

Article

Clinical and Laboratory Characteristics of Primary and Secondary Infertility in Married Couples

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Abstract: Infertility is a pressing issue in modern medicine and has a significant impact on demographic indicators and quality of life. According to the World Health Organization, approximately 15% of couples experience difficulties conceiving, highlighting the importance of timely diagnosis and treatment of this condition [1,2]. The aim of this study was to investigate the clinical and laboratory characteristics of primary and secondary infertility in married couples.

The study included 50 married couples. All patients underwent a comprehensive clinical and laboratory examination, including hormonal testing, sperm analysis, and clinical assessment. Primary infertility was detected in 40% of the subjects, secondary infertility in 40%, and the control group comprised 20%. The study results showed that hormonal imbalances, including hyperprolactinemia, elevated FSH and LH levels, and decreased ovarian reserve, play a leading role in women, which is consistent with current research data [3,4]. In men, spermatogenesis disorders were most frequently detected, including oligozoospermia and asthenozoospermia, accompanied by a decrease in sperm concentration, which is also confirmed by literary data [2,8].

Additionally, it was established that the development of infertility is influenced by concomitant factors, including inflammatory diseases of the reproductive system, as well as the lifestyle of patients (bad habits, stressful working conditions), which is consistent with the results of other studies [6,16]. Thus, the obtained data confirm the multifactorial nature of infertility and the need for a comprehensive approach to its diagnosis [3,4]. The use of clinical and laboratory research methods allows for increased accuracy in identifying the causes of infertility and facilitates the selection of optimal treatment strategies.

Keywords: infertility, primary infertility, secondary infertility, reproductive health, clinical and laboratory diagnostics, hormonal disorders, hyperprolactinemia, ovarian reserve, FSH, LH, spermogram, spermatogenesis disorders, oligozoospermia, asthenozoospermia, male infertility, female infertility, risk factors, reproductive medicine

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1. Introduction

Infertility is one of the most pressing medical and social problems in modern medicine. According to the World Health Organization, approximately 15% of couples worldwide experience difficulties conceiving, underscoring the significant impact of this condition on healthcare [1,2].

In recent years, there has been a tendency towards an increase in the prevalence of infertility, which is associated with the impact of unfavorable environmental factors, lifestyle changes, stress, as well as an increase in the age of marriage and pregnancy planning [5,7].

Modern research indicates that infertility in most cases is multifactorial and is caused by a combination of various factors, including hormonal imbalances, inflammatory processes, genetic factors, and social conditions [3,4]. Male factors play a significant role, being detected in approximately 40–50% of cases, necessitating mandatory examination of both partners [2,8].

Laboratory tests are particularly important in infertility diagnostics, allowing for the detection of latent reproductive dysfunctions. Hormonal tests assess the endocrine system and identify ovulatory dysfunction in women, while sperm analysis is a key method for assessing fertility in men [9,14].

Despite the active development of assisted reproductive technologies, including in vitro fertilization, timely diagnosis of the causes of infertility remains a determining factor for successful treatment.

In the context of modern clinical practice, a comprehensive approach that includes a simultaneous assessment of clinical, laboratory, and social factors affecting reproductive function is particularly relevant.

Thus, the study of clinical and laboratory characteristics of primary and secondary infertility is of significant scientific and practical interest and is an important step in improving diagnostic and therapeutic approaches.

2. Materials and Methods

The study included 50 married couples who sought treatment at a specialized infertility clinic. All patients were divided into three groups: those with primary infertility, those with secondary infertility, and a control group.

The age of the examined women ranged from 20 to 40 years, and that of the men from 20 to 50 years. The average age of women was 31.4 ± 0.7 years, and that of men was 34.8 ± 0.9 years. The average duration of infertility was 4.3 ± 0.5 years.

Inclusion criteria for the study were the presence of infertility for at least 12 months of regular sexual activity without the use of contraception, as well as the patients' consent to participate in the study.

Exclusion criteria were severe somatic diseases, oncological pathology, as well as the presence of acute infectious diseases at the time of examination.

All patients underwent a comprehensive examination, including:

Clinical methods:

- collection of anamnesis (reproductive, gynecological and andrological)
- assessment of menstrual function in women
- analysis of complaints and duration of infertility
- identification of risk factors (bad habits, stress, working conditions)
- Laboratory methods:
- general blood and urine analysis
- hormonal studies (FSH, LH, prolactin) using enzyme-linked immunosorbent assay (ELISA)
- assessment of ovarian reserve
- Andrological examination:
- sperm analysis was carried out in accordance with the recommendations of the World Health Organization [14]
- sperm concentration, motility and morphology were assessed

Additionally, the presence of concomitant diseases was taken into account, including inflammatory processes of the pelvic organs in women and diseases of the reproductive system in men.

Statistical data processing was performed using the SPSS software package. Quantitative data are presented as mean and standard error ($M \pm m$). The significance of differences was assessed using parametric methods; differences were considered statistically significant at a significance level of $p < 0.05$.

3. Results

The study revealed that primary infertility was detected in 40% of the couples examined, secondary infertility in 40%, and the control group comprised 20%. The average age of women was 31.4 ± 0.7 years, and that of men was 34.8 ± 0.9 years. The data obtained confirm an even distribution of infertility forms in the study sample, which allows for a comparable analysis of clinical and laboratory parameters between the groups. (Table 1)

Table 1. Distribution of subjects examined by groups

An analysis of clinical and laboratory parameters in women revealed significant hormonal imbalances that play a leading role in the development of infertility.

In particular, an increase in the level of gonadotropic hormones was noted:

- FSH - up to 18.3 mU/l
- LH - up to 14.5 mU/l

An increase in prolactin levels (up to 36.5 ng/ml) was also recorded, which may indicate a disruption in the regulation of the hypothalamic-pituitary system.

Some patients showed a decrease in ovarian reserve, which is an unfavorable prognostic factor and indicates a decrease in reproductive potential.

In addition, a significant number of women are diagnosed with concomitant gynecological diseases:

- polycystic ovary syndrome
- endometriosis
- uterine fibroids

It was noted that menstrual cycle disorders (oligomenorrhea, anovulation) were more common in patients with hormonal abnormalities, which confirms their relationship.

The obtained results are consistent with literature data, according to which hormonal disorders are the leading cause of female infertility [3,4,9].

An analysis of andrological parameters showed that a significant proportion of the men examined had various forms of spermatogenesis disorders, which indicates a significant role of the male factor in the structure of infertility.

According to the data obtained, the most common form of the disorder was oligospermia, diagnosed in 50% of men. This condition is characterized by a decrease in sperm count below reference values and is a key factor in reduced fertility.

Asthenozoospermia, detected in 25% of those examined, is characterized by decreased sperm motility, which significantly reduces the likelihood of their movement through the female reproductive tract and, consequently, fertilization.

Teratozoospermia, a condition characterized by abnormal sperm morphology, is diagnosed in 25% of men. This condition affects the ability of sperm to penetrate the egg and participate in fertilization. (Fig. 2)

Figure 2. Structure of spermatogenesis disorders in the examined men

The average sperm concentration in the study group was 4–8 million/ml, which is significantly lower than the normal values established by the World Health Organization [14].

Additionally, it was established that a number of patients had inflammatory diseases of the reproductive system, including orchitis and epididymitis, as well as sexually transmitted infections. These conditions can lead to impaired spermatogenesis due to damage to testicular tissue and changes in the composition of seminal fluid.

A link was also found between spermatogenesis disorders and lifestyle factors. Men with significant sperm abnormalities were more likely to have unhealthy habits, such as smoking and alcohol consumption, as well as exposure to stress and adverse work factors.

The obtained results are consistent with the data of international studies, according to which the male factor is detected in approximately 40–50% of infertility cases [2,8].

Thus, the conducted study confirms that spermatogenesis disorders are one of the leading factors of male infertility and require mandatory consideration in the comprehensive diagnosis of married couples.

Analysis of the hormonal profile in women revealed significant changes in the hypothalamic-pituitary-ovarian regulation system (Fig. 3).

Figure 3. Hormonal indicators in women with infertility

An increase in follicle-stimulating hormone (FSH) levels to 18.3 mIU/L was noted, which exceeds the reference values for women of reproductive age (3–10 mIU/L) [9]. An increase in FSH indicates a decrease in the functional activity of the ovaries and a reduction in ovarian reserve.

The level of luteinizing hormone (LH) reached 14.5 mIU/L with normal values of 2–12 mIU/L [12]. An abnormal FSH/LH ratio indicates ovulatory dysfunction and may be associated with endocrine disorders, including polycystic ovary syndrome.

An increase in prolactin levels to 36.5 ng/ml with a norm of up to 25 ng/ml [4] indicates hyperprolactinemia, which has an inhibitory effect on the secretion of gonadotropins and leads to suppression of ovulation.

As can be seen in Figure 3, the greatest deviation was noted in the level of prolactin, which indicates its key role in the disruption of reproductive function in the examined patients.

Thus, the identified changes in the hormonal profile confirm the presence of pronounced endocrine disorders and their significant role in the development of infertility [3,9].

Analysis of anamnestic data showed that a significant proportion of the examined patients had social and behavioral factors that could have a negative impact on reproductive function.

Smoking and alcohol consumption were identified as the most common risk factors. Patients with these habits were more likely to experience spermatogenesis disorders in men and hormonal imbalances in women. Nicotine and its metabolites are known to have a toxic effect on reproductive cells, reducing sperm quality and impairing ovarian function [16].

Stressful working conditions also played a significant role. Patients experiencing chronic psychoemotional stress were more likely to have hormonal imbalances, including elevated prolactin levels. Long-term stress leads to activation of the hypothalamic-pituitary-adrenal axis, which can disrupt the regulation of reproductive function [6].

Adverse occupational factors, such as exposure to high temperatures, chemicals, and physical stress, deserve special attention. In men, these factors can lead to impaired spermatogenesis due to damage to seminiferous tubule cells, while in women, they can contribute to the development of hormonal imbalances [7].

In addition, it has been established that patients' lifestyle, including irregular work and rest schedules, insufficient physical activity and an unbalanced diet, can also affect reproductive health.

The obtained data are consistent with the results of a number of studies that emphasize the significant role of social and everyday factors in the development of infertility [6,16].

Thus, the identified social and behavioral factors should be considered as important modifiable causes of infertility, which must be taken into account in a comprehensive diagnosis and the development of individualized approaches to treatment.

The conducted study allowed us to identify a number of patterns characterizing the structure and main causes of infertility in the examined married couples.

It has been established that primary and secondary infertility occur with the same frequency (40% each), which indicates the comparable importance of these forms in the overall structure of reproductive pathology.

An analysis of clinical and laboratory parameters revealed that hormonal imbalances play a leading role in women. Elevated FSH and prolactin levels, as well as changes in LH levels, indicate dysfunction of the hypothalamic-pituitary-ovarian axis and decreased ovarian reserve. These findings are consistent with current understanding of the leading role of endocrine factors in the development of female infertility [3,9].

In men, the main pathogenic factor was impaired spermatogenesis. The most common abnormalities were oligozoospermia, asthenozoospermia, and teratozoospermia, accompanied by decreased sperm concentration, motility, and normal morphology. These changes significantly reduce the likelihood of fertilization and confirm the significant role of male factors, consistent with the results of international studies [2, 8].

A distinctive feature of this study is the high incidence of combined forms of infertility, in which both female and male factors are present in a single couple. This confirms the multifactorial nature of infertility and the need for a comprehensive examination of both partners [4,6].

It has also been established that social and behavioral factors, including unhealthy habits, stress, and unfavorable working conditions, have a significant impact on reproductive function. These factors can exacerbate existing clinical and laboratory abnormalities and worsen the course of infertility [6,16].

Thus, the results of the study indicate that infertility is a complex condition that develops under the influence of a complex of interrelated factors - endocrine, andrological and social.

4. Discussion

The data obtained during the study confirm modern concepts about the multifactorial nature of infertility, in which the disruption of reproductive function is caused by a combination of endocrine, andrological and external factors [4,6].

An important aspect is the role of endocrine disorders in women. Elevated levels of FSH and prolactin, as well as changes in the ratio of gonadotropic hormones, indicate a disruption in the regulation of the hypothalamic-pituitary-ovarian axis. Such changes are considered one of the key mechanisms in the development of anovulation and decreased ovarian reserve, which is confirmed by a number of studies in the field of reproductive endocrinology [9,12].

At the same time, male factors make a significant contribution to the structure of infertility. Impaired spermatogenesis, including decreased sperm concentration, motility, and morphological normality, are considered critical parameters determining the likelihood of fertilization. According to Agarwal et al. (2021), male factors are detected in almost half of infertility cases, which is consistent with the findings [2].

It should be noted that in clinical practice, the male factor is often underestimated, which can lead to an incomplete diagnosis of the causes of infertility. Therefore, conducting a simultaneous examination of both partners is a fundamentally important diagnostic step [8].

The influence of socio-behavioral factors deserves special attention. Chronic stress, unhealthy habits, and unfavorable working conditions can have an indirect impact on reproductive function through hormonal imbalance and deterioration in sperm quality. Similar relationships have been described in a number of studies highlighting the role of lifestyle in the development of infertility [6,16].

Thus, the study results highlight the need for an interdisciplinary approach to infertility diagnosis, including not only clinical and laboratory methods, but also an assessment of lifestyle factors.

The practical significance of the obtained data lies in the possibility of more accurately determining the leading pathogenetic mechanisms of infertility and choosing individualized treatment tactics.

5. Conclusion

The study confirms that infertility is a complex pathological condition that develops under the influence of interrelated endocrine, andrological, and behavioral factors.

The identified changes in the hormonal profile in women indicate a disruption of the central mechanisms regulating the reproductive system, while deviations in spermogram parameters in men indicate a decrease in the functional activity of spermatogenesis.

The combined influence of these factors, as well as the role of social and living conditions, emphasize the need for a comprehensive approach to assessing the reproductive health of married couples.

The practical significance of this work lies in the fact that the use of clinical laboratory methods in combination with the analysis of lifestyle factors allows for increased diagnostic accuracy and justification for the selection of personalized strategies for managing patients with infertility.

The obtained results can be used to improve diagnostic algorithms and increase the effectiveness of treatment measures in the field of reproductive medicine.

6. Practical Recommendations

Based on the conducted study, it is advisable to recommend the following approaches to the diagnosis and management of patients with infertility:

1. Comprehensive examination of a married couple

Infertility diagnostics should be performed simultaneously in both partners with mandatory assessment of clinical and laboratory parameters, including hormonal profile in women and spermogram in men.

2. Early assessment of hormonal status in women

Determining the levels of FSH, LH and prolactin allows for the timely detection of endocrine disorders and assessment of ovarian reserve, which is important for choosing treatment tactics.

3. Mandatory andrological examination of men

Given the high frequency of spermatogenesis disorders, it is recommended that all male patients undergo a spermogram at the early stages of diagnosis.

4. Taking into account concomitant diseases

During the examination, it is necessary to pay attention to the identification of inflammatory and infectious diseases of the reproductive system, which can negatively affect fertility.

5. Correction of lifestyle factors

Patients should be advised to quit smoking and drinking alcohol, normalize their work and rest schedule, and reduce stress levels, which may help improve reproductive function.

6. Individualized approach to treatment

The choice of treatment tactics should be based on the identified causes of infertility, taking into account the combined influence of various factors.

7. Interdisciplinary approach

Managing patients with infertility requires the collaboration of specialists from various fields (gynecologists, andrologists, endocrinologists), which allows for increased diagnostic and treatment effectiveness.

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