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ORIGINAL ARTICLE

Measurement of Ovarian Reserve Before and After Laparoscopic Polycystic Ovarian Drilling

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Abstract

Background: **Ovarian reserve refers to the ovary's capacity for reproduction and is measured by the number of follicles present. 6%−8% of reproductive-age women suffer from polycystic ovary syndrome (PCOS), an endocrine condition. Ovulation-related infertility is mostly attributable to this.**

Aim and objectives: **Find out the influence of laparoscopic ovarian drilling on ovarian reserve in PCOS cases before and after laparoscopic ovarian diathermy (LOD), according to anti-mullerian hormone serum levels (AMH), ovarian volume, levels of follicle-stimulating hormone (FSH) on Day 2 of Menstruation, and antral follicle count.**

Patients and methods: **In this prospective observational research, 45 patients with ages ranging from 19 to 35 years were included and selected from attendees of obstetrics and gynecology clinics at El Hussein University Hospital. The study lasted for 1 year. Samples were collected by the systematic random method.**

Results: **There was no significant distinction in ovarian volume among the right and left ovaries after drilling. Nevertheless, there was a significant difference in the antral follicular count, with the right ovary having a lower count compared with the left ovary after drilling. The decrease in the mean AMH levels after management was statistically significant. Out of the total, 15.56% had amenorrhea (absence of menstrual periods), while 84.44% had oligo (infrequent menstrual periods).**

Conclusion: **We assessed ovarian volume, levels of AMH in serum, FSH on second day of the cycle of menstruation, and antral follicle count among those with PCOS before and after LOD to find out the influence of LOD on ovarian reserve.**

Keywords: Laparoscopic, Ovarian reserve, Polycystic ovary syndrome

1. Introduction

Size, quantity, and Oocyte quality in follicles correlate with ovarian reserve. The ovarian reserve is known as the reproductive capacity of the ovary, as indicated by the amount of follicles. The ovarian reserve declines with age and, consequently, women's ability to reproduce ovarian stromal blood flow, antral follicle count (AFC), sonographic variables (e.g., ovarian volume), hormonal parameters [e.g., estradiol (E2), anti-mullerian hormone (AMH), luteinizing hormone (LH), follicle-stimulating hormone (FSH), inhibin B levels, the FSH/LH ratio] and age are associated with ovarian reserve.[1]

To assess ovarian reserve, Gleicher *et al*. and Abd Ellatif and Ahmed determined the level of FSH in serum, E2 and inhibin B during the time of the follicular phase. During the follicular phase, transvaginal ultrasound tests are used to measure the count of antral follicles, which is one of the greatest predictors of ovarian reserve. During previous years, serum AMH level has emerged being one of the most precise and straightforward indicators of ovarian reserve. AMH, also known as mullerian inhibiting substance (MIS), which consider one of the transforming growth factor β (TGF-β) family.[2,3]

It is known as a dimeric glycoprotein generated by granulosa cells from birth to menopause which inhibits follicular recruitment to control the formation

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of primary follicles. During vivo and vitro research have demonstrated that AMH inhibits the employment of primordial follicles and reduces the number of developing follicles. Therefore, AMH plays an essential function in ovarian folliculogenesis, and its serum is related to the amount of antral follicles that are reflective. Its primary function is to inhibit primordial follicle growth organization, which is essential for selection of dominant follicles.[4]

Polycystic ovary syndrome (PCOS) is a widespread hormonal imbalance which impacts 6–8% of reproductively active-aged females. It consider the most common reason for infertility associated with ovulation. This condition is marked by ovulation disorders such as oligomenorrhea in addition to amenorrhea; in truth, immature follicles are incapable of ovulating. Serum AMH measuring is a useful indicator of infertility because it measures ovarian reserve and identifies women with low fertility.[5]

In recent years AMH has found utility recently as a potential predictor of ovarian stimulation response during In Vitro Fertilization (IVF) also be utilized as a means of establishing ovarian supply. In PCOS patients, inducing ovulation with laparoscopic ovarian diathermy (LOD) is common practice. There is a 30% failure rate with laparoscopic therapy and the reasons why are not known. Although LOD is seldom performed because of the destruction of ovarian tissue, it may be a possibility for infertile women who have not ovulated after using fertility drugs.[6]

Oocyte size, quantity, and quality in follicles are all factors that contribute to the ovarian reserve. Ovarian reserve refers to the ovary's capability for reproduction as seen by the presence of several follicles. Aging reduces a woman's ovarian reserve and her capacity to reproduce. Ovarian reserve can be measured by measuring AMH in the blood. During cycle bleeding, serum AMH levels were abolished and all aspects of the cycle have slight differences in intra-cycles.[3]

The purpose of our research was to evaluate the influence of laparoscopic ovarian drilling on ovarian reserve in PCOS patients both before and after LOD, as determined by FSH levels within the 2nd day of the menstrual period, ovarian volume, a follicular count and serum AMH levels.

2. Patients and methods

This prospective observational research that, 45 patients was involved and was derived from an attendee of Obstetrics and gynecology clinics of ELhussein University Hospital, Samples were collected by the systematic random method. The research protocol was authorized using the Local Ethics Committee of obstetrics and gynecology department of EL-Hussein University Hospital. The study lasted for 1 year and written informed consent were obtained.

Rotterdam Consensus was used to diagnose PCOS when at least 2 of the following were present: Oligomenorrhoea, with 8 or fewer menstrual cycles in the last year, or amenorrhea, Clinical and/or biochemical indicators of hyperandrogenism, including testosterone more than 2.6 nmol/l (74.9 ng/ml), increased and rostenedione more than 10 and Ultrasound transvaginal imaging reveals polycystic ovaries [evidence of ovarian stromal hypertrophy and multiple (more than or equal 10), small (2–9 mm) follicles arranged peripherally].[7]

2.1. Inclusion criteria

Medical attempts to induce ovulation have historically failed (CC resistance and failed HMG therapy), age: from 19 to 35 years old, and BMI: overweight.

2.2. Exclusion criteria

Age less than 35 years, Preexisting endocrine diseases such as hyperprolactinemia, persistent diabetes mellitus, and hypothyroidism, before any previous abdominal surgery or Cesarean delivery, and BMI greater than 40 kg/m^2.

After receiving each patient's informed permission, the following procedures were carried out on the patients: informed consent was taken from every patient, complete history taking and complete physical examination (General and Abdominal examination).

Under general anesthesia, laparoscopic ovarian drilling was performed. A GE Voluson S10 was used as an ultrasound machine.

2.3. Post-operative monitoring

Following the operation, AFC in addition to the ovarian volume was assessed using transvaginal ultrasound and serum AMH levels.

2.4. Follow-up

For 6 months for pregnancy success.

2.5. Measurement of AMH

Two enzyme-linked immunosorbent assays (ELISAs) were used for determining serum AMH: The

normal test, in which Immulon two plates (Dynatech Corp., Chantilly, VA) were cloaked in a blanket of monoclonal antibodies 10.6 (Dr. R. Cate, Cambridge, MA), acquired toward recombinant human AMH (rhAMH) through a 1-night incubation at the temperature of the room. 1 : 4, 1 : 8, 1 : 16, and 1 : 32 dilutions of sera were tested in Phosphate-Buffered Saline (PBS) having 1% of Bovine Serum Albumin (BSA). In 2nd antibody, we also utilized polyclonal antibody L40, which comprises of an IgG fraction collected through affinity chromatography on protein A-Sepharose from the serum of a rabbit which immunized with (rhAMH). L40 was preposed to the wells at 1 μg/ml in PBS-1% BSA and lasting for 1 h at room temperature. After that, an alkaline phosphatase-labeled goat anti-rabbit IgG antibody (Jackson ImmunoResearch Laboratories, Inc. West Grove, PA) was brought in and allowed to incubate for another hour before the effect was observed with an MRX spectrophotometer (Dynatech Corp.) at 405 nm, utilizing paranitrophenyl phosphate (Sigma Chimie, Saint-Quentin-Fallavier, France) as substrate.

2.6. Statistical analysis

SPSS 26.0 (SPSS Inc., Chicago, IL, USA) for Windows was utilized in order to acquire, tabulate, and statistically analyze all data. Qualitative data were defined through using number and percent. Quantitative data were termed utilizing range (minimum and maximum), standard deviation, mean and median. All statistical comparisons were two tailed with significance level of *P* value less than 0.05 demonstrates significance while, *P* greater than 0.05 indicates nonsignificant difference.

The used tests were: χ^2 test of significance, Fisher exact test and Independent *T*-test.

Table 1. Demographic data of included patients.

	Value ($N = 45$)
Age (years)	24.87 ± 4.11
BMI	31.04 ± 4.03
Duration of infertility (years)	1.8 ± 0.92

BMI (body mass index).

Table 2. Menstrual pattern of included patients.

	Value ($N = 45$) [n (%)]
Amenorrhea	7 (15.56)
Oligo-menorrhea	38 (84.44)

3. Results

Table 1.

The average age of the subjects is 24.87 years with a standard deviation of 4.11. The average BMI of the patients is 31.04 with a standard deviation of 4.03, which shows that the majority of the patients were overweight or obese. The duration of infertility is reported as a mean of 1.8 years with a SD of 0.92 (Table 2).

Out of the total, 15.56% had amenorrhea (absence of menstrual periods), while 84.44% had oligo (infrequent menstrual periods) (Table 3).

The table shows that the mean AMH serum level before management was 11.8 ± 2.61, with a median of 12 [interquartile range (IQR) of 10–14]. After management, the mean AMH serum level decreased to 6.64 ± 1.93, with a median of seven (IQR of 6–8). The decrease of the mean AMH levels after management was statistically significant ($P < 0.0001$) (Table 4).

The mean ovarian volume before LT was 12.49 ± 1.5, which significantly decreased to 7.84 ± 1.35 after LT ($P < 0.0001$). Similarly, the mean ant. follicular count before LT was 7.47 ± 1.52, which significantly increased to 13.13 ± 1.95 after LT ($P < 0.0001$) (Table 5).

The mean ovarian volume before RT was 12.82 ± 1.59, which decreased significantly to 8.24 ± 1.28 after RT ($P < 0.0001$). Similarly, the mean ant follicular count before RT was 13.87 ± 1.95, which decreased significantly to 8.18 ± 1.7 after RT ($P < 0.0001$) (Table 6).

Table 3. Anti-Mullerian hormone serum level before and after management.

AMH	Before management ($N = 45$)	After management ($N = 45$)	*P* value
Mean ± SD	11.8 ± 2.61	6.64 ± 1.93	<0.0001
Median (IQR)	12 (10–14)	7 (6–8)	

AMH (anti-mullerian hormone); IQR, interquartile range.

Table 4. Ant. follicular count and ovarian volume before and after drilling in left ovary.

	Before Drilling ($N = 45$)	After Drilling ($N = 45$)	*P* value
Ovarian volume	12.49 ± 1.5	7.84 ± 1.35	<0.0001
Ant. follicular count	7.47 ± 1.52	13.13 ± 1.95	<0.0001

Table 5. Ant. follicular count and ovarian volume before and after drilling in right ovary.

	Before drilling ($N = 45$)	After drilling ($N = 45$)	*P* value
Ovarian volume	12.82 ± 1.59	8.24 ± 1.28	<0.0001
Ant. follicular count	13.87 ± 1.95	8.18 ± 1.7	<0.0001

Table 6. Comparison between right and left ovary after drilling regarding ovarian volume and ant follicular count.

	After drilling (LT) ($N = 45$)	After drilling (RT) ($N = 45$)	*P* value
Ovarian volume	7.84 ± 1.35	8.24 ± 1.28	0.15645
Ant. follicular volume	13.13 ± 1.95	8.18 ± 1.7	<0.0001

There was no significant variance in ovarian volume among the left and right ovaries after drilling ($P = 0.15645$). However, there was a significant variation in antral follicular count, with the right ovary having a lower count compared with the left ovary after drilling ($P < 0.0001$).

4. Discussion

The current study shows age of the subjects on average is 24.87 years with a normal deviation of 4.11. The mean BMI of the patients is 31.04 with a SD of 4.03, which demonstrates the majority of the patients were overweight or obese. The duration of infertility is reported as a mean of 1.8 years with a SD of 0.92.

Our results consistent with Mohamed Zakareya *et al*. Who aimed to determine the effect of ovarian drilling on blood hormone levels in PCOS patients. The hormonal report comprised of Serum FSH, E2, LH, and Prolactin in addition to androgens [total and free testosterone and dehydroepiandrosterone sulfate (DHEA-S)]. They found that the mean age (years) 27.56 ± 3.74, the mean BMI (kg/m^2) 27.94 ± 4.04.[8]

The current study shows that out of the total, 15.56% had amenorrhea (absence of menstrual periods), while 84.44% had oligo (infrequent menstrual periods).

The present study can be supported by Seyam and colleagues. They found that in LOD group 20% had amenorrhea (absence of menstrual periods), while 80% had oligomenorrhoea (infrequent menstrual periods).[9]

The current study shows that the mean AMH serum level before management was 11.8 ± 2.61, with a median of 12 (IQR of 10–14). After management, the mean AMH serum level decreased to 6.64 ± 1.93, with a median of seven (IQR of 6–8). The decrease of the mean AMH levels after management was statistically significant ($P < 0.0001$).

Our results are consistent with Kamal and colleagues. They found that the mean AMH serum level before management was 8.34 ± 2.24. After management, the mean AMH serum level decreased to 5.39 ± 1.54. The decrease in the mean AMH levels after management was statistically significant ($P < 0.0001$).[10]

Also, our findings is in conformity with Kandil *et al*. Who intended to contrast the effects of ultrasound-guided transvaginal ovarian needle drilling (TND) against LOD on ovarian reserve and pregnancy rate in cases with clomiphene citrate (CC)-resistant PCOS. They found that the mean AMH serum level before LOD was 8.2 ± 2.9. 3 months after the procedure, the mean AMH serum level decreased to 5.9 ± 1.8. The decrease of the mean AMH levels after management was statistically significant ($P < 0.0001$).[11]

Recent research shows that the average size of an ovary before LT was 12.49 ± 1.5, which significantly decreased to 7.84 ± 1.35 after LT ($P < 0.0001$). Similarly, the mean ant. Follicular count before LT was 7.47 ± 1.52, which significantly increased to 13.13 ± 1.95 after LT ($P < 0.0001$). The mean ovarian volume before RT was 12.82 ± 1.59, which decreased significantly to 8.24 ± 1.28 after RT ($P < 0.0001$). Similarly, the mean ant follicular count before RT was 13.87 ± 1.95, which decreased significantly to 8.18 ± 1.7 after RT ($P < 0.0001$). There was no significant variation existed in ovarian volume among the left and right ovaries after drilling ($P = 0.15645$). However, there was a significant difference in antral follicular count, with the right ovary having a lower count compared with the left ovary after drilling ($P < 0.0001$).

The present study can be supported by Abd Ellatif and Ahmed, they found that Detailed explanations of the pre-LOD sonographic indicators for ovarian reserve, including ovarian volume and AFC. The characteristics of the pre-LOD biochemical indicators of the ovarian reserve, include the baseline serum FSH and AMH levels. When the pre-LOD results were compared with the post-LOD values, there was a statistically significant decrease in both the ovarian volume and the AFC on both sides.[3]

Also, our outcomes are consistent with Weerakiet and colleagues. They found that AFC varied significantly among groups. The women who suffered from PCOS had a greater total number of follicles than did the women in the other groups. (vs. the LOD group, $P = 0.0122$ and vs. the control group, $P = 0.000$). In the PCOS females with LOD, AFC was still great in contrast to the control group ($P < 0.01$). Summed ovarian volume did not differ between the LOD and the PCOS groups (*P*=NS). On the other hand, the total ovarian volume of women with PCOS was greater than that of women in the control group. ($P < 0.05$).[12]

4.1. Conclusion

Finally, we compare serum AMH levels, FSH on the second day of the menstrual cycle, ovarian volume, and AFC in patients with PCOS before and after LOD to assess the result of LOD on ovarian reserve. In PCOS females, the following happens after LOD: The levels of AMH dropped considerably through day 2 of the menstrual cycle, FSH levels rose sharply. There was a major drop in AFC and ovarian volume.

Ethics information

Its was approved by faculty.

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Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were no conflicts of interest.

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