TASHKENT MEDICAL ACADEMY

Journal of Educational and Scientific Medicine

Issue 5 | 2025

OAK.uz

Google Scholar

ISSN: 2181-3175

Journal of Education & Scientific Medicine
ISSN 2181-3175
Tashkent Medical Academy
Research Article
Open © Access

EFFECTIVENESS OF COMPLEX DIAGNOSTIC METHODS FOR INFERTILITY OF INFLAMMATORY ORIGIN

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Abstract: Infertility of inflammatory origin is a pressing issue in modern reproductive medicine. According to global statistics, infertility affects approximately one in five couples, with inflammatory factors accounting for a significant proportion. This study aimed to assess the effectiveness of comprehensive modern diagnostic methods in detecting inflammation-related infertility.

Materials and Methods: A total of 115 women were clinically evaluated and divided into three groups: Group I — primary infertility of inflammatory origin, Group II — secondary infertility, and Group III — clinically healthy women (control). Diagnostic tools included bacterioscopy, bacteriological culture, polymerase chain reaction (PCR), and functional methods such as ultrasonography and hysterosalpingography (HSG).

Results: A history of inflammatory disease or sexually transmitted infections (STIs) was identified in 80% of women in the primary infertility group and 65% in the secondary infertility group. Bacterioscopy revealed inflammatory signs in 75% and 60% of cases, respectively. PCR and bacteriological analysis detected chlamydia, ureaplasma, and mycoplasma in 15–35% of Group I and 40–50% of Group II. HSG indicated tubal obstruction in 40% of Group I and 50% of Group II. Statistically significant differences were observed between clinical, laboratory, and instrumental parameters ($p<0.05$).

Keywords: inflammatory infertility, STIs, diagnosis, PCR, HSG.

ЭФФЕКТИВНОСТЬ КОМПЛЕКСНОЙ ДИАГНОСТИКИ БЕСПЛОДИЯ ВОСПАЛИТЕЛЬНОГО ГЕНЕЗА

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Аннотация: Бесплодие воспалительного генеза остаётся одной из актуальных проблем современной репродуктивной медицины. По мировым статистическим данным, каждый пятый брак сталкивается с проблемами зачатия, при этом доля воспалительного фактора остаётся значительной. Целью настоящего исследования явилась оценка эффективности комплексных современных методов диагностики воспалительного бесплодия.

Материалы и методы: В исследование были включены 115 женщин, разделённых на три группы: I группа — с первичным бесплодием воспалительного генеза, II группа — с вторичным бесплодием, III группа — клинически здоровые женщины (контроль). Применялись бактериоскопический, бактериологический, ПЦР-анализ, а также функциональные методы — УЗИ и гистеросальпингография (ГСГ).

Результаты: У 80% женщин с первичным и у 65% с вторичным бесплодием в анамнезе выявлены воспалительные заболевания или ИППП. По результатам бактериоскопии признаки воспаления обнаружены у 75% и 60% соответственно. ПЦР и бактериологические исследования показали наличие хламидий, уреаплазм и микоплазм у 15–35% в I группе и у 40–50% — во II группе. Нарушение проходимости маточных труб при ГСГ выявлено в 40% и 50% случаев соответственно. Между исследуемыми показателями установлены статистически значимые различия ($p<0,05$).

Ключевые слова: воспалительное бесплодие, ИППП, диагностика, ПЦР, ГСГ.

YALLIG'LANISH GENEZLI BEPUSHTLIKNI KOMPLEKS TASHXISLASH USULLARINING SAMARADORLIGI

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Abstrakt: Yallig‘lanish genezli bepushtlik dunyo bo‘yicha reproduktiv salomatlikdagi dolzarb muammolardan biri bo‘lib, bepushtlik har beshinchi juftlikda uchrashi kuzatilmoqda. Mazkur maqolada ushbu bepushtlik turini aniqlashda zamonaviy va kompleks tashxis usullarining samaradorligi o‘rganildi. Maqsadi yallig‘lanish genezli bepushtlikni zamonaviy va kompleks tashxislash usullarini samaradorligini baholash.

Tadqiqot materiallari va usullari: Tadqiqotda 115 nafar ayol klinik jihatdan tahlil qilindi. 1-guruh birlamchi bepushtligi bo’lgan, 2-guruh ikkilamchi bepushtligi bo’lgan va 3-guruh nazorat guruhi, sog‘lom bo’lgan ayollar bo‘yicha tahlillar o‘tkazildi. Bakterioskopik, bakteriologik, PZRva funksional(UTT va GSG) usullari qo‘llanildi.

Natijalar: Birlamchi bepushtlik guruhidagi ayollarning 80% da, ikkilamchi bepushtlik guruhida esa 65% da yallig‘lanish yoki JYYK tarixi aniqlangan. Bakterioskopik tahlilda mos ravishda 75% va 60% da yallig‘lanish belgilariga duch kelindi. Bakteriologik va PZR tekshiruvlarida xlamidiya, ureaplazma va mikoplazma infeksiyalari birlamchi guruhda past (15–35%), ikkilamchi guruhda esa nisbatan yuqori (40–50%) aniqlangan. GSG tahlilida birlamchi guruhda 40%, ikkilamchi guruhda 50% da bachadon naylari o‘tkazuvchanligining buzilishi kuzatildi. Klinik, laborator va instrumental ko‘rsatkichlar orasida statistik farq mavjudligi ($p<0.05$) qayd etildi.

Kalit so‘zlar: Yallig’lanish jarayoni, bepushtlik,JYOYK,

Introduction: Inflammatory infertility has become one of the most widespread reproductive health issues worldwide in recent years. According to global statistics, infertility affects one in every five couples, with a particularly high proportion attributed to inflammation-related causes. In Central Asia, the prevalence of infertility due to inflammatory etiology may reach up to 50–60%. Among the most common underlying causes of this pathology are sexually transmitted infections, bacterial infections, and tubal occlusion, which is becoming increasingly prevalent. The complexity of early diagnosis of inflammatory infertility and the effectiveness of diagnostic methods remain key issues in both research and clinical practice today. In modern medicine, commonly used methods to detect inflammatory infertility include bacterioscopic and bacteriological analyses, functional diagnostics, polymerase chain reaction (PCR), and endometrial biopsy. However, the effectiveness of these methods and their application in clinical practice still pose significant challenges. According to statistical data, not only laboratory tests but also clinical observation and functional diagnostics play a crucial role in diagnosing inflammatory infertility. For example, studies have shown that in 40% of patients, tubal occlusion is caused by inflammatory processes. Furthermore, recent studies have demonstrated the increased effectiveness of combined treatments for inflammatory infertility, including antibiotics, immunotherapy, and physiotherapy. This study aims to explore modern diagnostic approaches for inflammatory infertility, analyze their effectiveness, and emphasize the necessity of further development in this area.Objective of the study: The primary goal of this study is to evaluate the effectiveness of using modern comprehensive methods for diagnosing inflammatory infertility.

The specific objectives are as follows: 1. To investigate clinical, laboratory, and instrumental methods for diagnosing inflammatory infertility and assess their diagnostic value.

2. To compare the diagnostic significance of bacterioscopic, bacteriological, and PCR tests in detecting inflammatory infertility.

3. To analyze the pathogenesis and clinical features of inflammatory infertility and develop new approaches to ensure its early diagnosis.

Additionally, this study aims to enhance the effectiveness of identifying inflammatory infertility through comprehensive diagnostic strategies and to develop recommendations for their integration into clinical practice.

Materials and Methods: The study was conducted at Family Polyclinic No. 30 located in the Uchtepa district of Tashkent city. A total of 115 married women aged between 18 and 40 years participated in the study. Participants were divided into three groups:

1. Primary infertility group (n = 40): Women diagnosed with infertility of inflammatory etiology. In this group, inflammatory processes are considered the primary cause of infertility.

2. Secondary infertility group (n = 40): Women with secondary infertility of inflammatory etiology. This group includes individuals with a history of previous pregnancies and analyzes the impact of past inflammatory conditions.

3. Control group (n = 35): Healthy women without any signs of infertility or inflammatory pathology.

Methods used for analysis:

1. Clinical-anamnestic assessment: Medical history and presenting symptoms of participants were collected. Preliminary diagnosis was based on patients’ complaints and anamnesis, focusing on identifying potential causes of infertility.

2. Bacterioscopic examination: Smears were taken from the vagina and cervical canal to detect signs of inflammation. This method included the evaluation of leukocytes, epithelial cells, and the condition of the vaginal microflora under a microscope.

3. Bacteriological analysis: Aimed at identifying pathogenic microorganisms causing urogenital inflammation. Smears from the vaginal and cervical canal were cultured to detect sexually transmitted infections.

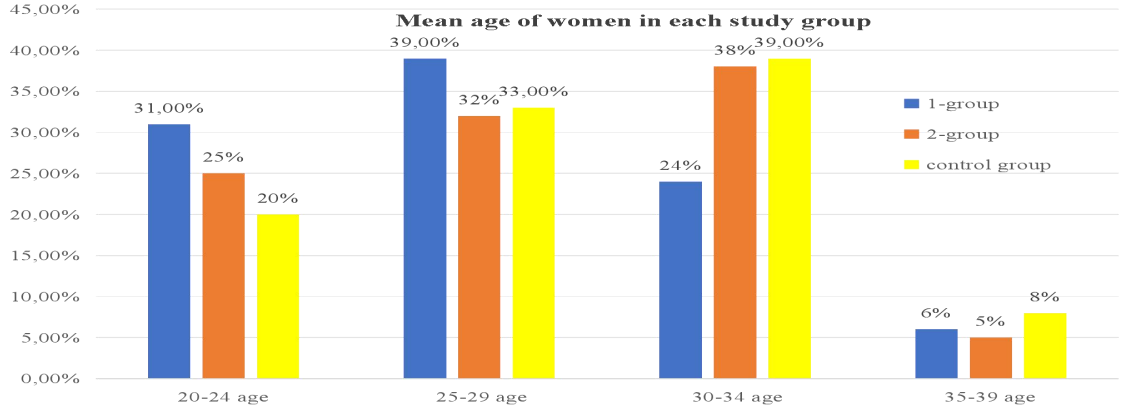
4. Polymerase Chain Reaction (PCR): PCR testing was used to detect Chlamydia trachomatis, Ureaplasma urealyticum, and Mycoplasma hominis, which are common infectious agents in inflammatory infertility.

5. Functional diagnostics: Ultrasound examination and hysterosalpingography (HSG) were used to assess tubal patency. HSG enabled visualization of uterine tube obstruction or permeability, providing insight into tubal factor infertility.

6. Statistical analysis: Data analysis was conducted using SPSS (Statistical Package for the Social Sciences). Statistical significance of differences between groups was evaluated using the Chi-square test, Student's t-test, and ANOVA, depending on the nature of the data.

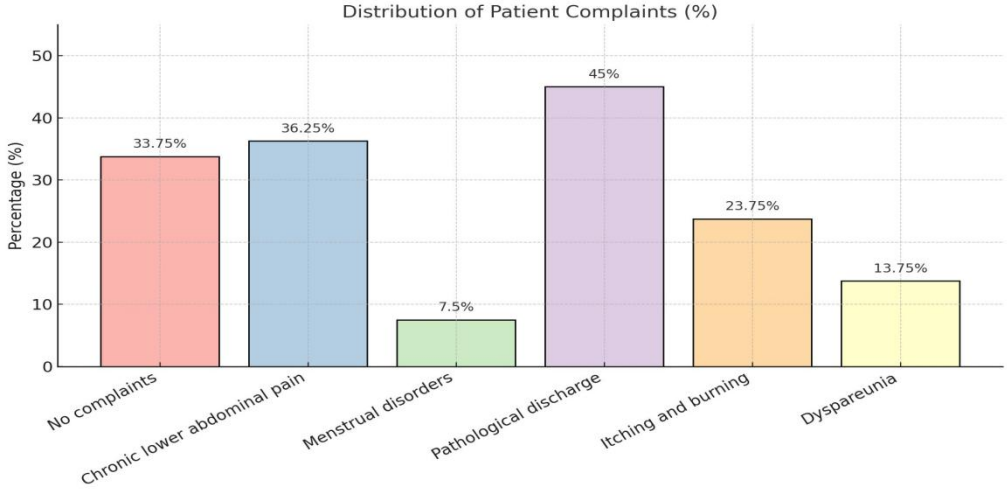
Results: A total of 115 women participated in the study and were divided into three groups: primary infertility (n=40), secondary infertility (n=40), and a control group of healthy women (n=35). The following results were observed:

Among the women with inflammatory infertility (n=80), the average age was 23.4±3.2 years in the primary infertility group, 26.5±2.3 years in the secondary infertility group, and 26.2±1.9 years in the control group.



The most common reason for seeking medical help among all participants was the inability to conceive. The average duration of infertility was 4±3.7 years in the primary group and 6.4±2.4 years in the secondary group. The duration of infertility was less than 2 years in 3 women (3.75%), up to 5 years in 40 women (50%), and more than 5 years in 37 women (46.25%).

The majority of the women reported specific symptoms: absence of complaints – 27 (33.75%), chronic lower abdominal pain – 29 (36.25%), menstrual irregularities – 6 (7.5%), pathological vaginal discharge – 36 (45%), itching and burning sensation in the vagina and urinary tract – 19 (23.75%), and dyspareunia – 11 (13.75%).



The average age of menarche was 13.8±2.3 years in the primary group, 13.2±1.8 years in the secondary group, and 12.8±1.9 years in the control group. Most women in all three groups had regular menstrual cycles – 67 (83.8%), while oligomenorrhea was identified in 13 women (16.2%). In the primary group, 35 women (87.5%) had regular cycles and 5 women (12.5%) had oligomenorrhea. In the secondary group, 32 (80%) had regular cycles and 8 (20%) had oligomenorrhea. All women in the control group had regular menstrual cycles.

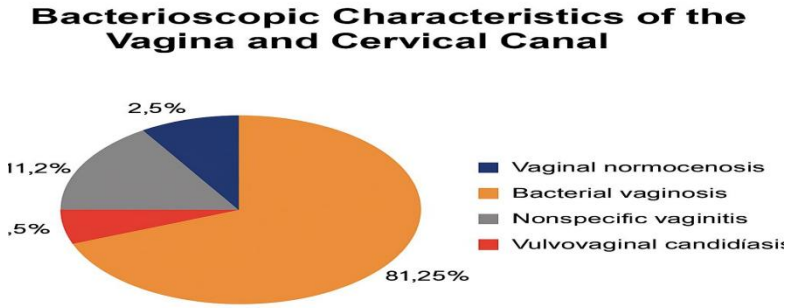
The average age at the onset of sexual activity was 19.1±4.1 years in the primary group, 19.5±4.6 years in the secondary group, and 19.7±3.8 years in the control group. Although the average age of sexual debut was similar across the

groups, in the secondary infertility group it more frequently occurred outside of marriage, often associated with inflammatory diseases of the reproductive organs, which are risk factors for infertility.

In the secondary infertility group (n=40), the distribution of outcomes from previous pregnancies was as follows: in 15 women (37.5%) the pregnancy ended unsuccessfully: 6 (15%) had spontaneous abortions, 5 (12.5%) had missed abortions, and 4 (10%) had ectopic pregnancies. In 12 women (30%), the pregnancy ended with childbirth, while in 13 cases (32.5%) it ended with a medical abortion. Thus, analysis of the obstetric history revealed that prior abortion (both spontaneous and medical) is a significant risk factor for the development of secondary infertility.

A majority of women with inflammatory infertility had concomitant extragenital diseases. In the primary infertility group, 32 women (80%) had various somatic diseases: chronic tonsillitis – 12 (30%), pyelonephritis – 1 (2.5%), and chronic cholecystitis – 4 (10%). In the secondary group, 33 women (82.5%) had somatic conditions, including chronic tonsillitis in 13 (32.5%) and chronic cholecystitis in 1 (2.5%).

Bacterioscopic Characteristics of the Vagina and Cervical Canal in Inflammatory Infertility: According to bacterioscopic examination results, pathological vaginal conditions were identified in 24 (60%) women in Group 1 and in 33 (82.5%) women in Group 2. Disruption of vaginal acid-base balance was observed in 68 (85%) of all patients, while normal pH levels were found only in 12 (15%) women. Based on the findings of vaginal smear microscopy, the following conditions were diagnosed: Vaginal normocenosis – 2 patients (2.5%),bacterial vaginosis – 65 patients (81.25%), nonspecific vaginitis – 9 patients (11.25%), vulvovaginal candidiasis – 4 patients (5%).



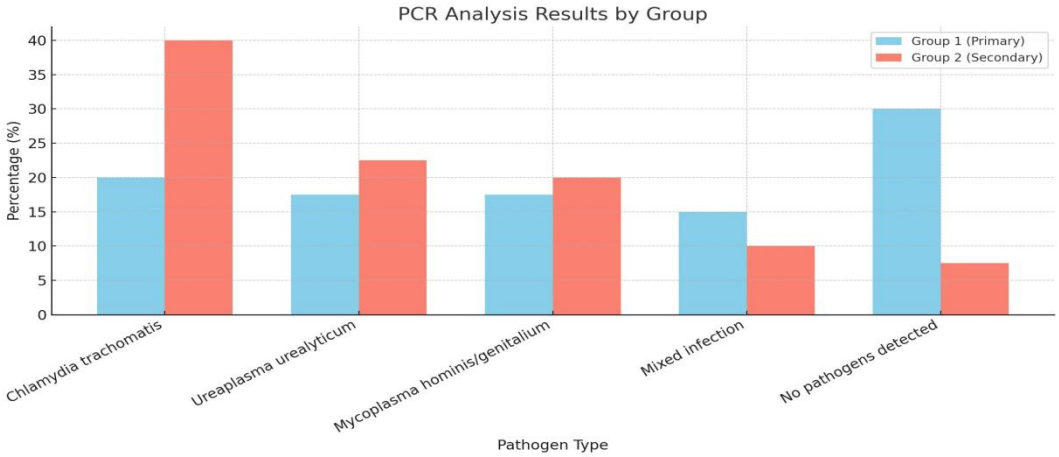
Bacteriological Examination Results: The bacteriological investigation revealed a higher prevalence of conditionally pathogenic microorganisms and sexually transmitted infections (STIs).Group 1 (Primary infertility, n=40): Escherichia coli – 9 (22.5%), staphylococcus epidermidis – 4 (10%), gardnerella vaginalis – 3 (7.5%), candida spp. – 6 (15%), trichomonas vaginalis – 1 (2.5%), neisseria gonorrhoeae – 1 (2.5%), chlamydia trachomatis – 8 (20%), ureaplasma urealyticum – 7 (17.5%), mycoplasma hominis/genitalium – 5 (12.5%), herpes simplex virus (HSV) – 1 (2.5%), cytomegalovirus (CMV) – 1 (2.5%).

Group 2 (Secondary infertility, n=40):Escherichia coli – 8 (20%), staphylococcus epidermidis – 6 (15%), gardnerella vaginalis – 5 (12.5%), candida spp. – 8 (20%), trichomonas vaginalis – 3 (7.5%), neisseria gonorrhoeae – 2 (5.0%), chlamydia trachomatis – 16 (40%), ureaplasma urealyticum – 9 (22.5%), mycoplasma hominis/genitalium – 10 (25%), HSV – 2 (5%), CMV – 1 (2.5%).

PCR Analysis Results: PCR (Polymerase Chain Reaction) testing was focused on identifying Chlamydia trachomatis, Ureaplasma urealyticum, and Mycoplasma hominis/genitalium, as well as their co-infections and cases where no pathogen was detected.

Group 1 (Primary infertility, n=40): Chlamydia trachomatis – 10 (20%), ureaplasma urealyticum – 7 (17.5%), mycoplasma hominis/genitalium – 7 (17.5%), mixed infection (Chlamydia + Ureaplasma + Mycoplasma) – 6 (15%), no pathogens detected – 10 (30%).

Group 2 (Secondary infertility, n=40): Chlamydia trachomatis – 16 (40%), ureaplasma urealyticum – 9 (22.5%), mycoplasma hominis/genitalium – 8 (20%), mixed infection – 4 (10%), no pathogens detected – 3 (7.5%).

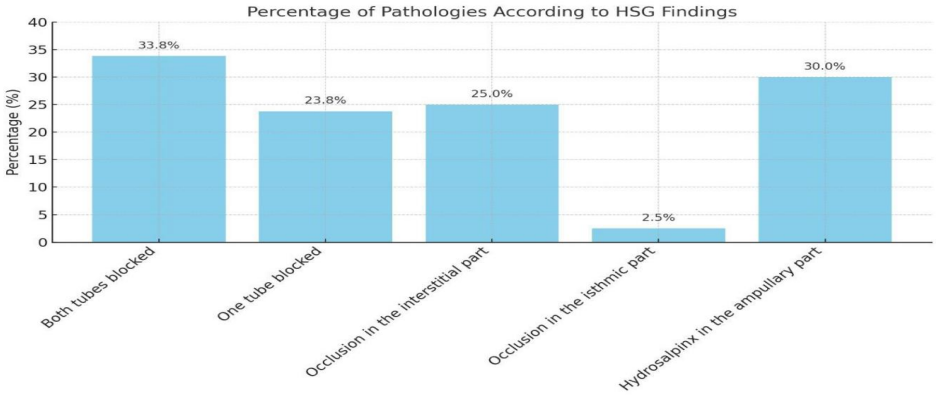


Ultrasound Folliculometry: To assess ovarian hormonal activity and confirm ovulation, all patients underwent serial transvaginal follicular ultrasound monitoring on days 9, 11, 13, 15, 17, 19, and 21 of the menstrual cycle. Folliculometry plays a crucial role in evaluating follicular growth dynamics, confirming ovulation, and quantitatively and qualitatively assessing endometrial thickness—important factors in the diagnosis of infertility.

Results: Group 1 (Primary infertility): Normal ovulation (n = 27): In 3 patients, follicle size was 20 mm with ovulation on day 14. In 10 patients, 19 mm follicles with ovulation on day 13. In 14 patients, follicles measured 18–22 mm with ovulation on days 14–15. Endometrial thickness ranged from 9 to 12 mm. Delayed ovulation (n = 13): In 5 patients, follicle size ranged from 22–25 mm with ovulation on day 16. In 8 patients, 23–26 mm follicles with ovulation on day 17. Endometrial thickness was 9–12 mm.

Group 2 (Secondary infertility): Normal ovulation (n = 13): In 3 patients, 20 mm follicles with ovulation on day 14. In 7 patients, 19 mm follicles with ovulation on day 13. In 3 patients, follicles were 18–22 mm with ovulation on days 14–15. Endometrial thickness ranged from 9 to 12 mm. Delayed ovulation (n = 27): In 10 patients, follicle size ranged from 22–25 mm with ovulation on day 16. In 17 patients, follicles measured 23–26 mm with ovulation on day 17. Endometrial thickness was 9–12 mm.

Hysterosalpingography (HSG) findings: Out of 80 patients, 46 showed fallopian tube occlusion. Among them: Bilateral tubal occlusion was found in 27 patients. Unilateral occlusion in 19 patients. Interstitial segment obstruction in 20 cases, isthmic segment occlusion in 2 cases, ampullary segment occlusion with hydrosalpinx formation in 24 cases.



Discussion: The study evaluated the effectiveness of using comprehensive diagnostic methods in identifying inflammation-related infertility. The findings demonstrated that the application of the polymerase chain reaction (PCR) method in detecting inflammatory etiology significantly enhanced diagnostic accuracy. Through this method, infections such as Chlamydia trachomatis, Ureaplasma urealyticum, and Mycoplasma hominis/genitalium were effectively identified, allowing for a more precise determination of infertility causes. Clinical analysis revealed that inflammatory processes were more active in both primary and secondary infertility groups. Notably, Chlamydia and Mycoplasma infections were more frequently detected in the secondary infertility group. In cases of secondary infertility, tubal occlusion and sexually transmitted infections (STIs) were identified as major contributing factors. Bacterioscopic and bacteriological examinations confirmed the presence of inflammatory processes, as evidenced by elevated leukocyte levels and relevant microscopic findings. These results underscore the role of inflammation as a key marker in both primary and secondary infertility. PCR-based identification of infections contributed to improved treatment outcomes. The accurate detection of the etiological factors through PCR allowed

for a targeted therapeutic approach, which significantly enhanced treatment efficacy. Post-treatment evaluations in Groups 1 and 2 showed a marked reduction in inflammatory indicators, further confirming the effectiveness of the comprehensive diagnostic and treatment strategy. In the control group of healthy women, inflammatory signs and infections were rarely observed, suggesting preserved reproductive health. These findings affirm the pivotal role of inflammation in the pathogenesis of infertility of inflammatory origin.

Conclusion: In the group with primary infertility, 80% of women had a medical history indicating prior inflammatory diseases and sexually transmitted infections (STIs). In the secondary infertility group, this figure was 65%, while in the healthy control group, only 10% of women had a history of inflammation. Bacterioscopic analysis revealed signs of inflammation (increased leukocyte count and epithelial changes) in 75% of women with primary infertility and 60% of those with secondary infertility. Bacteriological examination in the primary infertility group identified infectious agents such as Chlamydia trachomatis, Ureaplasma urealyticum, and Mycoplasma species. Chlamydia was found in 40% of patients, Ureaplasma in 35%, and Mycoplasma in 30%. In the secondary infertility group, the prevalence of these infections was 25%, 20%, and 15%, respectively. According to PCR analysis, Chlamydia was detected in 50%, Ureaplasma in 45%, and Mycoplasma in 40% of the primary infertility group. In the secondary infertility group, Chlamydia was found in 35%, Ureaplasma in 30%, and Mycoplasma in 25% of cases. Hysterosalpingography (HSG) results showed tubal obstruction or partial patency in 50% of women in the primary infertility group and in 40% of those in the secondary infertility group. In the control group, only 10% of women exhibited tubal patency issues. Statistically significant differences ($p<0.05$) were found between the primary and secondary infertility groups in terms of clinical, laboratory, and instrumental parameters. The study highlights the effectiveness of a comprehensive diagnostic approach, particularly the use of PCR, HSG, and bacteriological analysis, in accurately diagnosing inflammatory infertility and contributing to effective treatment.

The application of a comprehensive diagnostic approach proved effective in identifying the etiology of inflammation and played a key role in treatment planning. The use of PCR significantly increased the detection and successful treatment of infections. The findings confirm the necessity of a complex approach in the diagnosis and management of infertility of inflammatory origin.

Key Conclusions: 1. Effectiveness of complex methods: A comprehensive approach, especially with the application of PCR, significantly improves the detection and treatment of infections in inflammation-related infertility.

2. Main causes of infertility: Chlamydia, Ureaplasma, and Mycoplasma infections were among the leading causes of inflammatory infertility and were detected at high rates in both the primary and secondary infertility groups. Early detection and treatment of these infections are crucial.

3. Diagnosis of inflammatory processes: Bacterioscopic, bacteriological, and PCR tests are effective tools in detecting inflammatory processes and identifying the etiology of infertility.

Overall, a complex diagnostic and treatment approach is essential in managing infertility of inflammatory origin. It ensures accurate detection of causative factors and leads to more effective treatment, representing a significant advancement in reproductive healthcare.

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