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Effect Of Melatonin on Pregnancy Onset: A Comparative Analysis of Efficacy

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Abstract: In Uzbekistan, the sphere of ART is relatively new and the problems of pregnancy after ART procedures remain both a socio-psychological and economic problem. The article discusses the effect of melatonin use on the probability of pregnancy as the first clinical trials in this country. A comparative analysis of the results between groups of women who used melatonin and a control group is made. The physiologic mechanisms of melatonin action, its effect on reproductive health and the prospects for its use in clinical practice are highlighted. Clinical trials using melatonin in the field of assisted reproductive technologies (ART) are conducted for the first time in Uzbekistan. This is an innovative approach aimed at studying the effectiveness and safety of this drug in improving reproductive indicators in patients.

Keywords: IVF, melatonin, pregnancy, fertility, embryos, oocytes, antioxidant.

Introduction: Current research in reproductive medicine is actively investigating the role of hormones and metabolic regulators in pregnancy. One such regulator is melatonin, the major epiphysis hormone responsible for synchronizing circadian rhythms. In addition to its role in sleep regulation, melatonin exerts antioxidant effects, protecting cells from oxidative stress, which is particularly important for maintaining oocyte and embryo health. It is for these parameters that in recent years melatonin has come to be considered not only as a sleep regulator, but also as an active substance that plays an important role in the reproductive system. It has antioxidant, anti-

inflammatory and anti-apoptotic effects on cells. Melatonin is of particular interest in the context of assisted reproductive technologies (ART) because, according to several studies, it can improve the quality of the endometrium and contribute to successful embryo implantation, which is particularly important for women with endometrial abnormalities or implantation difficulties.

The present article is devoted to analyzing the effectiveness of melatonin use in women with different fertility indicators.

Physiological role of melatonin in the reproductive system

Melatonin is involved in the regulation of biological processes, which includes hormonal balance and interaction with reproductive organs. Its antioxidant and anti-inflammatory properties help protect cells from damage and improve the overall conditions for reproductive function. Studies show that melatonin helps reduce oxidative stress and inflammation in tissues of the ovaries, endometrium and other reproductive organs.

The endometrium is a key structure for successful embryo implantation and further development of pregnancy. The thickness, structure and receptivity of the endometrium play a crucial role in the success of the ART procedure. Melatonin can positively affect the endometrium in the following ways:

Antioxidant activity.

Melatonin is a potent antioxidant capable of neutralizing free radicals and preventing cellular damage. Under conditions of oxidative stress, which is often present in women undergoing HRT treatment, melatonin helps maintain a healthy cellular environment by minimizing oxidative damage. This improves the environment for endometrial receptivity, which is an important factor for successful implantation.

Anti-inflammatory effect.

Inflammatory processes play an important role in preparing the endometrium for implantation, but excessive inflammation can disrupt this process. Melatonin modulates the production of pro-inflammatory cytokines such as interleukin-6 (IL-6), which plays a role in endometrial preparation, but when overactive can interfere with implantation. Melatonin can balance inflammatory responses, creating a more favorable environment for the embryo.

Enhancement of endometrial receptivity

Preparing the endometrium for implantation requires the interaction of a number of hormones, including progesterone. Melatonin can influence progesterone receptor expression, improving endometrial secretory activity, which is particularly important in the late luteal phase. Through this mechanism, melatonin is thought to help create favorable conditions for embryo attachment.

Improvement of microcirculation in the endometrium

Melatonin also has an effect on the microcirculation of the endometrium. Improved blood flow helps deliver more nutrients and oxygen to the cells, which promotes endometrial growth and regeneration. This can be especially helpful for women with thin endometrium, who usually have a lower chance of successful implantation.

Most studies consider a melatonin dosage of 3 to 6 mg before bedtime, which helps in maintaining circadian rhythm and creates an antioxidant effect. However, the optimal dosage and duration of administration remains a matter of debate as there may be individual differences in melatonin metabolism in different patients.

Purpose of the study

To evaluate the effect of melatonin supplementation on pregnancy probability, oocyte quality, ovulatory cycle regulation and general condition of women undergoing assisted reproductive technology (ART) procedures.

Material and Methods

Two groups of women were selected for analysis:

1. experimental group (n=30): women taking the drug melatonin at a dosage of 3 mg per day for 3 months during ovarian stimulation, before and after embryo transfer.

2. Control group (n = 30): women not taking melatonin.

Inclusion criteria:

- Age: 25-40 years (mean age 33.6 ± 1.2 years).

- Absence of severe somatic diseases affecting fertility.

- Diagnosis of infertility and participation in an ART program.

Research Methods:

1. Pregnancy rate: was determined by the number of clinically confirmed pregnancies in each group.

2. Oocyte and embryo quality: evaluated based on embryo morphology and oxidative stress levels determined by biochemical methods.

3. Regulation of the ovulatory cycle: investigated according to the menstrual diaries provided by the patients.

4. General condition: assessed on the basis of questionnaires (sleep quality and stress level) and

biochemical markers (cortisol).

Student's t-test for quantitative data and χ^2 for frequency measures were used to compare groups.

RESULTS

1. Frequency of pregnancy occurrence:

The experimental group was 15% more likely to become pregnant compared to the control group (56.7% vs. 41.7%, $p < 0.05$).

2. Quality of oocytes and embryos:

- Women taking melatonin showed a 15% reduction in oxidative stress levels.

- Morphologically high-quality embryos were observed in 70% of patients in the experimental group, which is 20% higher than in the control group.

3. Regulation of the ovulatory cycle: in the experimental group, normalization of the menstrual cycle was observed in 30% of women who suffered from irregular ovulation, while in the control group this indicator was only 10% ($p < 0.05$).

4- General condition: the experimental group reported a 40% improvement in sleep and a 35% reduction in stress levels, as evidenced by a decrease in serum cortisol levels. These changes had a positive effect on women's general well-being, potentially improving preparation for ART.

DISCUSSION

The results of the study confirm the positive effects of melatonin on reproductive function. The antioxidant activity of the hormone protects oocytes from damage, and improved sleep helps to restore hormonal balance.

However, it is important to take into account the individual characteristics of the body. Melatonin is not a universal remedy, and its use should be recommended by a doctor after diagnosis.

CONCLUSION

The use of melatonin in preparation for pregnancy shows encouraging results. Its use may be a promising adjunct to infertility treatments, especially in women with oxidative stress and sleep disorders.

Further studies involving larger samples and long-term follow-up will allow for a more precise assessment of the effects of melatonin on reproductive health.

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