Review Article

Opportunistic Salpingectomy during Hysterectomy for Prevention of Ovarian Cancer: A Review of Literature

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Today, ovarian cancer is one of the most common cause of cancer related death among women and there is no effective screening test. Therefore, prevention is considered to be the best measure in reducing the incidence of ovarian cancer. Several studies suggest that ovarian cancer is derived from the fimbrial end of the fallopian tube. Thus, an increase in understanding of pathogenesis of epithelial ovarian cancer offers new preventive measures such as the bilateral salpingectomy. This procedure is easily done simultaneously with hysterectomy. However, most gynecologists usually perform hysterectomy, leaving both fallopian tubes. These patients could gain the benefit of ovarian cancer prevention if salpingectomy was performed at the same time. The authors propose this article to reveal advantages and disadvantages of opportunistic salpingectomy during hysterectomy in preventing ovarian cancer.

Keywords: Salpingectomy, Hysterectomy, Ovarian reserve

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Ovarian cancer is one of the leading causes of mortality in gynecological malignancy and the fifth most common cause of cancer death for women[1]. Since there is no benefit in screening protocols, the cancer is often diagnosed in a late stage. As a result, the survival rate is quite low[1]. Even if today's ovarian cancer treatment has progressed considerably, the mortality rate of ovarian cancer is still high. Therefore, prevention is considered to be the best measure.

The concept of salpingectomy for prevention of ovarian cancer has emerged for ten years due to an increase in understanding and availability of evidences for the origin of the epithelial ovarian cancer. Previous hypothesis proposed that some structures inside the ovary (which were postulated to arise from a transformation of the ovarian surface epithelium) were the etiology of ovarian cancer[2]. The theory that the origin of ovarian cancer is derived from the end of the fimbriae has been more accepted in the past decade[3]. Based on the recent studies, the fimbriae part of the fallopian tube has been recognized as the major origin of serous epithelial ovarian cancer[4].

In the past decade, the protocol of salpingectomy and oophorectomy has been proposed and practiced to prevent ovarian cancer in women at high risk, which included BRCA mutation, age of 40 or older, and no childbearing desire[5]. However, in 2010, a group of British Columbia physicians studying ovarian cancer, proposed salpingectomy should also be performed to preserve a women health. This protocol could eliminate early menopausal state, reduce osteoporosis, and cardiovascular disease[6]. This group has also suggested that the protocol could be run not only in the high-risk women, but also in the general population[7]. Thereby, opportunistic salpingectomy for women undergoing hysterectomy in replacement of sterilization has been suggested[7].

Hysterectomy is the most common operation in gynecologic practice worldwide. More than 650,000 cases are performed every year in USA[8] and 32,000 cases per year in Thailand[9]. In general, the hysterectomy, leaving both fallopian tubes and ovaries in place, is carried out to treat benign gynecological diseases such as myoma uteri, adenomyosis, endometrial hyperplasia, and abnormal uterine bleeding. Therefore, these groups of women will likely gain the benefit of ovarian cancer prevention if salpingectomy is performed as suggested. However, at present, salpingectomy during hysterectomy is not in the guideline. Nevertheless, there is a growing trend of performing this procedure, according to the

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Table 1. Advantage and disadvantage of the opportunistic salpingectomy during hysterectomy

Advantage	Disadvantage
1. Reduction in ovarian cancer risk	1. Possible impact on decreasing ovarian reserve
2. Prevention of fallopian tube complications after hysterectomy	
3. Elimination of any tubal re-operation after hysterectomy	
4. No increase in duration of operation, blood loss, blood requirement, and complications	

recommendation[10]. Of 234 gynecologists surveyed in the USA, 54% performed the opportunistic salpingectomy during hysterectomy with the belief of its contribution to reduce the risk of ovarian cancer and to prevent complications of the fallopian tubes after hysterectomy[10].

The objective of this article is to propose the advantages and disadvantages of the opportunistic salpingectomy during hysterectomy for the prevention of ovarian cancer.

Reduction of ovarian cancer risk

Even if the salpingectomy for prevention of ovarian cancer has been proposed since 2010, no evidence appeared until 2015, when a report from Sweden indicated the result of various operations on the morbidity of ovarian cancer. It was a prospective study in 251,465 people all over the country. Hysterectomy, together with salpingectomy and oophorectomy would prevent ovarian cancer with hazard ratio [HR] of 0.06 (95% CI 0.03 to 0.12), $p<0.001$. Salpingectomy could also prevent the ovarian cancer under HR of 0.65 (95% CI 0.52 to 0.81), $p = 0.001$. Hysterectomy only resulted in similar good effect as sterilization under HR of 0.79 (95% CI 0.70 to 0.88), $p<0.001$ and 0.72 (95% CI 0.64 to 0.81), $p<0.001$, respectively[11]. Moreover, the report also indicated that bilateral salpingectomy contributed to the effect in prevention of ovarian cancer and was associated with a 50% decrease in the risk of ovarian cancer. Prominent risk reduction of ovarian cancer would be observed 10 years or more, post operation[11].

In 2016, a meta-analysis report from 3,509 women undergoing salpingectomy and 5,655,702 control subjects found that bilateral salpingectomy could contribute to the prevention of ovarian cancer with odds ratio [OR] of 0.51 (95% CI 0.35 to 0.75)[12]. Until then, there was no report of population-based study regarding the result of salpingectomy during hysterectomy on the prevention of ovarian cancer. Nevertheless, a recent report using the estimation model described that salpingectomy during hysterectomy could reduce morbidity of ovarian cancer for 38.1% (36.5 to 41.3)[13].

Prevention of fallopian tube complications after hysterectomy

The fallopian tubes have no medical purpose after hysterectomy, but diseases and complications of the fallopian tube can occur. From the study of Guldberg et al[14], the finding indicated that women undergoing hysterectomy without salpingectomy [H-NS] were at risk of complications of the fallopian tubes and had 2.13 times greater risk of re-salpingectomy than those with intact uterus. In addition, Vorwergk et al[15] discovered adnexal complications were more incidental (26.9% and 13.9%, $p = 0.02$) and re-operations to treat these conditions were more frequently performed (12.56% and 4.16%, $p = 0.04$) in the laparoscopic H-NS groups, after follow-up for 55 to 92 months. These complications of fallopian tube included infections (salpingitis, pyosalpinx, and tubo-ovarian abscess), hydrosalpinx, tubal pregnancy, tubal prolapse in vagina, and primary fallopian tube carcinoma[16-19]. Of these, hydrosalpinx was the most common disease with an incidence of up to 35.5%[20,21]. Therefore, bilateral salpingectomy during hysterectomy can eliminate these risks.

Decreasing ovarian reserve after salpingectomy

There is conflicting data on ovarian reserve after opportunistic salpingectomy. Sezik et al[22] conducted a randomized controlled trial [RCT] compared ovarian reserve between the hysterectomy with salpingectomy [H-S] and H-NS. They found that there was no change in follicle-stimulating hormone [FSH], luteinizing hormone [LH], and estradiol levels between pre-operation and one month and six months post-operation of both groups, and no differences between the groups. The other studies[23,24] also found that there were no changes in ovarian reserve assessed by anti-Mullerian hormone [AMH], the potential hormone for ovarian reserve between pre-operation and three months post-operation.

A RCT was conducted in Ramathibodi Hospital that compared ovarian reserve (assessed by AMH) between women undergoing H-S and H-NS. AMH levels did not differ compared between pre-operation and six weeks, three months, and six months post-operation in the H-NS group. However, in the H-S group, the AMH level at six months post-operation was

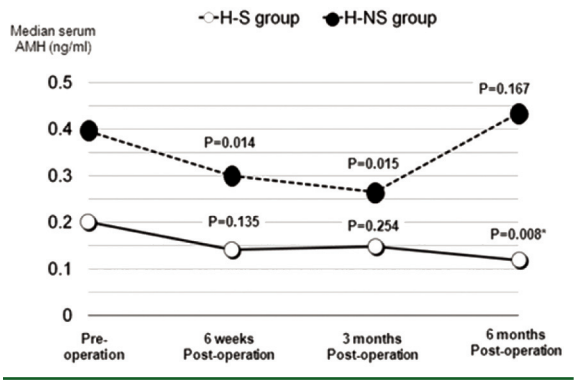

Figure 1. Shows the comparison of AMH levels between pre-operation and 6 weeks, 3 months, and 6 months post-operation in the hysterectomy and bilateral salpingectomy [H-S] and hysterectomy and non-bilateral salpingectomy [H-NS] groups.

significantly different from that at the pre-operation. As a result, AMH level at six months post-operation was significantly lower in the H-S than that in the H-NS groups[25] as shown in Figure 1.

By contrast, a cross-sectional comparative study from China demonstrated that the women undergoing salpingectomy before performing an assisted reproductive technology had lower AMH and higher FSH levels when compared with those without salpingectomy[26]. Recent evidence showed a significant decline of AMH levels after the laparoscopic hysterectomy both with and without salpingectomy assessed at three months after surgery[27]. In that study the opportunistic salpingectomy has no deleterious effect on the ovarian reserve with the fact that reduction rate of AMH level was similar compared between H-S and H-NS[27].

The important factor involving the ovarian reserve in this procedure may be a decrease in blood supply to the ovary resulting from destroyed arteries at the mesosalpinx during salpingectomy. However, it appears that even if the different operation techniques were applied resulting in the difference in blood volume supplied to the ovary, the ovarian reserve was not different according to the study of Venturella et al[28]. They compared ovarian reserve between women undergoing salpingectomy removing and sparing the mesosalpinx. There were no differences in changes of ovarian reserve parameters including AMH, FSH, antral follicle count [AFC], and blood flow between groups[28].

It was deemed that salpingectomy had no impact on ovarian reserve in short-term. However, there is no evidence of its impact on ovarian reserve in long-term follow-up. Interestingly, a recent study using a calculating model to assess ovarian age and found that there was no difference in ovarian age between women who had undergone H-S and those with intact uterus and adnexa[28].

Increasing difficulty, duration, and complications from salpingectomy during hysterectomy

In the past, half of gynecologists had experience in performing an opportunistic salpingectomy during a hysterectomy. The causes for the remaining gynecologists who had never performed this procedure were various. Sixty-nine percent of gynecologists believed the opportunistic salpingectomy had no positive effect, 40% believed it might increase duration of operation, and 34.1% believed it had a higher risk of complication[10]. However, evidence showed that the opportunistic salpingectomy did not increase in duration of operation[29,30], complications[30,31], and blood loss did not require more blood infusions[29-31]. Even though some reports connected salpingectomy with an increase in the duration of the operation[31] or an increase in longer lengths of hospital stays[30], they had no clinical significance. Moreover, the opportunistic salpingectomy did not increase the operation expense[13].

Future trend

The empirical data indicated that fallopian tube is the origin of ovarian cancer, resulting in the performing salpingo-oophorectomy to prevent ovarian cancer in the high-risk group of women. It has evolved into the concept of performing salpingectomy during hysterectomy to prevent ovarian cancer in the general populations. Although it is the data from women undergoing salpingectomy only, the opportunistic salpingectomy during hysterectomy for prevention of ovarian cancer will likely become the proper guideline. This measure has been under consideration by gynecologists at large. The Royal Australian and New Zealand Colleges of Obstetricians and Gynecologists have proposed to apply this measure on a case by case for patient[32]. In addition, the American College of Obstetricians and Gynecologists has proposed that the protocol is a more appropriate and practical alternative to reduce risk of ovarian cancer incidence than bilateral oophorectomy and salpingectomy. The healthcare providers should explain the advantage and disadvantage of opportunistic bilateral salpingectomy by retaining ovary for the patient's acknowledgement[33]. Therefore, the practice of bilateral salpingectomy

during a hysterectomy will likely become extensively performed in the future.

Conclusion

According to the current data, the benefit of opportunistic salpingectomy during hysterectomy is that it can contribute to reduce the risk of ovarian cancer. Furthermore, it can eliminate fallopian tube complications after hysterectomy without increase in expense, or duration of the operation. However, more studies are required with greater numbers of cases and longer durations to obtain a more complete empirical data regarding both advantages and disadvantages associated with this procedure.

What is already known on this topic?

There are a lot of disadvantages of leaving fallopian tubes in situ after hysterectomy such as hydrosalpinx, salpingitis, tubo-ovarian abscess, tubal prolapse in vagina, and fallopian tube carcinoma. Moreover, evidence revealed that the fimbriae part of fallopian tube is the major origin of serous epithelial ovarian cancer. Therefore, The Royal Australian and New Zealand Colleges of Obstetrics and Gynecologists [RANZCOG] and the American college of Obstetrics and Gynecologists [ACOG] have recommended that healthcare providers suggest and explain the advantage and disadvantage of opportunistic bilateral salpingectomy during hysterectomy for the patient's acknowledgement. However, according to the present studies, only half of gynecologists performed salpingectomy during hysterectomy because they believed salpingectomy had no positive effect and might increase postoperative complication and operative time.

What this study adds?

This paper reviews and updates the information about salpingectomy during hysterectomy. The benefits of opportunistic salpingectomy during hysterectomy is to decrease the risk of ovarian cancer and prevent fallopian tube complications after hysterectomy. Furthermore, the operative time and complications were not increased. The concern about adverse effect of opportunistic salpingectomy that it destroys blood vessels in the mesosalpinx, which supply the ovaries, might result in ovarian reserve decline. However, there is no short-term negative effects three months after surgery of opportunistic salpingectomy on ovarian reserve. Furthermore, this review included data about the effect of salpingectomy during hysterectomy in Thai population. The data showed that opportunistic salpingectomy have no adverse effect on ovarian reserve within three months. However, at 6 months after surgery, ovarian reserve of patients who underwent salpingectomy during hysterectomy decreased significantly when compared to patients who underwent hysterectomy alone. Until now, long-term effect of opportunistic salpingectomy on ovarian reserve is still not clear and need to be studied further. Therefore, before performing opportunistic salpingectomy, surgeon should inform the patients about the advantages and disadvantages of this procedure.

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Partridge E, Kreimer AR, Greenlee RT, Williams C, Xu JL, Church TR, et al. Results from four rounds of ovarian cancer screening in a randomized trial. Obstet Gynecol 2009;113:775-82.
2. Dubeau L. The cell of origin of ovarian epithelial tumors and the ovarian surface epithelium dogma: does the emperor have no clothes? Gynecol Oncol 1999;72:437-42.
3. Dubeau L. The cell of origin of ovarian epithelial tumours. Lancet Oncol 2008;9:1191-7.
4. Erickson BK, Conner MG, Landen CN Jr. The role of the fallopian tube in the origin of ovarian cancer. Am J Obstet Gynecol 2013;209:409-14.
5. Kauff ND, Domchek SM, Friebel TM, Robson ME, Lee J, Garber JE, et al. Risk-reducing salpingo-oophorectomy for the prevention of BRCA1- and BRCA2-associated breast and gynecologic cancer: a multicenter, prospective study. J Clin Oncol 2008;26:1331-7.
6. Kwon JS. Ovarian cancer risk reduction through opportunistic salpingectomy. J Gynecol Oncol 2015;26:83-6.
7. Miller DM, McAlpine JN, Gilks CB, Huntsman DG. Opportunistic salpingectomy: the way forward-response to Steven Narod. Curr Oncol 2013;20:143-4.
8. Tsui C, Klein R, Garabrant M. Minimally invasive surgery: national trends in adoption and future directions for hospital strategy. Surg Endosc 2013; 27:2253-7.
9. Srisukho S. Overview in abdominal hysterectomy [Internet]. Bangkok: Faculty of Medicine Chaingmai University; 2014 [cited 2018 Jan 11].

Available from: http://www.med.cmu.ac.th.
10. Gill SE, Mills BB. Physician opinions regarding elective bilateral salpingectomy with hysterectomy and for sterilization. J Minim Invasive Gynecol 2013;20:517-21.
11. Falconer H, Yin L, Gronberg H, Altman D. Ovarian cancer risk after salpingectomy: A nationwide population-based study. J Natl Cancer Inst 2015;107.
12. Yoon SH, Kim SN, Shim SH, Kang SB, Lee SJ. Bilateral salpingectomy can reduce the risk of ovarian cancer in the general population: A meta-analysis. Eur J Cancer 2016;55:38-46.
13. Kwon JS, McAlpine JN, Hanley GE, Finlayson SJ, Cohen T, Miller DM, et al. Costs and benefits of opportunistic salpingectomy as an ovarian cancer prevention strategy. Obstet Gynecol 2015;125: 338-45.
14. Guldberg R, Wehberg S, Skovlund CW, Mogensen O, Lidegaard O. Salpingectomy as standard at hysterectomy? A Danish cohort study, 1977-2010. BMJ Open 2013;3.pii:e002845.
15. Vorwergk J, Radosa MP, Nicolaus K, Baus N, Jimenez CJ, Rengsberger M, et al. Prophylactic bilateral salpingectomy (PBS) to reduce ovarian cancer risk incorporated in standard premenopausal hysterectomy: Complications and re-operation rate. J Cancer Res Clin Oncol 2014;140:859-65.
16. Ghezzi F, Cromi A, Siesto G, Bergamini V, Zefiro F, Bolis P. Infectious morbidity after total laparoscopic hysterectomy: does concomitant salpingectomy make a difference? BJOG 2009; 116:589-93.
17. Basu D, Ward SJ. Post-hysterectomy fallopian tube prolapse–a diagnostic pitfall. J Obstet Gynaecol 2007;27:324.
18. Singla A. An unusual case of torsion hydrosalpinx after hysterectomy: a case report. Aust N Z J Obstet Gynaecol 2007;47:256-7.
19. Callahan MJ, Crum CP, Medeiros F, Kindelberger DW, Elvin JA, Garber JE, et al. Primary fallopian tube malignancies in BRCA-positive women undergoing surgery for ovarian cancer risk reduction. J Clin Oncol 2007;25:3985-90.
20. Morse AN, Hammer RA, Walter AJ, Baker S, Magtibay PM. Does hysterectomy without adnexectomy in patients with prior tubal interruption increase the risk of subsequent hydrosalpinx? Am J Obstet Gynecol 2002;187:1483-5.
21. Repasy I, Lendvai V, Koppan A, Bodis J, Koppan M. Effect of the removal of the Fallopian tube during hysterectomy on ovarian survival: the orphan ovary syndrome. Eur J Obstet Gynecol Reprod Biol 2009;144:64-7.
22. Sezik M, Ozkaya O, Demir F, Sezik HT, Kaya H. Total salpingectomy during abdominal hysterectomy: effects on ovarian reserve and ovarian stromal blood flow. J Obstet Gynaecol Res 2007;33:863-9.
23. Morelli M, Venturella R, Mocciaro R, Di Cello A, Rania E, Lico D, et al. Prophylactic salpingectomy in premenopausal low-risk women for ovarian cancer: primum non nocere. Gynecol Oncol 2013; 129:448-51.
24. Findley AD, Siedhoff MT, Hobbs KA, Steege JF, Carey ET, McCall CA, et al. Short-term effects of salpingectomy during laparoscopic hysterectomy on ovarian reserve: a pilot randomized controlled trial. Fertil Steril 2013;100:1704-8.
25. Hongsakorn W, Lertvikool S, Tingthanatikul Y, Weerakiet S, editor. Effect of salpingectomy during hysterectomy on ovarian reserve by serum anit-mullerian hormone: A prospective randomized controlled study. Harmony of Women's Life Basic & Beyond 2014 Oct 14-17; Dusit Thani Pattaya Chonburi; 2014:185.
26. Ye XP, Yang YZ, Sun XX. A retrospective analysis of the effect of salpingectomy on serum antiMullerian hormone level and ovarian reserve. Am J Obstet Gynecol 2015;212:53-10.
27. Song T, Kim MK, Kim ML, Jung YW, Yun BS, Seong SJ, et al. Impact of opportunistic salpingectomy on anti-Mullerian hormone in patients undergoing laparoscopic hysterectomy: a multicentre randomised controlled trial. BJOG 2017;124:314-20.
28. Venturella R, Morelli M, Lico D, Di Cello A, Rocca M, Sacchinelli A, et al. Wide excision of soft tissues adjacent to the ovary and fallopian tube does not impair the ovarian reserve in women undergoing prophylactic bilateral salpingectomy: results from a randomized, controlled trial. Fertil Steril 2015;104:1332-9.
29. Berlit S, Tuschy B, Kehl S, Brade J, Sutterlin M, Hornemann A. Laparoscopic supracervical hysterectomy with concomitant bilateral salpingectomy--why not? Anticancer Res 2013;33: 2771-4.
30. Minig L, Chuang L, Patrono MG, Cardenas-Rebollo JM, Garcia-Donas J. Surgical outcomes and complications of prophylactic salpingectomy at the time of benign hysterectomy in premenopausal

women. J Minim Invasive Gynecol 2015;22: 653-7.
31. McAlpine JN, Hanley GE, Woo MM, Tone AA, Rozenberg N, Swenerton KD, et al. Opportunistic salpingectomy: uptake, risks, and complications of a regional initiative for ovarian cancer prevention. Am J Obstet Gynecol 2014;210:471.e1-11.
32. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG). Managing the adnexae at the time of hysterectomy for benign gynaecological disease [Internet]. 2016 [cited 2018 Jan 11]. Available from: https://www.ranzcog.edu.au/.
33. Committee on Gynecologic Practice. Committee opinion no. 620: Salpingectomy for ovarian cancer prevention. Obstet Gynecol 2015;125:279-81.