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Emad Marouf Abdel-Latif
Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Mohamed Atef Behery
Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Khaled Fathi Esmail Abo El-Soud
Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt,
khaledaboelsoud77@gmail.com

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ORIGINAL ARTICLE

Ovarian Reserve Changes After Tubal Surgery

Emad M. Abdel-Latif, Mohamed A. Behery, Khaled F. E. Abo El-Soud*

Department of Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***One of the most frequent operations in gynecological practice worldwide is salpingectomy. Ectopic pregnancies and salpingitis (such as symptomatic hydro or pyosalpinx) are common causes.***

Aim and objectives: ***This trial aims to look at how ovarian reserve is affected by either a bilateral or unilateral salpingectomy or tubal disconnection.***

Patients and methods: ***This was a Prospective Cohort research done on eighty cases of infertile women with a previous unilateral or bilateral hydrosalpinx and indicated for salpingectomy attending the outpatient clinics at El Hussein Maternity Hospital and Assisted Reproduction Unit, Faculty of Medicine, Al-Azhar University from February 2020 to December 2022.***

Results: ***Our results showed that whether pre- or post-operatively, there was no statistically significant alteration between mean AMH, LH, FSH & E2 levels in patients with unilateral and bilateral hydrosalpinx.Regarding the correlation between age and different variables pre-operatively, there was a statistically significant inverse (negative) correlation between ages, AMH, number of Antral follicles, and E2. A direct (positive) connection between the number of antral follicles, LH, anti-Mullerian hormone, & E2 was shown to be statistically significant, regardless of whether the correlation was measured before or after the operation. The number of antral follicles was negatively correlated with FSH, which was statistically significant. The direct relationship among the number of antral follicles, LH, and E2 was statistically significant.***

Conclusion: ***It appears that there is no immediate negative impact on ovarian reserve caused by salpingectomy.***

Keywords: Bilateral salpingectomy; unilateral salpingectomy; ovarian reserve

1. Introduction

When it comes to gynecological practices all around the world, salpingectomy is one of the surgical treatments that is performed the most frequently. Indications that are frequently seen include ectopic pregnancy & salpingitis (for instance, symptomatic hydro or pyosalpinx).[1]

In recent years, there has been a growing consensus that women who are undergoing in vitro fertilization (IVF) & have asymptomatic hydrosalpinx should be offered the option of having a salpingectomy surgically performed. In addition, salpingectomy is increasingly being performed during hysterectomy in women who are attempting to save their ovaries. This is because there is growing data that suggests ovarian cancer may have a tubal origin.[2]

Given the near closeness of the tubal & ovarian arteries, this growing trend in salpingectomy has been linked with a growing concern over its possibly detrimental effect on ovarian reserve. This issue is related to the possibility that it could cause damage to the ovarian blood supply simultaneously. Because of this, it has been speculated that salpingectomy could disrupt the blood supply to the ovaries, which would result in a reduction in the amount of blood that flows through the ovaries and a subsequent decrease in the amount of ovarian reserve.[3]

The majority of women who undergo salpingectomy are still in their reproductive years, so it's important to assess any damage to their ovarian reserve while they're young. When deciding whether or not to perform a salpingectomy, this information will be useful for both the patient and the doctor.[4]

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* Corresponding author at: Obstetrics and Gynecology, Faculty of Medicine for boys, Al-Azhar University, Cairo, Egypt.
E-mail address: khaledaboelsoud77@gmail.com (K. F. E. Abo El-Soud).

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Despite the abundance of ovarian reserve indicators, the consensus is that circulating anti-Mullerian hormone (AMH) provides the most accurate reading.[5]

Results show a strong agreement with the histology of ovarian follicle count. Additionally, serum AMH level is an excellent indicator for detecting relatively little alterations in ovarian reserve after salpingectomy since it remains relatively constant throughout the menstrual cycle with few fluctuations.[6]

The researchers set out to see how ovarian reserve fared after tubal disconnection, bilateral or unilateral salpingectomy, or both.

2. Patients and methods

This was a Prospective Cohort trial performed on eighty cases of infertile women with a previous unilateral or bilateral hydrosalpinx and indicated for salpingectomy attending the outpatient clinics at El Hussein Maternity Hospital and Assisted Reproduction Unit, Faculty of Medicine, Al-Azhar University from February 2020 to December 2022.

Inclusion criteria: Infertile women ages below 35 years, women with hydrosalpinx indicated for salpingectomy or tubal disconnection.

Exclusion criteria: Patients with suspected or known mullerian anomalies, ovarian pathology, polycystic ovarian disease, or systemic diseases like DM chronic hypertension.

Ethical consideration: Before participating, all participants in the research study were explained what would happen and asked for their written consent. Once the ethical committee gave its stamp of approval, the study could proceed.

2.1.Methods

All patients were subjected to the following:

History taking(Personal information, past medical & history of DM, surgical history, hypertensive disorders, renal disease, cardiac problems, chest troubles in addition to the history of laparotomies or other operations, Family history of infertility, and menstrual history (LMP, Obstetric history: if present including full details of previous pregnancy), Examination (abdominal Examination, general Examination, pelvic Examination & complete clinical Examination (Examination confirmed by ultrasonography to estimate antral follicle), laboratory investigations including (AMH&FSH, E2, LH, full blood count & blood sugar).

Pre-operative evaluation of ovarian reserve was conducted using anti-mullerian hormone and basal ultrasound to calculate the antral follicle count. Six months after surgery, the ovarian reserve was reevaluated using the same markers.

2.2.Procedure

A screening test was done for the diagnosis of unilateral or bilateral hydrosapenix in infertile patients. All cases were offered an ultrasonography to estimate antral follicles and a laboratory to evaluate ovarian function. Once we obtained 80 cases with hydrosalpinex before surgery and after six months of laparoscopic tubal surgery to reevaluate antral follicle and ovarian functions, we stopped the screening test.

2.3.Outcome

The antral follicle and ovarian function were investigated for each case.

Sample Size

Epi Info software estimated the sample size, considering the study's power to be 80%, the level of significance to be 5%, and the effect size that gives the minimal clinical difference before and after the procedure to be 30.

2.4.Statistical Analysis

Version 23.0 of IBM SPSS Statistics for Windows was used to conduct the statistical analysis. The IBM Corporation is based in Armonk, NYC. We employed normality tests such as the Kolmogorov-Smirnov & Shapiro-Wilk tests to determine if numerical data were normally distributed. The data on the number of anterior follicles was the only one that did not follow a normal (parametric) distribution. All the others were fine. The data presentation methods were the median, range, standard deviation (SD), and mean. The paired t-test was used to examine the parameters' changes after the parametric data operation. Hydrosalpinx, whether unilateral or bilateral, was compared using Student's t-test. Examining post-operative variations in the number of antral follicles was conducted using the Wilcoxon signed-rank test, which applies to non-parametric data. A Mann-Whitney classification of Unilateral & bilateral hydrosalpinx was compared using a U test. We employed Pearson's and Spearman's correlation coefficients to find the relationships between the variables. The significance level was determined at P equal to 0.05 or less.

3. Results

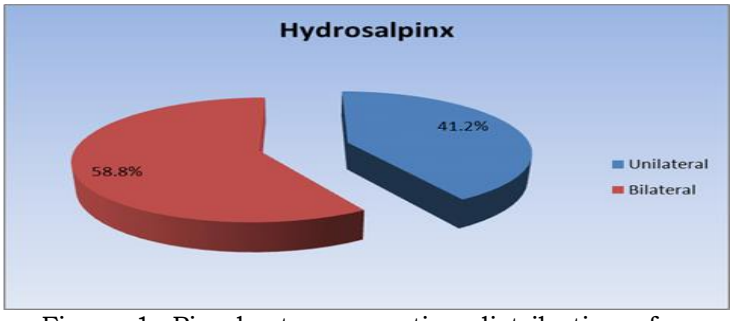

Figure 1. Pie chart representing distribution of hydrosalpinx in the study sample

More than half of patients (58.8%) had bilateral Hydrosalpinx while 41.2% had unilateral hydrosalpinx. Figure 1

Table (1): Descriptive statistics & outcomes of paired t-test to evaluate in relation to AMH (ng/mL) pre- as well as post-operatively

PRE- OPERATIVE (N = 80)		POST- OPERATIVE (N = 80)		P-VALUE	MEAN DIFFERENCE	95% CI FOR THE MEAN DIFFERENCE	EFFECT SIZE (D)
MEAN	SD	Mean	SD				
2.2	0.67	2.17	0.67	0.147	-0.02	-0.01-0.06	0.035

There was no statistically alteration in mean AMH levels post-operatively (P-value = 0.147, Effect size = 0.035). Table1

Table 2. Descriptive statistics & outcomes of Wilcoxon signed-rank test for comparison amongst number of Antral follicles pre- and post-operatively

PRE-OPERATIVE (N = 80)		POST-OPERATIVE (N = 80)		*P*-VALUE	*EFFECT SIZE (D)*
MEDIAN	Range	Median	Range		
7.5	4 – 11	7	4 – 11	0.456	0.167

There was no statistically significant change in median number of Antral follicles post-operatively (P-value = 0.456, Effect size = 0.167). Table 2

Table 3. Descriptive statistics and results of paired t-test for comparison between FSH (mIU/mL) pre- and post-operatively

PRE-OPERATIVE (N = 80)		POST-OPERATIVE (N = 80)		P-VALUE	MEAN DIFFERENCE	95% CI FOR THE MEAN DIFFERENCE	EFFECT SIZE (D)
MEAN	SD	Mean	SD				
6.18	1.5	6.19	1.63	0.863	0.01	-0.17- 0.14	0.009

*: Significant at P ≤ 0.05

There was no statistically significant variation in mean FSH levels post-operatively (P-value = 0.863, Effect size = 0.009). Table 3

Table 4. Descriptive statistics & results of paired t-test for comparison between LH (IU/mL) pre- and post-operatively

PRE-OPERATIVE (N = 80)		POST-OPERATIVE (N = 80)		P-VALUE	MEAN DIFFERENCE	95% CI FOR THE MEAN DIFFERENCE	EFFECT SIZE (D)
MEAN	SD	Mean	S D				
5.81	1.78	5.9	1.78	<0.001*	0.09	-0.14– 0.04	0.05

There was a statistically significant rise in mean LH levels post-operatively (P-value <0.001, Effect size = 0.05). Table 4

Table 5. Descriptive statistics as well as results of paired t-test for comparison between E2 (pg/mL) pre- and post-operatively

PRE-OPERATIVE (N = 80)		POST-OPERATIVE (N = 80)		P-VALUE	MEAN DIFFERENCE	95% CI FOR THE MEAN DIFFERENCE	EFFECT SIZE (D)
MEAN	SD	Mean	SD				
55.43	20.3	56.54	20.49	0.150	1.11	-2.64 – 0.41	0.054

There was no statistically significant variation in mean E2 levels post-operatively (P-value = 0.150, Effect size = 0.054). Table 5

Table 6. Descriptive statistics & results of Student's t-test for comparison amongst FSH, LH, AMH, & E2 in patients with unilateral and bilateral hydrosalpinx, whether pre- or post-operatively

TIME		UNILATERAL (N = 33)		BILATERAL (N = 47)		P-VALUE	MEAN DIFFERENCE	95% CI FOR THE MEAN DIFFERENCE	EFFECT SIZE (D)
		Mean	SD	Mean	SD				
PRE-OPERATIVE	AMH	2.12	0.73	2.25	0.63	0.406	-0.13	-0.43 – 0.18	0.19
	FSH	6.3	1.77	6.1	1.29	0.563	0.2	-0.48 – 0.88	0.132
	LH	5.67	1.94	5.91	1.66	0.550	-0.24	-1.05 – 0.56	0.136

	E2	52.51	19.75	57.47	20.64	0.286	-4.95	-14.12 – 4.22	0.244
POST-OPERATIVE	AMH	2.08	0.71	2.24	0.63	0.280	-0.16	-0.47 – 0.14	0.247
	FSH	6.23	1.93	6.17	1.41	0.879	0.06	-0.69 – 0.8	0.035
	LH	5.75	1.99	6.01	1.64	0.532	-0.26	-1.07 – 0.55	0.143
	E2	54.46	19.82	57.94	21.05	0.470	-3.39	-12.68 – 5.9	0.165

There was no statistically significant alteration between mean AMH, FSH, LH and E2 levels in patients with unilateral & bilateral hydrosalpinx. Table 6

Table 7. Outcomes of Pearson's & Spearman's correlation coefficients for the correlation amongst changed variables

TIME	VARIABLES	CORRELATION COEFFICIENT	P-VALUE
PRE-OPERATIVE	Age and AMH	-0.800	<0.001*
	Age and Antral follicles	-0.613 †	<0.001*
	Age and FSH	0.233	0.038*
	Age and LH	-0.542	<0.001*
	Age and E2	-0.577	<0.001*
	AMH and Antral follicles	0.669 †	<0.001*
	AMH and FSH	-0.139	0.218
	AMH and LH	0.594	<0.001*
	AMH and E2	0.627	<0.001*
	Antral follicles and FSH	-0.220 †	0.049*
	Antral follicles and LH	0.395 †	<0.001*
	Antral follicles and E2	0.574 †	<0.001*
	FSH and LH	0.099	0.384
	FSH and E2	-0.132	0.241
	LH and E2	0.695	<0.001*
POST-OPERATIVE	Age and AMH	-0.789	<0.001*
	Age and Antral follicles	-0.620 †	<0.001*
	Age and FSH	0.181	0.108
	Age and LH	-0.551	<0.001*
	Age and E2	-0.526	<0.001*
	AMH and Antral follicles	0.653 †	<0.001*
	AMH and FSH	-0.105	0.353
	AMH and LH	0.596	<0.001*
	AMH and E2	0.548	<0.001*
	Antral follicles and FSH	-0.158 †	0.160
	Antral follicles and LH	0.515 †	<0.001*
	Antral follicles and E2	0.575 †	<0.001*
	FSH and LH	0.165	0.143
	FSH and E2	0.027	0.810
	LH and E2	0.646	<0.001*

†: Spearman's correlation coefficient

As regards correlation between age and different variables pre-operatively; there was a statistically significant inverse correlation between age, AMH, number of Antral follicles and E2. There was a statistically significant direct correlation between age and FSH. While post-operatively; there was a statistically significant inverse (negative) correlation between age, AMH, number of Antral follicles and E2. There was no statistically significant correlation between age and FSH. As regards association between altered variables whether pre- or post-operatively; there was a statistically significant positive correlation amongst AMH, number of Antral follicles, LH and E2.There was a statistically significant negative connection between number of Antral follicles and FSH. There was a statistically significant direct association among number of Antral follicles, LH and E2. There was no statistically significant correlation between FSH, LH and E2.There was a statistically significant direct relationship amongst LH and E2, an increase in LH is associated with an increase in E2 and vice versa. Table7

4. Discussion

The main results of our study were as follows:

Eighty participants participated in the current research. Their ages ranged from eighteen to thirty-four, and the mean and standard deviation for age were 25.5 and 5.2, respectively.

In the present study, more than half of patients (58.8%) had bilateral Hydrosalpinx, while 41.2% had unilateral Hydrosalpinx.

In the current trial, there was no statistically significant change in mean AMH levels post-operatively and other ovarian function levels (FSH, LH, E2), and the median number of anterior follicles did not alter significantly after surgery.

In the present study, Whether pre- or post-operatively, there was no statistically significant

variance amongst mean AMH, LH, FSH, and E2 levels in patients with unilateral and bilateral Hydrosalpinx.

In the present study, whether pre- or post-operatively, there was no statistical variance among the median number of Antral follicles in patients with unilateral and bilateral Hydrosalpinx.

As regards the correlation between age and different variables pre-operatively, there was a statistically significant negative correlation between age, AMH, number of Antral follicles, and E2; older age is associated with a decrease in these variables and vice versa. There was a significant positive connection between age & FSH; older age is associated with an increase in FSH and vice versa. While post-operatively, there was a statistically significant inverse (negative) correlation between age, AMH, number of Antral follicles, and E2, older age is connected with a reduction in these variables & vice versa. There was no statistically significant association between age & FSH.

Before and following surgery, there was a positive and statistically significant relationship amongst AMH, the number of antral follicles, LH, and E2. Increasing the AMH level was correlated with increasing these variables, and vice versa. No link could be considered statistically significant between AMH & FSH. A statistically significant inverse connection was found between the number of antral follicles and the follicle-stimulating hormone (FSH) level. This means an increase in antral follicles is related to a decrease in FSH and vice versa. There was a statistically significant direct correlation between several Antral follicles, LH, and E2; an increase in Antral follicles is associated with an increase in these variables and vice versa. There was no statistically significant correlation between FSH, LH, and E2. There was a statistically significant direct relationship between LH & E2; an increase in LH is associated with an increase in E2 and vice versa.

These results agree with Amita et al ., who discovered that opportunistic salpingectomy did not affect ovarian reserve and vascularity after three months of operation; however, ovarian reserve depletion from the surgery could be long-lasting; consequently, patients with younger ages, in particular, may need longer-term follow-up evaluation.[7]

Similarly, Wang &Gu. Revealed that ovarian function in reproductive-age ladies is unaffected by prophylactic bilateral salpingectomy.[8]

Also, in a longitudinal study, Kobayashi et al. noticed no statistically significant variations amongst unilateral & bilateral cases when comparing AMH levels before and after surgery. Although salpingectomy, particularly bilateral surgery, may reduce the ovarian reserve assessed with AMH and AFC, we may not be able to conclude that salpingectomy hurts ovarian reserve. Further research is required to understand the impact of various salpingectomy approaches (surgical techniques & energy devices) on ovarian reserve and the sequential modifications to AMH and AFC in the medium to long term following operation for each indication.[9]

These results agree with Kotlyar et al.; It would seem that ovarian stimulation parameters and clinical pregnancy rates are unaffected by salpingectomy in individuals preparing for in vitro fertilization. In addition, hydrosalpinx instances warrant salpingectomy. When it comes to ovarian reserve, salpingectomy is generally ineffective. However, the justification for probable salpingectomy must be considered in light of the influence on IVF success and spontaneous conception rates.[10]

Also, Ahmed et al. observed no evidence that salpingectomy depletes ovarian reserve in the near term. The potential long-term negative impact on ovarian reserve is an important issue that needs further research, especially because salpingectomy can cause harm to the ovarian blood supply at the same time.[4]

Similarly, Ohad et al. determined that IVF individuals do not have any changes to their ovarian response or reserve, including AMH levels, following a salpingectomy. These conclusions need to be confirmed by larger and more prospective research.[11]

Also, Can et al . stated that following tubal ligation and tubal salpingectomy, we did not see any detrimental effect on ovarian reserve when evaluating FSH, E2, & AMH levels.[12]

In contrast, Chen et al. demonstrate that salpingectomy may considerably reduce AFC in women 35–39 years old, which could mean that their ovarian reserve has deteriorated. Nevertheless, there was not a significant distinction in the live birth rates among patients aged 35-39 and those aged under 35 who underwent IVF treatment. Furthermore, regardless of patient age, the salpingectomy group, as well as the control group, had similar levels of bFSH, but, as well as bE2, duration of Gn, number of available embryos, total Gn dosages, fertilization rates, and pregnancy outcomes. Clinical pregnancy and live births were negatively correlated with older women. Clinical pregnancy and live birth were negatively correlated with older women.[13]

Mosammat et al ., based on what we know so far, it seems that ectopic pregnancy patients who undergo salpingectomy may have impaired ovarian function and, in the case of bilateral salpingectomy, a reduced reproductive lifespan. It is necessary to assess the long-term effects of

unilateral and bilateral salpingectomy. It is also important to be cautious during clamping to avoid inadvertently including the infundibulopelvic ligament.[14]

5. *Conclusion*

Ovarian reserve appears to be unaffected in the short term by salpingectomy. Concerns about long-term negative effects on ovarian reserve necessitate additional research, especially because salpingectomy may cause harm to the ovarian blood supply simultaneously..

Disclosure

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There are no conflicts of interest.

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