CORRELATION BETWEEN AMH LEVEL AND NUMBER OF OOCYTES, EMBRYOS OBTAINED BY AGE GROUPS IN PATIENTS UNDERGOING IN VITRO FERTILIZATION COMBINED WITH PREIMPLANTATION GENETIC TESTING FOR ANEUPLOIDY

Nguyen Ngoc Diep[1], Quan Hoang Lam[1]
Tran Van Khoa[2], Nguyen Thanh Tung[1]

Summary

Objectives: To evaluate the correlation between the concentration of AMH (Anti-mullerian hormone) with the number of oocytes and embryos obtained in general and in each maternal age group, in particular on infertile patients undergoing in vitro fertilization (IVF) combined with preimplantation genetic testing for aneuploidy (PGT-A). ***Subjects and methods:*** A prospective, descriptive study of 186 infertile patients undergoing IVF - PGT-A, divided into three groups according to their ages at delivery: Group I: less than 30 years; group II: 30-35 years; group III: over 35 years. ***Results:*** Generally, AMH level was positively correlated with the number of oocytes and embryos obtained with r of 0.301; 0.193, respectively. At the age of less than 30, there was no statistically significant correlation between AMH and the number of oocytes and embryos ($p > 0.05$); in group II: AMH had a significant positive correlation with the number of oocytes obtained ($r = 0.248$, $p < 0.05$); in group III: AMH had a positive correlation with both the number of oocytes and the number of embryos with r of 0.385; 0.412, respectively ($p < 0.05$). ***Conclusion:*** The general AMH concentration in patients undergoing IVF - PGT-A was statistically significantly positively correlated with the number of oocytes and embryos obtained. In patients 30 - 35 years old, AMH level was significantly weak positively correlated with the number of mature oocytes. In the group over 35 years old, AMH level was statistically significantly positively correlated with the number of oocytes and the number of obtained blastocysts. No significant correlation was found between AMH levels and the number of oocytes or blastocysts in the age group under 30.

** Keywords: AMH (Anti-mullerian hormone); Mature oocyte; Blastocyst.*

[1]Military Institute of Clinical Embryology and Histology, Vietnam Military Medical University
[2]Department of Biology and Medical Genetics, Vietnam Military Medical University
Corresponding: Nguyen Ngoc Diep (nndiep301@gmail.com)
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INTRODUCTION

Approaching infertile patients at high risk of chromosomally abnormal embryos is always a complex problem for assisted reproduction, especially in advanced women. The first test is always the endocrine test, and the most meaningful index to evaluate an ovarian reserve and contributes to the prognosis for treatment effect is the AMH index. Because of its value, AMH was interested in scientists very early. Some studies have shown a correlation between AMH levels and maternal age; the more advanced the maternal age, the lower the hormone concentration [1]. Some other studies show that, besides a negative correlation with maternal age, AMH has a positive correlation with the number of antral follicle counts (AFC) and the number of oocytes obtained after each cycle of stimulation of patients undergoing in vitro fertilization (IVF) [1, 2]. However, most research surrounding this hormone index is mainly evaluated on patients treated with IVF. Here, we analyze the relationship between the AMH index and the number of AFC, the number of oocytes and embryos obtained in high-risk patients for chromosomal abnormalities undergoing IVF combined with preimplantation genetic testing for aneuploidy (PGT-A), and analyze these relationships in each maternal age group to get more information about the characteristics of this patient groups to provide more basis for accessing and counseling patients.

SUBJECTS AND METHODS

1. Subjects

186 infertile patients with indications for IVF-PGT-A at the Military Institute of Clinical Embryology and Histology, Military Medical University, from October 2017 to December 2020.

2. Methods

* *Study design:* A prospective, descriptive study.

The study was performed, including. The indications for PGT-A were mainly recurrent miscarriage, recurrent failed assistant reproductive treatment, or advanced maternal age. One hundred eighty-six female patients were divided into three age groups: Group I: < 30 years; Group II: 30-35 years; Group III: > 35 years.

** Study parameters:*

The first is an evaluation of the AFC, performed on day 2 of the menstrual cycle. Then, ovarian stimulation time will last about 10-12 days. After ovarian stimulation cycles, embryos were fertilized via ICSI; then, these embryos were cultured to the blastocyst stage on days 5 or 6 for biopsy. During the study, we collected data about the research parameters, including AMH concentration, AFC, number of mature oocytes, fertilized oocytes, number of embryos at the cleavage stage, and blastocysts. Analysis results, we evaluated the correlation between AMH and the number of oocytes and embryos in the entire study sample in general and in each age group in particular.

RESULTS AND DISCUSSION

1. Characteristics of study patients

Analyzing the whole data, we got the following results:

Table 1: Some basic parameters of the patient.

Parameters	Study patients	
	Min - max (n = 186)	**$\bar{X}$ ± SD**
Age (years)	24 - 47	35.19 ± 4.45
Infertility duration (years)	0 - 15	4.37 ± 2.98
AMH (ng/mL)	0.27 - 22	3.99 ± 3.14
AFC	1 - 43	13.98 ± 7.02
No. of MII	1 - 25	9.38 ± 5
No. of fertilized oocytes	1 - 21	6.82 ± 4.16
No. of day three embryos	1 - 21	6.73 ± 4.16
No. of blastocysts	1 - 14	3.55 ± 2.27

Table 2: Comparison of differences in some parameters between age groups.

Parameters	Study groups						p (1-2-3)
	Group I (n = 22) (1)		Group II (n = 79) (2)		Group III (n = 85) (3)		
	Min - max	$\bar{X}$ ± SD	Min - max	$\bar{X}$ ± SD	Min - max	$\bar{X}$ ± SD	
Age (years)	24 - 29	27.91 ± 1.58	30 - 35	32.97 ± 1.57	36 - 47	39.13 ± 2.52	< 0.001
Infertility duration (years)	0 - 5	2.37 ± 1.53	1 - 10	4.08 ± 2.42	1 - 15	5.16 ± 3.43	
AMH (ng/mL)	2 - 15.9	5.48 ± 3.04	0,27 - 22	4 ± 3.35	0,5 - 13,3	3.59 ± 2.86	< 0.05 (0.041)
AFC	9 - 33	17.82 ± 6.89	4 - 43	14.44 ± 7.33	1 - 34	12.57 ± 6.39	< 0.05 (0.005)
No. of MII	3 - 25	12.5 ± 6.18	2 - 23	9.83 ± 4.55	1 - 24	8.16 ± 4.7	< 0.05 (0.001)
No. of fertilized oocytes	2 - 18	8.87 ± 4.73	1 - 18	7.33 ± 3.98	1 - 21	5.8 ± 3.93	< 0.05 (0.003)
No. of day three embryos	2 - 18	8.73 ± 4.8	1 - 18	7.25 ± 4	1 - 21	5.72 ± 3.91	< 0.05 (0.003)
No. of blastocysts	1 - 10	4.28 ± 2.42	1 - 9	3.74 ± 2.02	1 - 14	3.18 ± 2.4	0.078

Our data showed that in patients undergoing IVF - PGT-A, some clinical and laboratory characteristics are the same as the general trend in patients treated with IVF without embryo genetic screening: AMH level, AFC, the number of retrieved oocytes and obtained embryos decreased with maternal age [3]. Table 2 indicated that AFC, the level of AMH, the number of oocytes, and embryos all decreased statistically significantly with the increase of the maternal age groups with $p < 0.05$.

2. The correlation between AMH concentration and the number of oocytes, embryos

Table 3: The correlation between the AMH level and AFC, oocytes, and embryo.

	AMH		
	n	**r**	**p**
AFC	186	0.460	< 0.001
No. of MII	186	0.301	
No. of fertilized oocytes	186	0.247	< 0.05 (0.001)
No. of day three embryos	186	0.238	< 0.05 (0.001)
No. of blastocysts	186	0.193	< 0.05 (0.008)

Evaluated all 186 patients, table 3 showed a statistically significant positive correlation between AMH level and AFC, the number of oocytes, and obtained embryos.

AMH level was significantly and positively correlated with AFC with $0.3 < r = 0.460 < 0.5$ and $p < 0.001$

AMH level was significantly weak and positively correlated with the number of MII with $0.1 < r = 0.301 < 0.3$ and $p < 0.001$

AMH level was significantly weak and positively correlated with the number of fertilized oocytes with $0.1 < r = 0.247 < 0.3$ and $p < 0.05$

AMH level was significantly weak and positively correlated with the number of oocytes on day 3 with $0.1 < r = 0.238 < 0.3$ and $p < 0.05$

AMH level was significantly weak and positively correlated with the number of blastocysts with $0.1 < r = 0.193 < 0.3$ and $p < 0.05$

This result is similar to the results of the study on IVF patients without embryo genetic screening of the author Barbakadze et al. (2015), the author Sun et al. (2020), and Tian et al. (2021) also showed a positive correlation between AMH concentration and AFC, number of oocytes retrieved and embryos obtained in patients [1, 2, 4].

3. The correlation between AMH level and the number of oocytes and embryos in the age groups

Table 4: The correlation between AMH level and AFC, the number of retrieved oocytes, and obtained embryos in group I.

Group I	AMH		
	n	r	p
AFC	22	0.284	0.200
No. of MII	22	0.000	1.000
No. of fertilized oocytes	22	-0.104	0.644
No. of day three embryos	22	-0.144	0.522
No. of blastocysts	22	-0.131	0.562

Table 5: The correlation between AMH level and AFC, the number of retrieved oocytes, and obtained embryos in group II.

Group II	AMH		
	n	r	p
AFC	79	0.427	< 0,001
No. of MII	79	0.248	< 0.05 (0.027)
No. of fertilized oocytes	79	0.202	0,075
No. of day three embryos	79	0.192	0.090
No. of blastocysts	79	0.000	0.999

Table 6: The correlation between AMH level and AFC, the number of retrieved oocytes, and obtained embryos in group III

Group III	AMH		
	n	r	p
AFC	85	0.493	< 0.001
No. of MII	85	0.385	< 0.001
No. of fertilized oocytes	85	0.334	< 0.05 (0.002)
No. of day three embryos	85	0.338	< 0.05 (0.002)
No. of blastocysts	85	0.412	< 0.001

Evaluating in individual age groups, we found that the correlation was not statistically significant with $p > 0.05$ in the group under 30 years old between the AMH concentration with AFC, number of oocytes, and obtained embryos.

In group II (30 - 35 years old), we found that AMH level was statistically significant positive correlated with AFC ($0.3 < r = 0.427 < 0.5$; $p < 0.01$), and there was a statistically significant weak positive correlation with the number of mature retrieved oocytes ($0.1 < r = 0.248 < 0.3$; $p < 0.05$). The correlation between AMH and the number of embryos in this group was positively correlated but not statistically significant, with $p > 0.05$.

In the group of 35 years and older (group III), our data showed a statistically significant positive correlation of AMH level with AFC, number of mature oocytes, number of fertilized oocytes, number of embryos at the cleavage stage, and number of obtained blastocysts ($0.3 < r < 0.5$; $p < 0.05$).

Our study's results are similar to that of Sun et al. in 2020 analyzed a group of IVF patients without embryo genetic screening. The author divided the study patients into three groups: Group I, including patients aged 22 to 28; group II: 29 - 35 years old; group III: 36 - 43 years old. Synthesized data also indicated that AMH level was significantly positively correlated with the number of oocytes obtained in groups II and III ($p < 0.01$); the positive correlation was not significant in group I with $p = 0.061$.

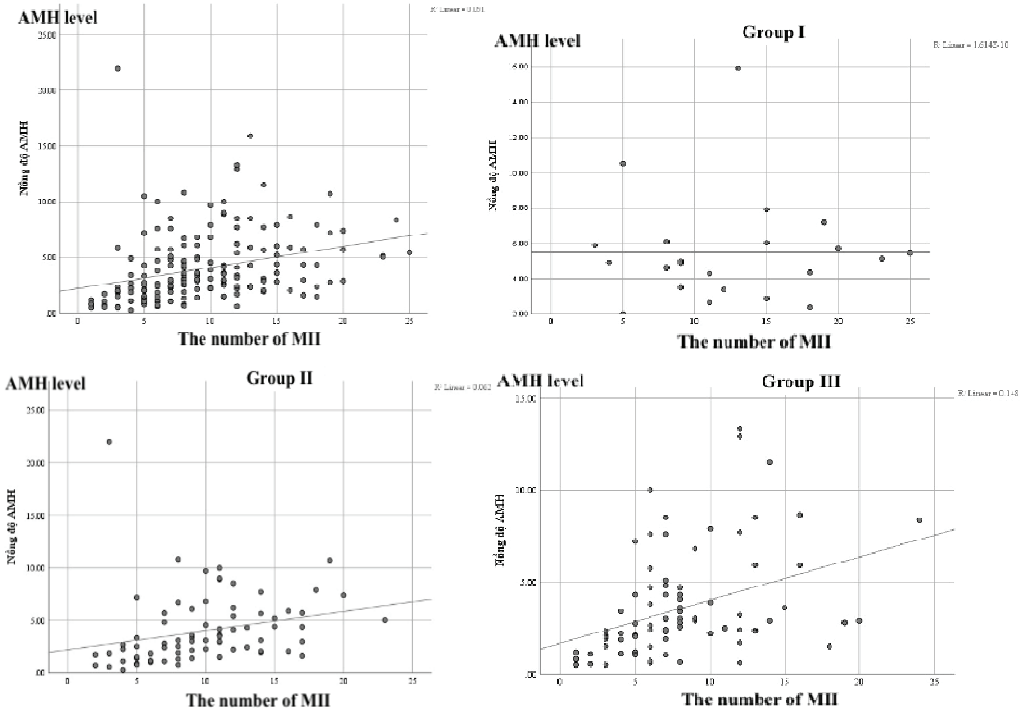

Figure 1: The correlation between AMH level and the number of MII in age groups.

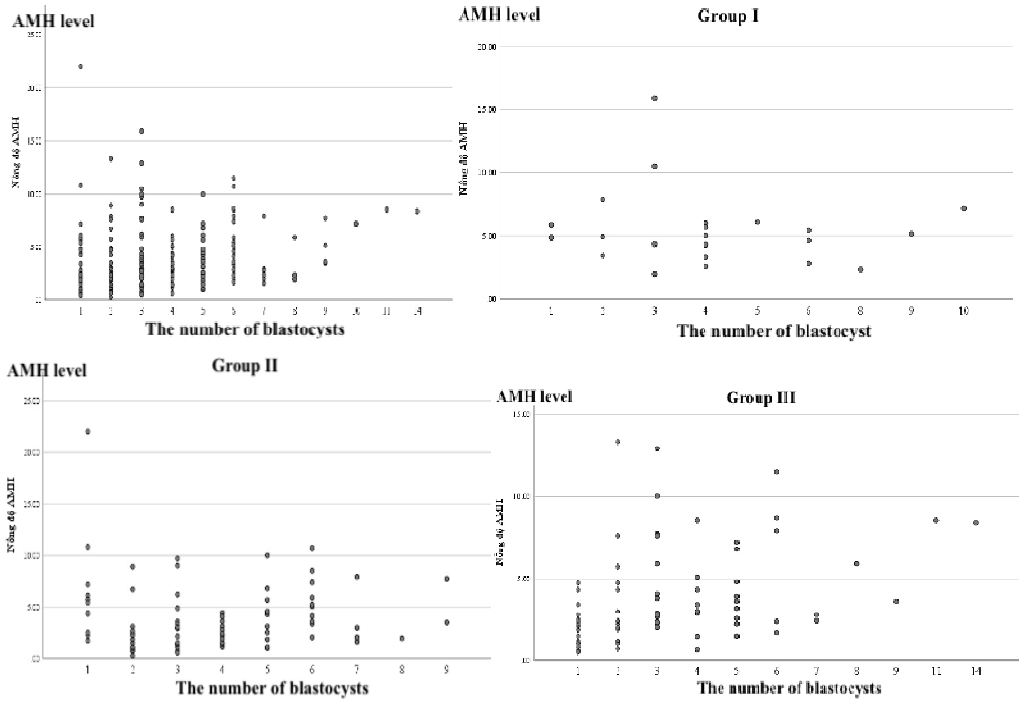

Figure 2: The correlation between AMH level and the number of blastocysts in age groups.

CONCLUSION

Study the correlation between AMH level and the number of retrieved oocytes and blastocysts obtained on 186 patients at high risk of chromosomally abnormal embryos undergoing IVF combined with PGT-A. Analyzing the whole data, we found that:

The AMH level in general in patients treated with IVF - PGT-A was statistically significantly positively correlated with the number of oocytes and obtained embryos.

AMH level was significantly weak and positively correlated with the number of mature oocytes in patients 30 - 35. In the group over 35 years, AMH level was statistically significantly positively correlated with the number of obtained oocytes and blastocysts. No significant correlation was found between AMH level and the number of oocytes and embryos in the age group under 30.

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