

Biomedical Communication

Influence of Physical Activity on the Development of Infertility in Men Aged 24-50

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ABSTRACT

Every year the number of families without children in Russia is growing. Each has its own reasons: social or the presence of pathology of the reproductive system. The number of families in which pregnancy does not occur for more than a year from the beginning of planning is growing every year. Therefore, it is becoming more urgent to establish the causes of the development of infertility, as well as develop additional and more informative methods for its diagnosis and effective treatment. The objective was to assess the reproductive health status of men of fertile age and to establish whether the type of occupational activity may be one of the causes of male infertility in Penza Oblast (Russia). Based on the Perinatal Center "Regional Children's Clinical Hospital named after N.N. Filatov" (Penza, Russia), the authors collected and analyzed archived data for 2014-2019. The data on 986 men with a diagnosis of male infertility were processed using summary methods of statistical analysis in the Statistica 7.0 program. Based on the information obtained from the patients' medical history and the results of spermograms, a database was formed. The authors determined whether age-related changes in the body could be one of the causes of infertility in the study group. Male infertility was identified predominantly in persons aged 26 to 36 years, which could be caused by low physical activity during working hours. The sedentary lifestyle of men associated with professional activity causes an increase in the temperature of the scrotal organs. As a consequence, spermatogenesis and its hormonal regulation are disturbed, which leads to the development of male reproductive health disorders. The patients were divided into two groups according to their activity during working hours. A comparison of the obtained results and the results of statistical analysis allowed the authors to conclude that the probability of male infertility is higher in men who are sitting for a long time than in those who are physically active during the working day.

KEY WORDS: ACTIVITY, MALE INFERTILITY, OCCUPATION, SPERMOGRAM, STATISTICS.

INTRODUCTION

The declining birth rate in Russia is an alarming factor for society (Demographic Yearbook of Russia 2019, 2020). Currently, special attention is paid to the problem of family infertility and methods of solving it from a medical point of view. Along with the female factor, the cause of infertility in the family can be a male or a mixed factor. Male infertility is a common condition among married couples. According to the World Health Organization, in 47% of cases, infertility is caused by impaired sexual function in men. Decreased fertility is most commonly associated with spermatogenesis. Recently, modifiable lifestyle factors have been playing an important role in the development of infertility, generating

interest in this area of research. According to Rosstat data from 2014 to 2019, the coefficient reflecting the number of marriages per 1,000 people in Russia decreased from 8.4 to 6.5, while the coefficient reflecting the number of births per 1,000 people in Russia decreased from 13.3 to 10.1. This allows us to conclude that the number of families who do not have children is increasing every year in Russia. Each family has its own reasons for this: social or reproductive system abnormalities (Radzinsky et al., 2020; Ramzi, 2021).

Currently, special attention is being paid to studying the problem of family infertility and how to solve it from a medical point of view. Apart from the female factor, infertility in the family may also be caused by male or mixed factors. The number of families in which pregnancy does not occur over a year of planning is increasing every year, so it becomes more relevant to establish the causes of infertility, to develop additional and more informative methods of diagnosis and effective treatment. There is an opinion that

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one of the causes of male infertility is a sedentary lifestyle (Ilacqua, et al., 2018; Melonek et al., 2021). The objective of the study was to assess the reproductive health status of men of fertile age, using clinical and diagnostic laboratory examination data, statistical analysis, as well as to evaluate the influence of a sedentary lifestyle (occupational activity) on the development of male infertility in Penza Oblast (Russia).

MATERIAL AND METHODS

Between 2014 and 2019, N.N. Filatov Regional Children's Hospital examined 986 men diagnosed with male infertility and formed two groups of patients based on daily muscle activity. The data were provided for research in a generalized form without specified personal data. The results of the analysis included patients' medical history and spermogram results: age (24-50 years old), total sperm count, sperm concentration in 1 ml, actively motile sperm cells, inactive sperm cells, morphologically normal sperm cells, defective sperm cells. Patients' activity at work was also considered. Besides, one of the inclusion criteria was the absence of pregnancy in the spouses during the year of married life together. Of particular note is that the results of the general blood and urine tests and serological and microscopic examination of the prostate secretion in the examined patients were within the normal range.

An ultrasound examination of the prostate, scrotal and penile organs revealed no abnormalities; all the patients had no history of previous or newly diagnosed STDs; the MAR test was normal, i.e. <50% (Dolgov, 2006); and there were no changes in the hormonal status of the patients. During verification of the patients' ejaculate results, the following conditions were observed: ejaculate dilution time, viscosity, and pH were within normal limits; leucocytes, erythrocytes, and amyloid cells were present in amounts not exceeding the acceptable values; crystallization phenomenon and sperm glutination were not detected. Based on the results of data collection, a database was created, including information from patients' medical history and the results of their spermograms: age; total number of sperm cells; concentration of sperm cells in 1 ml; actively motile sperm cells; immobile sperm cells; morphologically normal sperm cells; defective sperm cells; activity at work. STATISTICA 7.0 program was used for statistical processing of archived data from 2014-2018.

RESULTS AND DISCUSSION

The following results were obtained during the analysis of the available material. During 2014-2019, the birth rate in Penza Oblast decreased by more than 40%. Thus, in 2014, 14,736 children were born in the region, and in 2019, their number did not exceed 8,782, which can be attributed to many factors, including male infertility. Considering these results, an age periodization was performed (Kochetov, et al., 2012) to establish the age category of patients predominant in the study group. As a result of statistical analysis of the data, it was found that more than 50% were patients between 26 and 36 years old. The dependence of the spermatozoa concentration in 1 ml of ejaculate on the

age of the patients was determined by plotting a scatter diagram. The obtained diagram allows us to conclude that there is a dependence of spermogram indicators on age and that among the patients included in the study, a significant decrease in sperm concentration in 1 ml ejaculate is observed in men over 37 years. Normally, the concentration of spermatozoa in 1 ml of ejaculate should be greater than 20 million (Kurashvili, 2009). The scatter diagram shows that the spermogram indicator takes values below normal in patients aged 28 years and above. Similarly, the relationship between the age of the patient and the number of active spermatozoa, which should normally be >50%, is determined. The scatter diagram for this criterion indicates that a significant decrease in the analyzed index (<50%) is found in patients from the age of 25 years.

The dependence of spermogram indicators on the physical activity of the examined patients at work, which was the main objective of our study, turned out to be significant. Men in Penza Oblast are engaged in professional activities for an average of 9 hours a day, which is most of their time spent awake. If a man spends this time sedentary or sitting, the consequences for the body and the reproductive system, in particular, can be adverse. Many factors can interfere with the normal course of spermatogenesis, such as taking medication, X-rays, increased scrotal temperature, etc. The testicular temperature must not exceed 33°C for the testicular function to be most effective, which is ensured by the seven scrotal membranes with several temperature regulation mechanisms. When a man is in a sitting position for a long time, the testicles overheat. Therefore, spermatogenesis, as well as the synthesis and secretion of male sex hormones, namely 5 α -dihydrotestosterone synthesis from testosterone by 5 α -reductase enzyme, are inhibited (Ilacqua et al., 2018; Radzinsky et al., 2020).

The haematotesticular barrier can be impaired in inactive men, resulting in anti-sperm antibodies in sperm, which immobilize the spermatozoa and impair fertilization (Dohle et al., 2010). To establish the influence of sedentary occupational activity on the development of infertility, a new criterion "Activity at work" was introduced. The first group included men in the following positions: programmer, accountant, driver, concrete worker, dispatcher, operator, worker on duty, engineer, technologist, director, or power engineer — i.e. less active men, due to "sedentary" work. The second group included men in the following positions: car electrician, welder, mechanic, manager or salesman, laborer, electrician, handyman, locksmith, boreturner, policeman — these are men with moderate physical activity at work.

Using the STATISTICA 7.0 program, we determined the percentage of patients according to the "Activity at work" criterion in infertility. The number of less active patients in the study group was found to be slightly higher (59%). To assess the dependence of the development of infertility in the examined patients on the values of the spermogram, we built a scaling diagram for the following criteria: total sperm count, inactive spermatozoa, morphologically normal spermatozoa, and defective spermatozoa. A scatter diagram of the total sperm count in the ejaculate shows that this

figure is twice as low in the ejaculate of less active men. The number of inactive spermatozoa should not normally exceed 50% (Rebrova, 2002; Kurashvili, 2009; Radzinsky et al., 2020).

The scaling diagram for the analyzed criterion indicates that in men who work mainly in the sitting position, the number of inactive spermatozoa exceeds 70%. Statistical processing of the spermogram results for the number of morphologically normal and defective spermatozoa was also performed by constructing range diagrams. It is assumed that in healthy men, the number of morphologically normal spermatozoa should be greater than 4% (Kurashvili, 2009). Therefore, after evaluating the results obtained, it can be concluded that there are no cases of the absence of morphologically normal spermatozoa in the group of more active patients (group 2).

The degree of influence of the relationship between professional activity, sedentary lifestyle, and heat factor on the male reproductive system is currently poorly understood. Previously, experiments were carried out with the effect of heat on the organs of the scrotum, during which it was found that the heat factor has a negative effect on male fertility (Durairajanayagam et al., 2015).

CONCLUSION

A statistical analysis of clinical and diagnostic laboratory criteria of patients with infertility shows that in Penza Oblast in 2014-2019, men aged 26 to 36 years prevail among patients diagnosed with male infertility. One of the reasons for the development of the disease in patients may be an inactive lifestyle due to "sedentary" work, which causes an increase in testicular temperature, leading to a decrease in spermatogenesis. Age-related changes in the male body are not the only cause of infertility in the study groups. Reduced physical activity is one of the most important causes of male infertility.

Conflict of Interest: Authors declares no conflicts of interests to disclose.

Ethical Clearance Statement: The Current Research Work Was Ethically Approved by the Institutional Review Board (IRB) of Medical Institute of Penza State University, Penza, Russia.

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