellano et al., 2017).

Ultimately, these multi-model analyses indicate that moving away from traditional tubal ligation in favor of universal opportunistic salpingectomy could generate a macro-economic healthcare benefit as high as \$445 million in annual savings within the United States (Rufin et al., 2024). Consequently, the current body of economic evidence strongly suggests that opportunistic salpingectomy is a highly efficient allocation of healthcare resources that should be universally endorsed and compensated by third-party insurance payers (Rufin et al., 2024; Walheim et al., 2024).

7. Discussion

Limitations of Current Literature

Despite the compelling clinical and economic arguments for universal opportunistic salpingectomy, the existing body of evidence, and by extension, our current study, contains several key limitations that warrant careful consideration.

First, long-term oncological data relies heavily on retrospective registries. Long-term, prospective randomized data remains scarce while large-scale trials (such as the TUBA-WISP trial) continue to mature. Second, perioperative safety assessments within the published

literature are highly diverse. Studies pool safety outcomes from low-risk elective procedures alongside high-risk, urgent obstetric interventions, clouding the true baseline risk profile of opportunistic salpingectomy in standard settings. Furthermore, significant disparities in cohort sizes across the reviewed literature introduce potential bias. Because the absolute number of cases differed drastically between individual studies, direct data comparisons are limited. This baseline variance is further compounded by the geographic and structural scope of the data; several included studies were single-center in nature, whereas others utilized sweeping, country-wide registries.

From a patient-counseling perspective, it is imperative for future patients to know the exact percentages of possible surgical risks to accurately capture these complications. Because many of the current cohort comparisons demonstrate statistically non-significant differences in morbidity, there is a clinical danger that this data may be misinterpreted as a sign that these complications simply do not occur. Our ability to map the true scope of these complications is also restricted by systemic tracking limitations. Readmissions due to postoperative complications may not be completely captured if patients were subsequently admitted to other facilities, thereby underestimating the true complication rate. Similarly, post-discharge pain management and patient recovery metrics could not be measured with adequate accuracy, as over-the-counter (OTC) pain medication intake remains highly unquantifiable in retrospective designs.

Finally, data regarding endocrine safety and ovarian reserve preservation are largely restricted to short follow-up windows, leaving a distinct lack of multi-decade prospective data to definitively rule out accelerated menopause. Several of the most comforting endocrine outcomes currently cited in the literature are limited to a brief 6-month follow-up period. Extended observation windows are necessary to track long-term anti-Müllerian hormone trajectories over years rather than months, allowing researchers to definitively rule out delayed ovarian senescence or premature follicular depletion.

8. Conclusion

In conclusion, the clinical transition from mechanical tubal occlusion to total opportunistic salpingectomy represents a milestone in preventative oncology and reproductive medicine. Concomitant reproductive organ surgery demands thorough patient counseling and informed consent. The surgical literature confirms that complete tissue excision offers a risk reduction

against lethal high-grade serous carcinomas while imposing a negligible burden on operative efficiency, immediate safety, or short-term endocrine health. From a macroeconomic perspective, the procedure has advantages over existing contraceptive workflows, translating into substantial long-term savings. Future multi-decade prospective science, particularly in larger populations of parturients, remains desirable to validate its lifelong physiological safety profile and propose global clinical guidelines.

9. Disclosure

Author Contribution

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