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Completeness of salpingectomy intended for ovarian cancer risk reduction

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HIGHLIGHTS

- Following salpingectomy, 5.6% ($n = 6/107$) of ovaries had residual salpingeal tissue.
- There was no difference in residual salpingeal tissue by surgeon level ($p = 1.0$).
- There was no difference in residual salpingeal tissue by surgery type ($p = 0.42$).

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ABSTRACT

Background: Prophylactic salpingectomy has been heavily promoted based on the theory that serous tubal intraepithelial carcinoma is a precursor lesion for serous ovarian carcinoma. However, the validity of prophylactic salpingectomy has yet to be proven through adequate research. The purpose of this study is to evaluate the completeness of salpingectomy intended for ovarian cancer risk reduction.

Materials and methods: Women without a history of ovarian cancer who were undergoing salpingoophorectomy at a single institution in Honolulu, Hawaii were enrolled in this study. Salpingectomy was performed prior to oophorectomy. A blinded pathologist then examined the ovaries for the presence of residual salpingeal tissue. Data collected included type of surgery (minimally invasive or laparotomy) and level of surgeon (attending or resident). Data were analyzed using Fisher's exact test.

Results: A total of 107 ovaries were examined. Following salpingectomy, 5.6% ($n = 6/107$) of ovaries had residual salpingeal tissue present and 94.4% ($n = 101/107$) of ovaries were absent of salpingeal tissue. Of the ovaries with residual salpingeal tissue, there was no difference in level of surgeon (attending $n = 3/107$, resident $n = 3/107$, $p = 1.0$) or type of surgery (minimally invasive $n = 5/107$, laparotomy $n = 1/107$, $p = 0.42$).

Discussion: This is the largest blinded study ever conducted to examine ovaries for residual salpingeal tissue after salpingectomy. In addition, this is the only study to compare learner versus attending outcomes in this setting. This study found that over 94% of salpingectomies resulted in complete removal of salpingeal tissue. Of the ovaries with residual salpingeal tissue, there wasn't a difference among surgeon level and surgery type, but the study was not powered to detect this. This study supports the continued clinical practice of prophylactic salpingectomy for ovarian cancer risk reduction.

1. Background

Prophylactic salpingectomy has been heavily promoted based on the theory that serous tubal intraepithelial carcinoma is a precursor lesion for serous ovarian carcinoma [1–3], so that surgical excision of the fallopian tube will reduce a woman's risk of ovarian cancer. The American College of Obstetricians and Gynecologists endorses prophylactic salpingectomy at time of surgery for benign disease given its benefits and lack of adverse sequelae [4].

Mouse models have demonstrated the efficacy of prophylactic salpingectomy, as genetically modified mice at high-risk of ovarian cancer did not develop cancer following prophylactic salpingectomy [5]. Other studies have reported that approximately 4–6% of women with *BRCA* mutations who undergo salpingectomy have evidence of early tubal malignancy [6,7]. Falconer et al. performed one of the largest population-based cohort studies to date and found that prophylactic salpingectomy significantly lowers the risk for ovarian cancer with a hazard ratio of 0.65 [8]. While the current literature supports the practice of prophylactic salpingectomy for

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ovarian cancer risk reduction, most studies are limited by a mixture of retrospection, small sample sizes, short term follow up, and selection bias favoring *BRCA* carriers. Additional research is needed.

The goal of prophylactic salpingectomy is to surgically excise all salpingeal tissue. However, it is not uncommon for residual salpingeal tissue to remain adherent to ovaries, which could possibly decrease the efficacy of this surgery. The purpose of this descriptive study is to evaluate the completeness of salpingectomy intended for ovarian cancer risk reduction. The primary objective is to examine the percentage of salpingectomies that result in complete removal of salpingeal tissue from the ovary. This study also looks at intraoperative variables that could affect completeness of salpingectomy, such as surgeon level and surgery type.

2. Materials and methods

Study exemption was obtained from the Hawaii Pacific Health Research Institute. This is a single institution study in Honolulu, Hawaii from June 2018 to January 2019. Inclusion criteria included women without a history of undergoing ovarian pathology undergoing risk-reducing salpingoophorectomy. All subjects were consented prior to study enrollment.

During the same operation, subjects underwent salpingectomy immediately prior to oophorectomy. The fallopian tube and ovary were then removed from the pelvis separately. Salpingectomies were performed by transecting the mesosalpinx below the fallopian tube, then transecting the fallopian tube at the level of the cornua. For the laparoscopic approach, the salpingectomy was performed using Ligasure®. For the robotic assisted laparoscopic approach, the salpingectomy was performed using bipolar Maryland forceps for cauterization, followed by monopolar scissors for transection. For laparotomy, the salpingectomy was performed using the bovie. Mode of surgery was not influenced by study enrollment.

Ovaries were then examined microscopically by a blinded gynecologic pathologist. Ovaries were cut at 2 mm intervals, and all specimens were completely analyzed for the presence or absence of tubal-type epithelium and architecture (Figs. 1 and 2).

A Fisher's exact test was performed for descriptive data. Statistical differences were considered significant for p-values less 0.05.

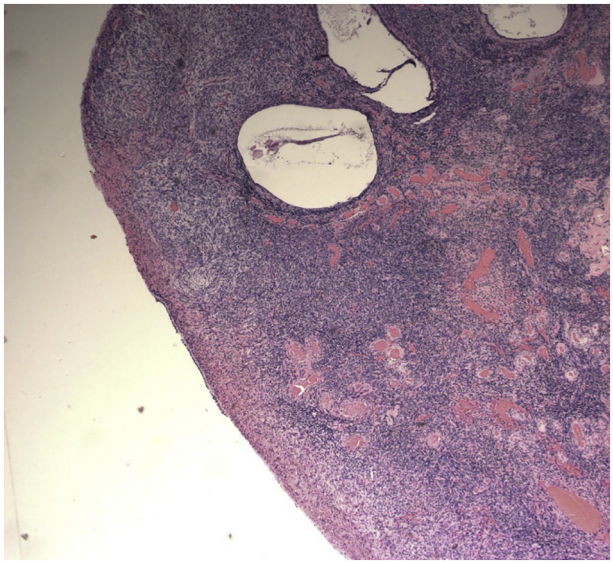

Fig. 1. Ovary with absent salpingeal tissue status post salpingectomy.

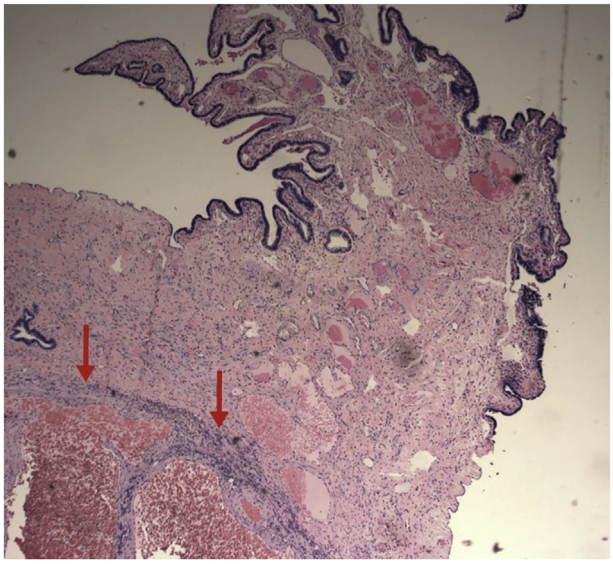

Fig. 2. Ovary with residual salpingeal tissue status post salpingectomy (arrows).

3. Results

A total of 107 salpingectomies were performed on 55 patients. Salpingoophorectomies were performed individually or concomitantly with total hysterectomy, lymph node dissection, and ileostomy. Indications for salpingoophorectomy varied from endometrial cancer, endometrial cancer precursors, cervical cancer precursors, and high-risk genetic mutations.

Salpingectomies were evenly distributed between attending (46.7%, $n = 50$) and resident (53.3%, $n = 57$) surgeon. A majority of salpingectomies were performed via a minimally invasive approach (91.6%, $n = 98$), of which 1 was performed laparoscopically and 97 were robotic assisted laparoscopically. The remaining 8.4% (n = 9) of salpingectomies were performed via laparotomy (Table 1).

Status post salpingectomy, 5.6% of ovaries ($n = 6/107$) had residual salpingeal tissue. Of the ovaries with residual salpingeal tissue, there was no difference in level of surgeon (attending $n = 3/107$, resident n = 3/107, $p = 1.0$) or type of surgery (minimally invasive $n = 5/107$, laparotomy $n = 1/107$, $p = 0.42$) (Table 1).

4. Discussion

This is the largest blinded study ever conducted to examine ovaries for residual salpingeal tissue status post salpingectomy. This study found that over 94% of salpingectomies resulted in complete removal of salpingeal tissue. Of the ovaries with residual salpingeal tissue, there wasn't a difference among surgeon level and surgery type, but the study was not powered to detect this.

In May 2017, Ayres et al. found that 15% ($n = 3/20$) ovaries had residual salpingeal tissue status post salpingectomy, challenging the efficacy of prophylactic salpingectomy in the prevention of

Table 1
Sample distribution and findings.

Sample distribution	Sample size	Residual salpingeal tissue	P-value
Number of ovaries	107	6 (5.6%)	–
Level of surgeon			
Attending	50 (46.7%)	3 (6.0%)	1.00
Resident	57 (53.3%)	3 (5.3%)	
Type of surgery			
Minimally invasive	98 (91.6%)	5 (5.1%)	0.42
Laparotomy	9 (8.4%)	1 (11.1%)	

ovarian cancer [9]. This study recruited only women at high-risk of ovarian cancer (history of breast cancer, *BRCA* gene mutation, and family history of ovarian cancer). In contrast, our sample size was five times larger and includes women with a wide range of indications for salpingectomy, such as endometrial intraepithelial neoplasia. The relatively high rate of residual salpingeal tissue following salpingectomy reported by Ayres et al. could be attributed to the decreased sample size and/or recruitment of solely high-risk patients. Ayres et al. may be more applicable to women at high-risk of ovarian cancer while our study may be more applicable to relatively low-risk women, which would be more representative of the general population undergoing prophylactic salpingectomy at the time of benign surgery as endorsed by the American College of Obstetricians and Gynecologists. While these findings support the continued practice of prophylactic salpingectomy, long term prospective studies, such as double-blinded randomized controlled studies, are needed to determine the true efficacy of salpingectomy for ovarian cancer risk reduction.

The number of ovaries with residual salpingeal tissue following salpingectomy was low, so the study was not powered to detect factors significantly associated with residual salpingeal tissue. The authors hypothesize that the presence of adnexal adhesions, inflammation, and/or endometriosis would be associated with increased rates of residual salpingeal tissue due to increasingly difficult dissections. Another hypothesis is that the advanced optics in robotic assisted laparoscopy would decrease the rate of residual salpingeal tissue, whereas the cases chosen for laparotomy are often more difficult and would result in increased rates of residual salpingeal tissue secondary to selection bias.

In the setting of a difficult dissection, the surgeon should demonstrate clinical judgment to determine if opportunistic salpingectomy is appropriate for the patient. Heroic measures should not be taken to ensure complete resection of the fallopian tube during opportunistic salpingectomy. Electrocautery ablation of residual salpingeal tissue can be considered, but there is no strong evidence to support a decreased risk of ovarian cancer with this method.

This study is unique because it is the first to compare learner versus attending outcomes for salpingectomy and found that there was no difference in the rate of completeness. Salpingectomy is a relatively quick and uncomplicated surgery. Previous studies have shown that concomitant salpingectomy requires an additional 16 min of surgical time and is not associated with increased length of hospital stay, readmission, blood transfusion, infection, or fever [10,11]. This study supports the ease of salpingectomy because it shows that salpingectomy can be effective regardless of the level of surgeon.

A strength of this study is its relatively large sample size with over 100 specimens. An obvious study limitation is that it was not powered to detected a significant difference between surgeon level and surgery type. A majority of surgeries were performed via robotic assisted laparoscopy, which could be viewed as a limitation; However, it does reflect an actual change in how medicine is practiced as robotic assisted surgery becomes more popular. Another limitation is that the study was performed at a single institution with a single attending surgeon, which decreases the generalizability of the study. Moreover, due to the limitations of retrospective chart review, the presence of adnexal adhesions, inflammation, and/or endometriosis were not documented, which would likely increase the difficulty of dissection and rates of residual salpingeal tissue on the ovary.

In conclusion, this study found that salpingectomy is an effective method to remove salpingeal tissue from ovaries and supports the continued clinical practice of prophylactic salpingectomy for ovarian cancer risk reduction. More research, particularly long-term studies, are needed to determine the true efficacy of salpingectomy intended for ovarian cancer risk reduction.

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None.

Author contribution

J. Wong, J. Killeen, and M. Carney conceived and designed the study, in addition to collecting the data. J. Wong performed the data analysis and wrote the paper.

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Declaration of competing interest

The authors report no conflict of interest.

References

[1] D.W. Kindelberger, Y. Lee, A. Miron, et al., Intraepithelial carcinoma of the fimbria and pelvic serous carcinoma: evidence for a causal relationship, Am. J. Surg. Pathol. 31 (2007) 161–169.
[2] B.K. Erickson, M.G. Conner, C.N. Lenden, The role of the fallopian tube in the origin of ovarian cancer, Am. J. Obstet. Gynecol. 209 (2013) 409–414.
[3] R.J. Kurman, I. Shih, The dualistic model of ovarian carcinogenesis: revisited, revised, and expanded, Am. J. Pathol. 186 (2016) 733–747.
[4] The American College of Obstetricians and Gynecologists, Salpingectomy for ovarian cancer prevention, in: ACOG Committee Option Number 774, April 2019.
[5] J. Kim, D.M. Coffey, C.J. Creighton, et al., High-grade serous ovarian cancer arises from fallopian tube in a mouse model, PNAS 109 (2012) 3921–3926.
[6] M.J. Callahan, C.P. Crum, F. Medeiros, et al., Primary fallopian tube malignancy in BRCA-positive women undergoing surgery for ovarian cancer risk reduction, J Clinc Oncol 25 (2007) 3985–3990.
[7] A. Finch, P. Shaw, B. Rosen, et al., Clinical and pathologic findings of prophylactic salpingoophorectomies in 159 BRCA1 and BRCA2 carriers, Gynecol. Oncol. 100 (2006) 58–64.
[8] H. Falconer, L. Yin, H. Gronberg, et al., Ovarian cancer risk after salpingectomy: a nationwide population-based study, J. Natl. Cancer Inst. 107 (2015) dju410.
[9] C. Ayres, et al., Challenging salpingectomy as a risk-reducing measure for ovarian cancer, Int. J. Gynecol. Cancer 27 (2017) 703–707.
[10] F.E. Hanley, J.N. McAlpine, C.L. Pearce, et al., The performance and safety of bilateral salpingectomy for ovarian cancer prevention in the United States, Am. J. Obstet. Gynecol. 216 (2017) 270.e1–270.e9.
[11] J.N. McAlpine, G.E. Hanley, M.M. Woo, et al., Opportunistic salpingectomy: uptake, risks, and complications of a regional initiative for ovarian cancer prevention, Am. J. Obstet. Gynecol. 210 (2014) 471.e1–471.e11.