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# Study on the Diagnostic Value of Combined Detection of Sperm Quality, Sex Hormone and Ovulation in Infertility

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## ABSTRACT

**Objective: To analyze the application value of combined detection of sperm quality, sex hormone and ovulation in the diagnosis of infertility. Methods: The study was conducted from June 2021 to June 2022. Sixty infertile couples who received IVF cycle treatment in our hospital during this period were selected as the observation group, and 60 couples with good sperm quality and follicle number ≥ 5 who conceived naturally after gynecological disease treatment were selected as the control group during the same period. The sperm quality, sex hormones and ovulation of the two groups were observed, and the change of positive rate was detected by the combined detection method. Results: Compared with the control group, the observation group had less semen (2.82 ± 0.12) ml, lower concentration (69.17 ± 1.28) × $10^6$/ml, normal sperm morphology rate (2.92% ± 0.11%), lower survival rate (70.25% ± 1.16%), higher deformed sperm index (1.39 ± 0.11), and significant differences between groups (P < 0.05); The levels of FSH (7.15 ± 1.33) U/L, LH (5.13 ± 0.53) mU/ml, E2 (72.34 ± 5.11) ng/L, AMH (3.87 ± 0.67) ng/ml and AFC (7.15 ± 0.76) in the control group were significantly better than those in the observation group (P < 0.05). Compared with the single detection method of the three groups, the positive detection rate of the combined diagnosis method was higher, and the difference between the groups was significant (P < 0.05). Conclusion: For the diagnosis of infertility, the combined detection method of sperm quality, sex hormone and ovulation can effectively clarify the problems existing in the couple, significantly improve the detection rate of the cause of the patient, and is more conducive to guiding clinical symptomatic treatment, which is worthy of promotion and reference.**

## 1. INTRODUCTION

In the face of the current domestic family planning policy of China's comprehensive opening, the

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number of pregnant people has increased significantly. Infertility is a relatively common disease of the reproductive system, which tends to occur in couples of childbearing age. In recent years, the incidence of this disease has gradually increased due to the influence of lifestyle, living environment and eating habits [1]. Infertility is related to many factors, such as ovulation disorder, fallopian tube obstruction and low sperm quality, which seriously affect the quality of life and family happiness. At the same time, it will also bring different degrees of negative impact on the population growth of China. Therefore, early diagnosis and timely treatment has become the focus of research [2]. In this study, 60 infertile couples who came to our hospital for diagnosis and treatment from June 2021 to June 2022 were selected for analysis, and the application value of the combined detection method of sperm quality, sex hormone and ovulation was discussed. The details are as follows.

## 2. DATA AND METHODS

### 2.1. General Information

The study was conducted from June 2021 to June 2022. 60 infertile couples who were treated in our hospital during this period were selected as the observation group, and 60 normal pregnant couples with good sperm quality and follicle number ≥ 5 during the same period were selected as the control group. In the control group, the average age of couples was (30.25 ± 1.27) years (range, 22 - 37 years); The average body mass index was (24.36 ± 1.22) kg/m$^2$ (range, 22 - 27 kg/m$^2$). The average age of couples in the observation group was (30.27 ± 1.25) years (range, 22 - 39 years); The average body mass index was (24.34 ± 1.25) kg/m$^2$ (range, 22 - 27 kg/m$^2$). The course of infertility was 1 - 7 years, with an average of (3.74 ± 0.11) years. There was no significant difference between the two groups ($P > 0.05$).

### 2.2. Methods

According to the fifth edition of WHO Laboratory Manual for Human Semen Examination and Processing [3], semen samples were collected from all male testers, the computer semen analysis system was used to observe the changes of semen volume, sperm concentration, sperm survival rate and other indicators.

For the two groups of women, in the morning of the third day of the menstrual cycle, 5 ml of venous blood was drawn on an empty stomach, centrifuged at 3000 r/min for 10 min, and then the changes of follicle estrogen (FSH), luteinizing hormone (LH), estradiol (E2), sex hormone and anti Mullerian hormone (AMH) were measured with Roche Cobas e601 automatic immune analyzer, and vaginal color Doppler ultrasound was performed. Before the examination, empty the bladder, put the condom probe into the cervix, observe the morphological changes of the fallopian tube, calculate the number of bilateral sinus follicles (AFC) and observe the size of the ovary.

**Joint test:** Combine the above indicators.

### 2.3. Observation Indicators

1) Sperm quality: Male sperm quality change was observed in the two groups, including semen volume, concentration and survival rate.

2) Sex hormone and B ultrasound examination results: observe the change of sex hormone indicators in the two groups, including LH, FSH, and observe the number of follicles and the change of ovarian size.

3) Infertility detection rate: The positive rate of infertility detected by single sperm quality, sex hormone, ovulation and the above combined indicators was analyzed and compared.

### 2.4. Statistical Methods

SPSS25.0 statistical software was used for analysis. Measurement data were expressed in X ± s, t-test was performed; n (%) was used to represent count data, and $\chi^2$ was used for data test, and statistical significance was represented as $P < 0.05$

## 3. RESULTS

### 3.1. Comparison of Sperm Quality Data between the Two Groups

Compared with the control group, the amount of semen in the observation group was less (2.82 ± 0.12) ml, and the concentration was lower (69.17 ± 1.28) × $10^6$/ml; the normal sperm morphology rate and survival rate of the observation group were (2.92% ± 0.11%) and (70.25% ± 1.16%), and the deformed sperm index was higher (1.39 ± 0.11). There were significant differences between groups ($P < 0.05$). See Table 1 for details.

### 3.2. Comparison of the Results of Sex Hormones and Ovulation Ultrasound Examination

The levels of control group FSH (7.15 ± 1.33) U/L, LH (5.13 ± 0.53) mU/ml, E2 (72.34 ± 5.11) ng/L, AFC (7.15 ± 0.76) and OV (4.48 ± 0.46) $cm^3$ were significantly higher than those in the observation group ($P < 0.05$), as shown in Table 2.

### 3.3. The Results of Detection Rate of Single Index and Combined Index in Three Groups Were Compared

Compared with the three groups of single indicators, the detection rate of joint detection method for 60 cases of couples was significantly higher ($P < 0.05$). See Table 3 for details.

**Table 1.** Comparison of sperm quality analysis results ($\bar{x}$ ± s).

| Group | Cases | Semen volume (ml) | Concentration (×$10^6$/ml) | Rate of normal morphology (%) | Survival rate (%) | Abnormal sperm index |
|---|---|---|---|---|---|---|
| Observation group | 60 | 2.82 ± 0.12 | 69.17 ± 1.28 | 2.92 ± 0.11 | 70.25 ± 1.16 | 3.39 ± 0.11 |
| Control group | 60 | 3.39 ± 0.22 | 81.54 ± 2.13 | 6.12 ± 0.23 | 79.38 ± 5.27 | 1.12 ± 0.08 |
| t | | 5.564 | 38.558 | 97.222 | 13.106 | 15.376 |
| P | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Table 2.** The analysis of sex hormone and ovulation data ($\bar{x}$ ± s).

| Group | Cases | FSH (U/L) | LH (mU/ml) | E2 (ng/L) | AMH (ng/ml) | AFC (number) |
|---|---|---|---|---|---|---|
| Observation group | 60 | 36.25 ± 4.28 | 4.08 ± 0.17 | 23.37 ± 6.28 | 1.14 ± 0.26 | 3.11 ± 0.24 |
| Control group | 60 | 7.15 ± 1.33 | 5.13 ± 0.53 | 72.34 ± 5.11 | 3.87 ± 0.67 | 7.15 ± 0.76 |
| t | | 50.293 | 14.612 | 46.851 | 5.37 | 39.265 |
| P | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Table 3.** Comparison of diagnostic detection rate [n (%)].

| Test items | Positive rate |
|---|---|
| Abnormal sperm quality | 52 (86.67) |
| Abnormal ovulation | 49 (81.67) |
| Sex hormones | 52 (86.67) |
| Joint detection | 60 (100.00) |

## 4. DISCUSSION

Research shows that [4, 5], couples of childbearing age who do not take contraceptive measures have an average 25% chance of pregnancy in each menstrual cycle, 50% should be able to conceive within 3 months after marriage, 72% should be able to conceive within 6 months after marriage, 80% - 85% should be able to conceive within 12 months after marriage, and infertility may affect about 10% of couples of childbearing age. Therefore, if you have regular sex for more than one year after marriage without taking any contraceptive measures, and your spouse is unable to conceive or can conceive but fails to conceive and deliver, you should consider the possibility of infertility, which is collectively referred to as infertility in medicine, including male infertility and female infertility. Affected by living conditions, work pressure, personal bad living habits and other factors, the incidence of infertility is gradually on the rise. With the proposal of national policies, eugenic birth and eugenic rearing, it is necessary to strengthen the examination of infertility in couples of childbearing age and determine the causes of infertility [6, 7].

Male infertility is mostly related to sperm quality decline, testicular damage, varicocele, reproductive tract infection, etc. Sperm quality includes quantity, activity and morphology [8]. According to the new WHO semen testing manual, the sperm concentration should be at least 15 million/ml, the semen volume should be ≥1.5 ml, and the forward motile sperm should be ≥32%. In terms of sperm morphology, the healthy sperm should be ≥4%, and the malformation rate should be <96%. In daily life, smoking, drug taking, alcoholism, drug abuse, extramarital sexual behavior and other bad habits will affect the secretion of male hormones, harm the gonads and reproductive tract, induce erectile dysfunction or loss of libido, sperm malformation, and eventually cause male infertility [9, 10]. Female infertility is mainly caused by the lesions of reproductive system related tissues or diseases of uterus and ovary. In addition, ovulation dysfunction and endocrine diseases related to sex hormone abnormalities are also the main problems of clinical female infertility [11]. Studies have shown that [12] ovulation dysfunction occurs in 15 percent of all pregnant couples, and up to 40 percent of female infertility can lead to significant menstrual disturbances (infrequent menstruation or amenorrhea), and may also reduce symptoms. The most common causes include polycystic ovary complex (PCOS), obesity, weight gain or loss, strenuous exercise, thyroid dysfunction, hyperprolactinemia, etc. Therefore, it is necessary to combine clinical experience and theoretical knowledge to select appropriate examination methods to diagnose infertility, help improve the patient's pregnancy function and meet their fertility requirements [13]. According to the research results, the data show that the low sperm activity, low concentration, low survival rate and high abnormal sperm index of infertile men will affect the fertility quality. In the sex hormone examination indicators, it can be found that there are abnormalities in the sex hormone indicators in the observation group. FSH and LH are related to the control of reproductive activities; LH has the role of ovulation promotion; Together with FSH, it acts on the corpus luteum and secretes progesterone; The abnormally high level of FSH indicates premature ovarian failure; The low level of LH indicates that there is dysfunction in the pituitary or hypothalamus, which leads to infertility [14, 15]. Serum E2 is an important indicator for monitoring menstrual abnormalities. By observing serum sex hormone indicators, we can understand the functional status of hypothalamus and ovary, predict ovulation time and evaluate ovarian function, and also help clinicians understand the changes and progress of female infertility [16, 17]. Anti-mullerian hormone (AMH) is a dimeric glyconeptide, also known as Mullerian duct inhibitor (MIS), which is mainly produced by granulosa cells and has the highest expression in secondary follicles, presinus follicles and small sinus follicles. The level of AMH is relatively stable within and during the menstrual cycle and is an excellent indicator for assessing ovarian reserve. In view of ovulation, vaginal Doppler ultrasound technology is used to understand the size of the ovary and the number of follicles with the help of high-frequency probes. By monitoring the development of follicles, we can observe whether they are factors affecting female infertility, and also observe whether there are abnormalities in the structure of the uterus and ovary. If the ovary is small and the number of ovulations is small, it indicates that abnormal ovulation will lead to decreased fertility. In addition, vaginal ultrasound can also monitor ovarian reflux; It plays an important role in predicting ovulation and evaluating ovarian function [18, 19]. The detection methods of three groups have relatively accurate diagnosis results, but there are also subjectivity, misdiagnosis, missed diagnosis and

other problems. The research results show that, compared with the single indicators of three groups, the detection rate of joint testing for 60 cases of couples is higher ($P < 0.05$), indicating that in order to better improve the diagnosis of infertility and help patients develop more reasonable and effective treatment methods, multiple joint testing can provide more diagnostic basis for patients' follow-up treatment, and help to meet the pregnancy needs of patients [20, 21].

## 5. CONCLUSION

To sum up, for the diagnosis of infertility, the combined detection method of sperm quality, sex hormone and ovulation can effectively identify the problems of both couples, significantly improve the detection rate of patients' causes, which can be further promoted and applied in clinical practice.

## 6. LIMITATIONS OF THE STUDY

The main business of the Reproductive Health Research Center is to carry out work around human assisted reproductive technology. Most of the selected research objects are infertile people, with a narrow regional scope. The research results obtained do not represent the conventional level of normal and healthy semen of men who have given birth, but also have certain limitations. It is necessary to expand the scope of research, or select men who have naturally had a first child as the research object, which is more representative.

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## CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

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