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ORIGINAL ARTICLE

A Study to Evaluate the Effect of Opportunistic Salpingectomy on Ovarian Reserve and Function

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Abstract

Background There are conflicting reports on status of ovarian function after hysterectomy and opportunistic salpingectomy in premenopausal women. The present study was undertaken to understand the effect of salpingectomy done at the time of hysterectomy on ovarian reserve and function as measured by serum AMH and FSH levels before and after the surgery.

Methods This was a prospective study conducted on 60 women who underwent hysterectomy at our tertiary care centre, Shri Guru Ram Rai Institute of medical and health sciences, Dehradun, from January 2020 to September 2021. Serum AMH and FSH levels were monitored preoperatively and 3 months postoperatively in patients undergoing hysterectomy with bilateral salpingectomy and hysterectomy without salpingectomy.

Results The mean age of the patients was 41.83 yrs in group 1 and 43.73 yrs in group 2 [p value = 0.078]. Most common indication of hysterectomy was AUB-L in both the groups (86% and 80%, respectively). Mean operative time was 115.50 min in group 1 and 114.40 min in group 2 [p value = 0.823]. Mean intra-operative blood loss was 214 ml in group 1 and 199.33 ml in group 2 [p value = 0.087]. Serum AMH and FSH were insignificantly decreased in both the groups post-operatively after 3 months, and the difference between both groups was also not statistically significant.

Conclusion Salpingectomy done at the time of hysterectomy for benign indications with preservation of ovaries did not have any short-term adverse effects on ovarian reserve and function.

Keywords Opportunistic salpingectomy · Hysterectomy · Ovarian reserve · Ovarian function

Introduction

There is common agreement amongst gynaecologists to preserve healthy looking ovaries in premenopausal woman requiring hysterectomy for a benign cause. Prophylactic oophorectomy to avert the risk of ovarian cancer in high-risk women may be an optimum procedure, but in low-risk premenopausal women, it is not only unnecessary but may also lead to premature menopause and endanger their lives by increasing the risk of cardiovascular disease [1].

Since last two decades, it has become clear and commonly accepted theory that the majority of ovarian cancers originate from fallopian tube epithelium and not from ovary itself [2]. Due to increased awareness of this fact, practice of elective salpingectomy during hysterectomy for benign conditions, in order to prevent ovarian cancer, has been advocated. Salpingectomy during hysterectomy for benign gynaecological indications (also known as opportunistic salpingectomy) might reduce the overall incidence of ovarian cancer [2].

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Ovarian functional performance after hysterectomy and elective salpingectomy is a matter of concern, especially in younger women requiring hysterectomy for non-malignant indications. According to a literature review by Buffetau et al., performing opportunistic salpingectomy does not seem to cause an increase in morbidity, but its impact on ovarian function is uncertain in particular the occurrence of early premenopausal symptoms [3]. Kar C Long and colleagues believe that the risk-reducing salpingectomy may reduce the risk of ovarian cancer by 76–99%, but it results in surgical menopause leading to a significant impact in quality of life [4]. Although opportunistic salpingectomy is deemed safe by majority, the effect of resection of fallopian tubes on functional ability of ovaries left behind remains doubtful due to conflicting studies. Therefore, the present study was undertaken to understand the effect of salpingectomy done at the time of hysterectomy on ovarian reserve and function as measured by serum AMH and FSH levels before and after the surgery in comparison with patients with no salpingectomy.

Materials and Methods

This was a prospective comparative study conducted in the Department of Obstetrics and Gynaecology at Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, India, after clearance from institutional ethics committee. A written informed consent was taken from all the subjects. All premenopausal women who underwent abdominal hysterectomy with/without salpingectomy with ovaries intact were included in the study. Following women were excluded from the study:

- Postmenopausal women who underwent hysterectomy.
- Women who underwent abdominal hysterectomy with unilateral or bilateral oophorectomy or salpingo-oophorectomy.
- Women on hormonal therapy or hormonal contraception for the last 3 months.
- History of previous gynaecological uterine or ovarian surgeries.

Subjects were divided into two groups:

- **Group 1**: women who underwent abdominal hysterectomy with salpingectomy with ovaries intact.
- **Group 2**: women who underwent abdominal hysterectomy without salpingectomy with ovaries intact.

Detailed history was noted including demographic profile of patient, history of present complaint, obstetric history, menstrual history, past surgical and medical history, indication of surgery, operative time, blood loss during surgery, intra-operative findings, post-operative period and histopathology.

Technique of Salpingectomy

Complete fallopian tube from its fimbriated end up to uterotubal junction was removed. Caution was given to avoid injury to the ovarian vessels and to divide the mesosalpinx as close to the fallopian tube as possible. A monopolar electrocautery device with coagulation current was used to cauterize and transect the mesosalpinx. Small vessels between the ovary and tube and near the uterotubal junction were ligated with Vicryl No. 1–0 if required.

Outcome Measures were:

1. Levels of serum AMH and serum FSH in groups 1 and 2.
2. Comparison of preoperative serum AMH and S. FSH levels with the levels 3 months after surgery in both groups.
3. Comparison of post-operative change in serum AMH and FSH levels between the two groups.

For serum AMH, 0.5 ml serum was collected in red top container tube. Testing was done by the Ansh Ultra-Sensitive Anti-Mullerian hormone (AMH) enzyme-linked immunoassay (ELISA), which is a quantitative three-step sandwich immunoassay. For serum FSH, 0.6 ml serum was collected in a red top container tube. Testing was performed on an immunoassay analyser.

Data were described in terms of range, mean ± standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. Comparison of quantitative variables between the study groups was made using the Student t-test. For comparing categorical data, Chi-square ($\chi 2$) test was performed and exact test was used when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21 version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

Results

The study included 60 women who underwent hysterectomy for benign conditions during the study period with 30 women in each group.

Majority of women were in perimenopausal age group (Table 1). The mean age of women with salpingectomy was 41.83 ± 4.56 years (minimum 35 years, maximum 49 years),

and mean age in group 2 was 43.73 ± 3.59 years (minimum 38 years, maximum 51 years). The distribution of age in both groups was similar [*p* value = 0.078]. Mean BMI in group 1 was 25.40 ± 3.17 kg/m^2 (minimum 18.6, maximum 30.7) and in group 2, it was 26.45 ± 3.22 kg/m^2 (minimum 22.7, maximum 33.3). The difference in both the groups was not statistically significant [*p* value = 0.208]. In both groups, the majority of women required hysterectomy for fibroid uterus (86% in group 1 and 80% in group 2), followed by adenomyosis (13% in group 1 and 17% in group 2). The indications for surgery were similar in both groups [*p* value = 0.539].

Mean operative time in group 1 was 115.50 min (minimum 80 min, max-180 min) and 114.40 min in group 2 (minimum 85 min, maximum 155 min). The difference between the groups was not statistically significant [*p* value = 0.823]. As seen in Table 2, mean blood loss was 214 ± 31.50 ml in group 1 (minimum blood loss was 180 ml and max 285 ml) and 199 ± 33.62 ml in group 2 (minimum blood loss was 80 ml and maximum 280 ml). The difference between the groups was not statistically significant [*p* value = 0.087].

On histopathological examination, the majority of specimens showed leiomyoma (86% in group 1 and 83% in group 2) followed by adenomyosis: 13% in group 1 and 17% in group 2. The difference was not statistically significant [*p* value = 0.546]. On histopathology of fallopian tubes in group 1, findings were unremarkable in 15 patients (49%), while in 8 (27%), findings were suggestive of paratubal cyst, salpingitis in 2 (7%) and tubal hyperplasia in 5 (17%) patients.

Mean preoperative and post-operative serum AMH and FSH values in the two groups are shown in Table 3 and Fig. 1. Mean preoperative AMH value in group 1 was 3.45 ± 1.98 ng/ml and 3.93 ± 1.45 ng/ml in group 2.

Table 1 Baseline characteristics of groups 1 and 2

	Group 1 (30)	Group 2 (30)	*t*/Chi-square value	*p*-value
Age (Mean ± SD)	41.83 ± 4.56	43.73 ± 3.59	1.792	0.078
Religion				
Hindu	28 (93%)	27 (90%)	0.218	0.640
Muslim	2 (7%)	3 (10%)		
Parity				
Nullipara	2 (7%)	1(3.5%)	2.569	0.766
Primipara	0 (0%)	1(3.5%)		
Multipara	28 (93%)	28 (93%)		
Dietary history				
Non-veg	4 (13%)	3 (10%)	0.162	0.688
Veg	26 (87%)	27 (90%)		
Height (mean ± SD)	158.53 ± 4.22	154.30 ± 5.22	3.455	0.001
Weight (mean ± SD)	63.97 ± 6.01	63.63 ± 6.38	0.208	0.836
BMI Kg/m^2 (mean ± SD)	25.40 ± 3.17	26.45 ± 3.22	− 1.274	0.208

Table 2 Mean operative time and blood loss in the two groups:

	Group 1		Group 2		*t*	*p*-value
	Mean	SD	Mean	SD		
Operative time (min)	115.50	18.54	114.40	19.47	0.224	0.823
Blood loss (ml)	214.00	31.50	199.33	33.62	1.744	0.087

Table 3 Comparing preoperative and post-operative S. FSH and AMH values

	Group 1		Group 2		t	p-value
	Mean	SD	Mean	SD		
Pre-op AMH	3.45	1.98	3.93	1.45	− 1.078	0.285
Post-op AMH	3.13	1.84	3.60	1.45	− 1.110	0.272
Mean difference in serum AMH	− 0.32 (9.27%)		− 0.33 (8.39%)			0.568
Pre-op FSH	10.07	8.73	7.74	1.87	1.433	0.157
Post-op FSH	9.54	8.39	7.31	1.84	1.419	0.161
Mean difference in in S.FSH	− 0.53 (5.2%)		− 0.43 (5.55%)			0.359

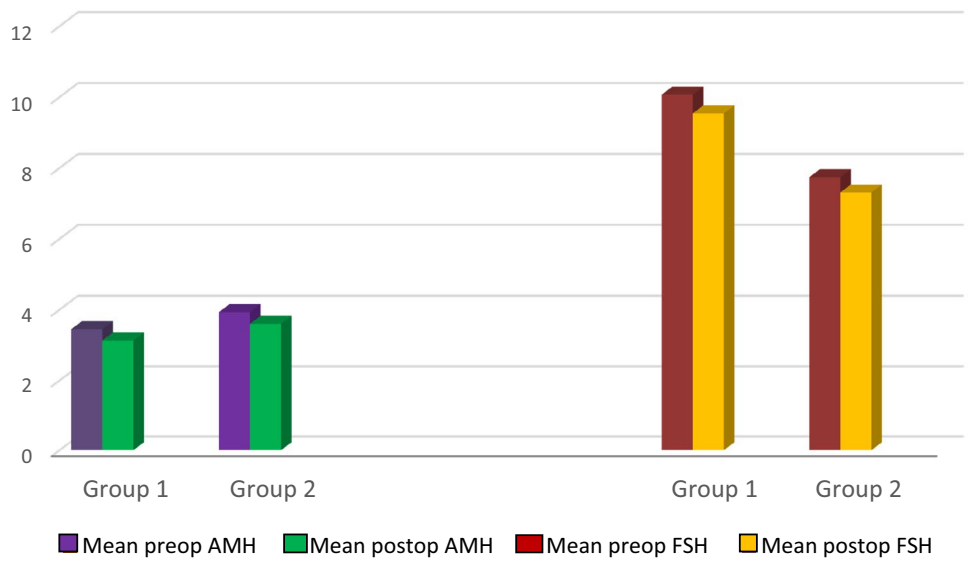

Fig. 1 Mean preoperative and post-operative serum AMH and FSH values

Difference was not statistically significant [p value = 0.285]. Mean post-operative values of serum AMH were 3.13 ± 1.84 ng/ml in group 1 and 3.6 ± 1.45 ng/ml in group 2. Mean difference between preoperative and post-operative serum AMH levels in group 1 was −0.32 (9.27% fall), which was not significant [p value = 0.316]. Mean difference between preoperative and post-operative serum AMH levels in group 2 was −0.33 (8.39% fall), which was not significant [p value = 0.472]. Difference between the two groups was also not statistically significant [p value = 0.568].

Mean preoperative FSH was 10.07 ± 8.73 ng/ml in group 1 and 7.74 ± 1.87 ng/ml in group 2. The difference of preoperative FSH in both the groups was not statistically significant [p value = 0.157]. Mean post-operative FSH was 9.54.7 ± 8.39 mIU/ml in group 1 and 7.31 ± 1.84 mIU/ml in group 2. Mean difference between preoperative and post-operative S.FSH levels in group 1 was −0.53 (5.2% fall), which was not significant [p value = 0.374]. Mean difference between preoperative and post-operative S. FSH levels in group 2 was −0.43 (5.55% fall), which was not significant [p value = 0.285]. Difference between the two groups was also not statistically significant [p value = 0.359].

Discussion

The practice of opportunistic salpingectomy during hysterectomy for benign indications where ovaries are preserved has been advocated in recent years. The approach has stemmed from two facts—firstly, the ovaries continue to function after hysterectomy and produce oestrogen necessary to maintain bone and cardiac health. And the second reason is a more recent understanding of genesis of ovarian cancer that the fallopian tubes may be the origin of the ovarian malignancies which a woman may develop in later life. However appropriate the practice of opportunistic salpingectomy is, it is always associated with the concern of diminished ovarian activity after surgery. Many researchers have tried to study the effect of salpingectomy on ovarian function with mixed results.

Most women in our study were parous women in their fourth decade of life. The mean age of women in cases was 43.83 ± 4.56 years, and in the control group it was 43.73 ± 3.59 years. The age group of women was comparable in both groups. This was useful in removing the bias of age-related decline in ovarian function.

Wang S. et al. did a similar study to evaluate the effect of prophylactic bilateral salpingectomy on ovarian reserve in 373 premenopausal women. All women in this study had undergone hysterectomy for benign reasons, and study subjects were matched for bias factors like patients age (mean age group = 44.72 ± 3.96 years), operative time and blood loss [5]. On the other hand, mean age of women in studies by Sahin et al. and Rodgers et al. was much less (30.9 and 33.06 years, respectively) [6, 7]. Majority of women were P2 in our study (40% in group 1 and 53% in group 2), which was comparable to the studies done by Tavana et al. and Asgari et al. [8, 9].

Mean BMI was 25.40 in group 1 and 26.45 kg/m2 in group 2. Mean weight and BMI in the various studies were between 25.40 and 28.99, which is comparable to that in our study [7–10].

The most common indication for hysterectomy was leiomyoma in our participants in both case and control groups. In a study by Tavana and colleagues, hysterectomy was done for AUB according to PALM-COEIN classification. Most common indication was leiomyoma in the study followed by adenomyosis, which is in accordance with our study [8]. In

a study by Atalay et al., there were 42 women in TAH group and 44 women in TLH group. Most common indication for hysterectomy in their study was benign disease of uterus, which was in accordance with our study [11].

Table 4 shows the comparison of operative time and blood loss in the two groups in various studies. In our study, the majority of women had unremarkable histopathology of fallopian tubes in group 1 (49%). Other findings were as follows: paratubal cyst (27%), salpingitis (7%) and tubal hyperplasia (17%). Chene Gautier et al. in a study of histopathology of fallopian tubes after laparoscopic hysterectomy for benign uterine pathology found that most women (95.5%) had normal histopathology of tubes followed by the presence of paratubal cyst in 2.5%, tubal papilloma in 0.5%, hydrosalpinx in 0.5%, tubal endometriosis in 0.5% and paratubal hemangioma in 0.5% [12].

In our study, the mean preoperative serum AMH was 3.45 ± 1.98 ng/ml in salpingectomy group and mean preoperative serum AMH value in group 2 was 3.93 ± 1.45 ng/ml. In a study by Rodgers et al., pre-op serum AMH values were 3.52 ng/ml [7]. Pre-op serum AMH values were 2.10 and 1.98 ng/ml in studies by Sahin et al. and Atalay et al., respectively [6, 11]. This indicates the cohort group of our study was comparable with other studies.

Arijit Singha et al. studied the effects of total abdominal hysterectomy (with at least one ovary preserved) on ovarian function in 52 women with 37 age-matched women as controls. They measured serum AMH and FSH and did transvaginal ultrasound Doppler to assess ovarian blood PI and RI indices to measure ovarian stromal blood supply. They observed an inverse correlation between serum AMH and FSH ($P = 0.0006$; $r = -0.4583$). But the RI and PI values in both groups were normal. This study concluded that even with preserved ovaries, TAH affects ovarian function despite normal blood supply, unlike our study [13].

Another study by Sumita Aneja et al. done with an objective of assessing effect of salpingectomy on ovarian reserve by pre- and post-operative AMH values and vascularity by a pre- and post-operative ultrasound Doppler observed that opportunistic salpingectomy did not affect ovarian reserve and vascularity at after 3 months of surgery [14]. Table 5 shows the comparison of preoperative serum AMH and postoperative serum AMH values as seen in different studies.

The mean preoperative serum FSH in women with salpingectomy in our study was 10.07 ± 8.73 and 7.74 ± 1.87 mIU/ml in groups 1 and 2. Mean preoperative S. FSH levels in study by Arijit Singha et al. was 8.26 mIU/ml, which was comparable to our study [13]. In a study by Sahin C. et al., the post-operative follow-up was done after six months and ovarian function was assessed by clinical parameters of menopause like hot flushes, sweating, insomnia, etc., by Kupperman index (KI), serum FSH levels and ovarian volume.

Table 4 Comparing operative time and intraoperative blood loss in different studies

Characteristics	Study	Type of design	Sample size	Mean	P-value
Blood loss (ml)	Tavana et al. [8]	Prospective comparative	33 (TAH) 33 (TLH)	114.5 85.5	< 0.01
	Tehranian et al.[10]	RCT	15(group 1) 15 group 2)	150.8 140.4	0.97
	Our study	Prospective study	30(Group1) 30(group2)	214 199.3	0.087
Intraoperative time (minutes)	Tehranian et al. [10]	RCT	15(Group1) 15(group 2)	220.21 220.86	0.92
	Tavana et al. [8]	Prospective study	15(group 1) 15(group2)	180 136	0.65
	Our study	Prospective study	15 (group1) 15(group2)	115.50 114.40	0.823

Table 5 Comparing pre- and post-op serum AMH values in different studies

Author	Sample size	Type of study	Pre-op AMH (ng/ml)	Post-op AMH (ng/ml)	P-value
Sahin et al. 2016 [6]	61	Prospective cohort	2.10 ± 1.74	2.20 ± 1.52	0.254
Atalay et al. 2016 [11]	103	Prospective cohort	1.98 ± 1.30	1.67 ± 1.06	0.173
Tehranian A et al. [10] 2017	30	Prospective study	1.32 ± 0.91	1.05 ± 0.88	0.154
Singha A et al.[13] 2016	52	Prospective study	2.43 ± 0.65	3.14 ± 0.91	0.0006
Our study 2021	60	Prospective comparative study			
	30 group 1		3.45 ± 1.98	3.13 ± 1.84	0.285
	30 group 2		3.94 ± 1.4	3.60 ± 1.45	0.272

They concluded that there was no difference with respect to each variable and the salpingectomy after TAH-BLS does not alter ovarian function [6].

Mohommad et al. did a systematic meta-analysis and scrutinised 37 studies on effect of salpingectomy on ovarian reserve and analysed 8 eligible studies [15]. The overall analysis of this study was based on laterality, age and AMH kits and revealed that there are no short-term changes in serum AMH concentrations after salpingectomy.

There are more studies of salpingectomy at the time of laparoscopic hysterectomy but very few done with abdominal hysterectomy. Afsaneh Tehranian and co-workers, in a balanced, single-centred, double-blinded, randomized, controlled trial, studied the effect of salpingectomy on ovarian function in total of 30 patients undergoing elective abdominal hysterectomy (15 with salpingectomy and 15 without salpingectomy) [10]. After screening for serum AMH and FSH preoperatively and three months post-operatively, they found that bilateral salpingectomy during hysterectomy had no deleterious effects on ovarian reserve.

Limitations

Our study only evaluated two parameters, namely serum AMH and S. FSH levels. Clinical parameters of menopause, ovarian volume and blood flow by sonography were not included. We had a small sample size and being a time-bound study, we could only follow up women up to three months post-operatively.

Our study has yielded encouraging results, which opens up other areas of research on the effect of pelvic surgeries on ovarian function, reserve, volume and blood flow. Larger studies with long-term follow-up can be done to have more data for significant results.

Conclusion

Ovarian function and reserve as measured by preoperative and post-operative FSH and AMH, respectively, did not significantly differ in cases with salpingectomy when compared with women without salpingectomy, suggesting that performing salpingectomy did not have any short-term adverse effects. Also, there was no increased operative time, risks and blood loss due to salpingectomy. It is recommended that salpingectomy should be done at the time of hysterectomy as this may lead to decreased incidence of high-mortality ovarian malignancy for which there is no reliable screening test available. At the same time by preservation of ovaries, there is a prevention of surgical menopause and its consequences.

Declarations

Conflict of interest Our study had no conflict of interest.

Ethical approval Institutional ethical committee clearance was obtained for study. The authors hereby declare that the article is original, neither the article nor a part of it is under consideration for publication anywhere else and has not been previously published anywhere. We have declared all vested interests. We have meticulously followed the instructions. The article if published shall be the property of the journal.

Informed consent Informed consent was obtained from all patients included in study.

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