Institute of Experimental Morphology, Pathology and Anthropology with Museum
Bulgarian Anatomical Society

Acta morphologica et anthropologica, 22
Sofia ● 2015

Effects of Aging on Sperm Morphology and Fertility

M. Pencheva[1], Y. Koeva[1], A. Aleksandrov[2] , N. Atanassova[3]

[1] Department of Anatomy, Histology and Embryology, Medical University of Plovdiv, Bulgaria
[2] AG Center "Salmanida", Plovdiv, Bulgaria
[3] Institute of Experimental Morphology, Pathology and Anthropology with Museum, Bulgarian Academy of Sciences, Sofia, Bulgaria

Infertility affects about 14% of the couples of childbearing age. Several studies show that in about 40% of couples infertility is due to changes in spermatogenesis. Infertility itself does not threaten the physical health of men, but it has a major impact on mental and social well-being of married couples. The aim of our study was to determine the infertility distribution among a group of men with fertility problems, age range when it is observed, the associated morphological defects in comparison to the WHO criteria and possible reasons for infertility. The study examines the extent of infertility in age groups and morphological characteristics of semen analysis. The results obtained clearly reflect the global trend of harmful factors affecting spermatogenesis associated with lower sperm quantitative and qualitative indicators in human males.

Key words: infertility men, semen analysis, sperm morphology, reproduction.

Introduction

Infertility affects about 14 % of couples of childbearing age [1]. For many years infertility is attributed mainly to female factor, whereas the role of the male is highly underestimated. Several studies show that about 40% of couples infertility is due to changes in spermatogenesis. Infertility itself does not threaten the physical health of men, but has a major impact on the mental and social well-being of married couples. Infertile men are more susceptible to depression and aggression. Crucial in such cases is exactly prepared semen analysis and adequate treatment plan. The first step after detecting abnormal semen analysis is to precise the reason for infertility. Only comprehensive evaluation of the data and the relationship between them can give a prognosis for fertility ejaculate.

In Bulgaria the first studies of male infertility began in the middle of the last century. In 1978 Nalbanski conducted extensive research among childless couples and found that in 33.19% of them direct cause of infertility is male infertility [8]. Today, the percentage is even higher, according to a report by the Ministry of Health [10]. In year 2010, couples with fertility problems are about 270 000 [9]. The reasons for these alarming data are probably changed lifestyle and diet, the use of ionizing devices, stress and many others.

Objective

The aim of the study was to determine the influence of age on sperm morphological defects and sterility among group of men.

Materials and Methods

The study was conducted among 74 males, average age of 34.9 years (20-51 years old.) Families with long (primary or secondary) infertility from Plovdiv that visited "Salmanida" AG Center (Obstetrics and Gynaecology Center) in the period from May to September 2014 were included in the present study.

Each patient signed written informed consent. Semen for seminologic study was obtained by masturbation after 3-5-day sexual abstinence in a sterile container and stored at room temperature 18-20 °C. Qualitative and quantitative studies were carried out to determine the volume of ejaculate and concentration of spermatozoa in 1 ml. Total sperm count, evaluation of motility and morphology in Kruger strict criteria [3] were investigated using a light microscope (Olympus) and camera for counting cells (Makler).

The evaluation of the results was carried out according to the criteria of the World Health Organization (WHO) [11].

All data were processed with statistical program SPSS 17.0, by applying descriptive and variation analysis

Results

Our study found that only 40.54% of the men have normal sperm parameters respectively with normal fertility (normozoospermia), while the remaining 59.46% expressed varying degrees of infertility and reduced or lack of fertility.

The largest percentage of patients were with oligoastenozoospermia (25.68%), followed by those with astenoteratozoospermia (16.22%). Significantly rarely are diagnosed men with oligozoospermia (6.7%) and azoospermia (6.7%), and only at 4.05% with astenozoospermia and oligoastenoteratozoospermia **(Fig.1)**.

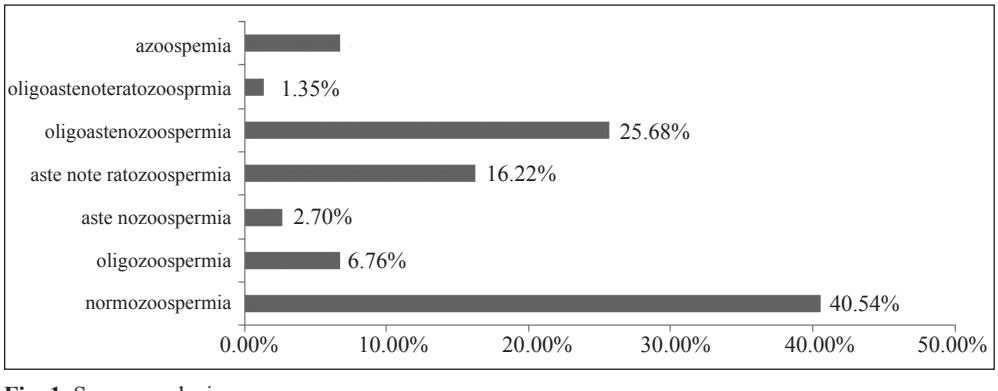

Fig. 1. Semen analysis

By analysis of the distribution of different types of infertility in age groups we found oligoastenozoospermia-minute diagnosed with approximately equal frequency in men between 31-40 years (28.85%) and 41-50 years (30.77%). All other types of infertility occur mainly in the age group 41-50 years (46.15%) **(Fig. 2)**

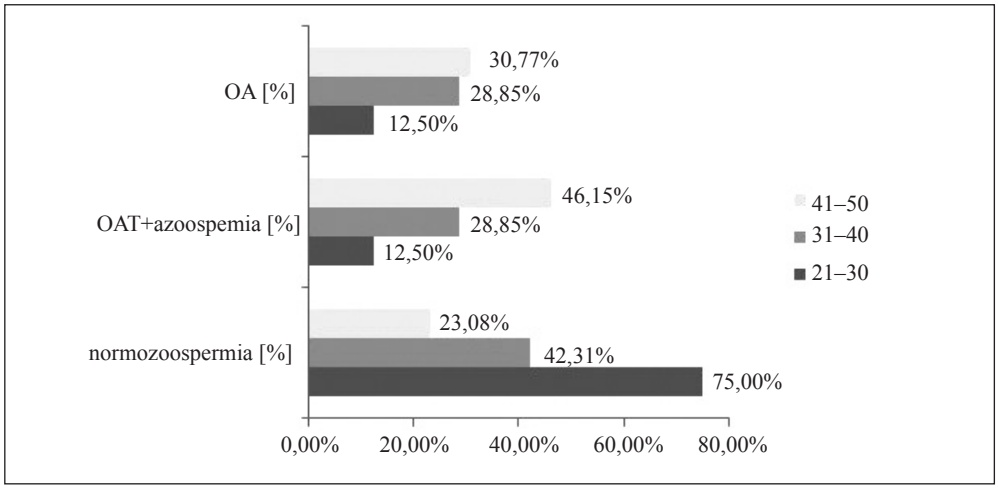

Fig. 2. Distribution of patients by age

The results of the morphological characteristics of semen analysis are shown in the diagram below:

N – Normozoospermia

OA – Oligoastenozoospermia

OAT – Oligoastenoteratozoospermia

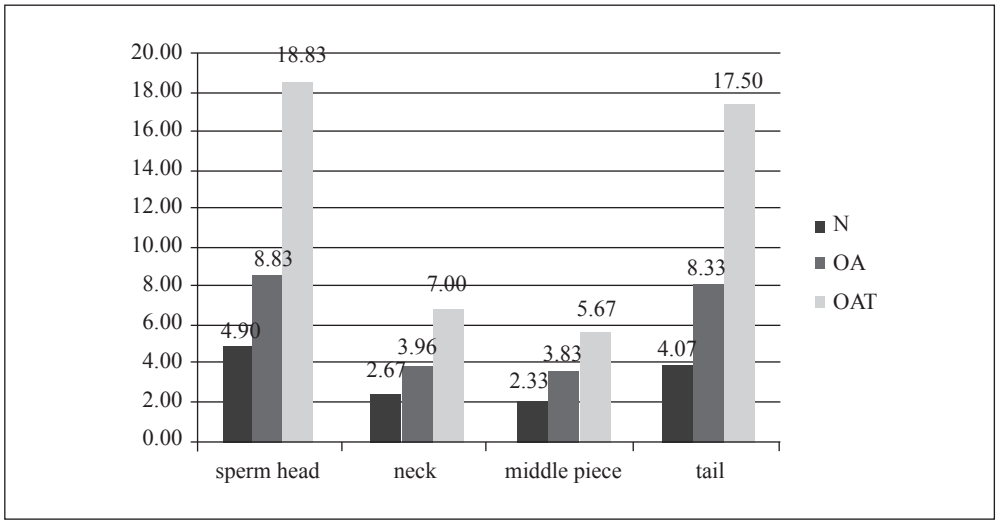

Fig. 3. Morphological characterization of sperm

The highest percentage of defects was reported in sperm head and sperm flagellum apparatus in patients with:

- Normozoospermia – sperm head (4.9%), tail (4.07%)
- Oligoastenozoospermia – sperm head (8.83%), tail (8.33%)
- Oligoastenoteratozoospermia – sperm head (18.83%), tail (17.5%).

Discussion

The present study demonstrates that the number of sperm reaching its peak in men aged 21-30 years and it is reduced after 50 years of age. Also it was found that sperm motility is highest around the age of 25 and lowest after age 50. Comparing the number of spermatozoa with normal morphology in ejaculate in men aged 21-30 years to men aged over 50 it was found that the sperm motility decreased by about 50%. Sperm morphology determines success in fertilization and embryo development. In sperm morphological assessment, the percentage of sperm with normal and abnormal shape, analyzing the head, the volume of acrosome, neck, middle and caudal part were evaluated. Normally, more than 14% of sperm should have a normal shape and structure, according to the criterion by Kruger et al. (1986, 1988, 2010), the deviations are considered abnormal forms [3]. According to Ilieva and Tsvetkova [6], anomalies in the shape of the head of the sperm are combined with the pathology of the genital tract, cryptorchidism, epididymal cysts, prostatitis, epididymitis, varicocele, torsio testis. Incorrect placement of the head, its shape and size can lead to abnormalities in sperm motility and penetration ability. Numerous studies prove that the violations in the neck and middle part of the sperm due to anomalies in the construction of axonema – lack of protein dynein, microtubule and fibrils and improper disposal of mitochondria are result of genetic defects. Morphological studies reported that abnormalities in sperm tail were found in a higher percentage in diseases such as chronic epididymitis, epididymal cyst and postparotidic orchitis [5]. It is well known that the cellular or physiological changes in the urogenital tract increased with age. Testicular biopsies demonstrate narrowing and sclerosis of the lumen of the seminiferous tubules, reduced spermatogenesis and increased degeneration of germ cells, and atrophy with diminished function of Leydig cells [2].

Changes in the prostate that occur with age, such as smooth muscle atrophy and reduced water and protein content can lead to reduction in the semen volume and sperm motility. In addition, changes in the epididymis, associated with age, suppress energetic movement sperm capacity. Epididymitis is hormonally sensitive tissue that plays an important role in sperm maturation [7]. Thus, the reduction of the hormonal levels associated with age may lead to a decrease in mobility in older men.

Second, the aging provides a longer period of impact of exogenic factors on the reproductive system. Older men have been exposed longer to the carcinogenic effects of smoking, possibility of diseases, including genitourinary infections than younger men.

Other parameters that may be affected by age include sperm morphology, which is shown to be a sensitive indicator of status and changes in the epididymis. Several studies have shown age-related defects in the genetic integrity of sperm. For example, age is associated with increased aneuploidy in sperm production in humans [4] and mice, as well as increasing in the frequency of the *de-novo* gene mutations.

Conclusion

The results obtained clearly reflect the global trend of harmful factors affecting spermatogenesis associated with lower sperm quantitative and qualitative indicators in human males.

References

1. **Adams, J. A., T. S. Gallowa, D. E. Mondial, S. C. Esteves, F. Matthews.** Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. – Environ Int., 2014 Sep; 70: 106-112.
2. **Barbutska, D., Iv. Koeva, M. Bakalska, N. Atanasova, E. Detchev.** Aging and steroidogenesis in testicle-morphological analysis. – MU, Plovdiv, IEMPAM-BAS, 2014.
3. **Cooper, T. G., E. Noonan, S. von Eckardstein, J . Auger, H. Baker, H. Behre, T. Haugen, T. Kruger, Wang, M. Mbizvo, K. Vogelsong.** World Health Organization reference values for human semen characteristics. – Human Rep. Up., **16**(3), 2010, 231-234.
4. **Friedman, J.** Genetic disease in the offspring of older fathers. – Obstet. Gynecol., 57, 1981, 745-749.
5. **Hancock, A., D. de Kretser.** The axonemal ultrastructure of spermatozoa from men astenospermia. – Fertility Sterility, **57**, 1992, 661-664.
6. **Ilieva, I., P. Tsvetkova.** Morphological changes in the head of the sperm and infertility. – Repr. Health, **14**, 2008, 20-24
7. **Lowe, X., Br. Eskenazi, D. Nelson, Sh. Kidd, A. Alme, A. Wyrobek.** Frequency of XY sperm increases with age in fathers of boys with klinefelter syndrome. Correspondence, Medical Center, San Francisco, – J. Am. Hum. Genet., **69**(5), 2001, 1046-1054.
8. **Nalbanski, B.** Male infertility as a cause of infertility in the family: medico-biological, seminologic and medical and social studies. Sofia, 1978.
9. Annual report on the activities of the "I Want a Baby", 2010, Plovdiv.
10. "Investigation of the frequency and causes of infertility," Report of the Ministry of Health, National Institute of Statistics on Population Fund and the UN, Sofia, 2005.
11. World Health Organization Laboratory Manual for Examination of Semen and Sperm-Cervival Mucus Interaction, 4th Edition, 1999. Cambridge University Press, Cambridge.