УДК 616-008.92:616.177-089.188.11
ГРНТИ 76.29.48

Лецин Денис Валериевич
Запорожский государственный медицинский университет

АНАЛИЗ ИЗМЕНЕНИЙ ЭЛЕКТРОЛИТНЫХ ПОКАЗАТЕЛЕЙ У ЖЕНЩИН ПРИ ЭКСТРАКОРПОРАЛЬНОМ ОПЛОДОТВОРЕНИИ

Letsin D.V.
Zaporizhzhia State Medical University

ANALYSIS OF CHANGES IN ELECTROLYTE PARAMETERS IN WOMEN DURING IN VITRO FERTILIZATION PROGRAM

DOI: 10.31618/ESSA.2782-1994.2021.4.75.170

Цель исследования: определить концентрацию основных электролитов плазмы у женщин на основании определения клинико-патогенетической роли нарушений нейроэндокринной регуляции водно-солевого обмена путем индивидуализации медикаментозной коррекции в программе экстракорпорального оплодотворения, а также изучить данные о современных методах профилактики и коррекции электролитных нарушений.

Материалы и методы исследования: Было обследовано 110 пациенток в программе экстакорпорального оплодотворения.

Выводы: Таким образом, при применении стандартных протоколов индукции овуляции в программе экстракорпорального оплодотворения у пациенток наблюдаются изменения электролитных показателей калия и натрия крови.

Синдром гиперстимуляции яичников по данным статистического анализа выявлено только у пациенток основной группы со стандартными протоколами индукции овуляции. Данный синдром не наблюдался у пациенток получавших комбинированную терапию.

Aim of the research. To determine the concentration of basic plasma electrolytes in women in in vitro fertilization program who received more individualized medication correction on the basis of determination the clinical and pathogenetic role of disorders of the neuroendocrine regulation of water-salt metabolism, as well as to study data of the modern methods of prevention and correction of electrolyte disorders.

Research materials. 110 patients in vitro fertilization program were examined.

Conclusions. Thus, when using standard protocols for ovulation stimulation in in vitro fertilization program patients are more prone to have potassium and sodium imbalance.

Ovarian hyperstimulation syndrome was detected only in patients of the main group with the standard ovulation induction protocols. This syndrome was not observed in patients receiving the combination therapy.

Ключевые слова: репродуктивное здоровье, водно-солевой обмен, калий, натрий, экстракорпоральное оплодотворение, синдром гиперстимуляции яичников.

Key words: reproductive health, water-salt metabolism, sodium, potassium, in vitro fertilization, ovarian hyperstimulation syndrome.

Introduction

Water-salt metabolism is a part of mineral metabolism and a combination of water and salts entering the body, their distribution in the internal environment and excretion from the human body [1, 2, 3]. Water-salt metabolism ensures the blood volume, osmotic pressure and acid-base balance stability [4, 5, 6].

The number of women with disorders have been increasing recently. That is primarily connected with hypothalamic-pituitary dysfunction, autoimmune diseases, emergence of puberty and adolescence somatic diseases, which are common at the adulthood [7]. The use of supporting reproductive technologies in this category of patients is not always effective. It occurs due to the difficulty of selecting an adequate ovarian stimulation protocol with a high probability of developing water-salt metabolism disorders [8, 9, 10].

There are some predictors that are considered quite uninformative and lead to ovarian hyperstimulation syndrome due to the lack of risk factors in case of abnormal water-salt metabolism [11]. They include young age, polycystic ovary syndrome, elevated antimullerian hormone levels, stimulation of ovarian superovulation with gonadotropin-releasing hormone agonists and a large number of follicles during the ovarian stimulation [8, 12, 13, 14].

Ovarian hyperstimulation syndrome is an iatrogenic condition that occurs in response to the controlled ovarian stimulation. The etiological and pathogenetic mechanisms of this syndrome have not still been ascertained [7, 15, 16].

The risk of developing ovarian hyperstimulation syndrome is constantly increasing when applying supporting reproductive technologies in this category of patients using the modern protocols of the controlled ovarian stimulation [17, 18].

The objective of this study was to determine the concentration of basic plasma electrolytes in women at the in vitro fertilization program who received more individualized medication correction based on the determination of the clinical and pathogenetic role of

the neuroendocrine regulation of water-salt metabolism disorders, as well as to explore the modern methods of electrolyte disorder prevention and correction.

Research materials and methods included 110 in vitro fertilization program patients examined at ME (Municipal Enterprise) Regional Medical Center for Human Reproduction, Zaporizhzhia City Council, Zaporizhzhia. The main group was divided into two subgroups: 1st subgroup included 60 patients who were induced the ovulation at the in vitro fertilization program in accordance with generally accepted recommendations; 2nd subgroup included 30 patients who received the combination therapy (diuretics, nootropics and vasoactive drugs) as a supplement to standard ovulation stimulation schemes. Its aim was to prevent and correct the disorders of neuroendocrine water-salt metabolism regulation in women. The control group included 20 patients with a lack of somatic and hormonal disorders of the reproductive system who were inseminated with male sperm in the physiological cycle.

Both main and control group patients were induced the anthropometry with the determination of the body mass index and the establishment of the woman morphological type. The sodium and potassium concentration in the serum was identified.

The above-mentioned diagnostic set for all women in the control group was duplicated the next day after they were induced the ovulation trigger.

Another medical examination was performed in the control group the next day after the ovulation, which was confirmed via ultrasound folliculogenesis monitoring.

Student's t-test for independent groups and one-factor variance analysis (ANOVA) were used for comparison in independent groups. To compare the indicators in the groups before and after the conduction, Student's t-test for independent groups was used. The differences were considered statistically significant at ≤0.05.

The results. The average ages of the examined women at the in vitro fertilization program were 33,50±0,59 years (the 1st subgroup), 33,77±0,72 years (the 2nd subgroup) and 31,80±0,88 years (the control group).

As a result of the clinical and statistical analysis, on the second and third menstrual cycle day, the 1st subgroup patients had an increase in potassium and sodium level (potassium - 4,60±0,04 mmol/l; sodium – 143,97±0,36 mmol/l) compared to the 2nd subgroup patients (potassium - 4,51±0,07 mmol/l; sodium – 142,88±0,65 mmol/l) and patients of the control group (potassium - 4,39±0,08 mmol/l; sodium – 143,69±0,61 mmol/l).

Table 1.

Disorders of electrolyte metabolism in patients on the 2nd – 3rd day of the menstrual cycle

Indicator	1st subgroup n=60	2nd subgroup n=30	control group n=20	p- values by one-factor variance analysis
Potassium, mmol/l	4,60±0,04*	4,51±0,07	4,39±0,08	0,074
Sodium, mmol/l	143,97±0,36	142,88±0,65	143,69±0,61	0,219

Note* - statistically significant difference from the comparison group by t-test (p <0,05)

After the ovulation trigger was introduced, the potassium and sodium increase was also observed in patients of the 1st subgroup (potassium - 4,68±0,06 mmol/l; sodium - 142,60±0,34 mmol/l) in comparison with the 2nd subgroup patients (potassium - 4,45±0,06 mmol/l; sodium -141,43±0,59 mmol/l) and patients of the control group (potassium - 4,57±0,07 mmol/l; sodium – 142,72±0,53 mmol/l).

Table 1.

Disorders of electrolyte metabolism in patients after ovulation trigger

Indicator	1st subgroup n=60	2nd subgroup n=30	control group n=20	p- values by one-factor variance analysis
Potassium, mmol/l	4,68±0,06	4,45±0,06	4,57±0,07	0,049
Sodium, mmol/l	142,60±0,34	141,43±0,59	142,72±0,53	0,132

Note*: - statistically significant difference from the comparison group by t-test (p <0,05)

As a result of the statistical analysis, it was determined that the risk of developing ovarian hyperstimulation syndrome was observed in patients of the 1st and 2nd subgroups whereas the syndrome of ovarian hyperstimulation was occurred only in the 1st subgroup patients. (Table 3).

Table 3.

The concentration of major blood electrolytes in patients at the risk of developing ovarian hyperstimulation syndrome and with ovarian hyperstimulation syndrome, M±SD

Indicator	Patients with ovarian hyperstimulation syndrome n=14	Patients at the risk of developing ovarian hyperstimulation syndrome n=27	control group n=20
Potassium, mmol/l	4,72±0,17	4,58±0,08	4,57±0,07
Sodium, mmol/l	142,42±0,82	141,90±0,67	142,72±0,53

Note*: - statistically significant difference from the comparison group by t-test (p <0,05)

Among the 1st subgroup patients with ovarian hyperstimulation syndrome, the potassium level was increased somewhat the next day after the ovulation trigger introduction (potassium - 4,72±0,41 mmol/l), although the sodium level was decreased (sodium - 142,42±9,46 mmol/l) compared to the patients of the same group on the second and third menstrual cycle day (potassium - 4,68±0,15 mmol/l, sodium - 144,34±10,3 mmol/l). Ovarian hyperstimulation syndrome was not observed in the patients of the 2nd subgroup (Fig. 1).

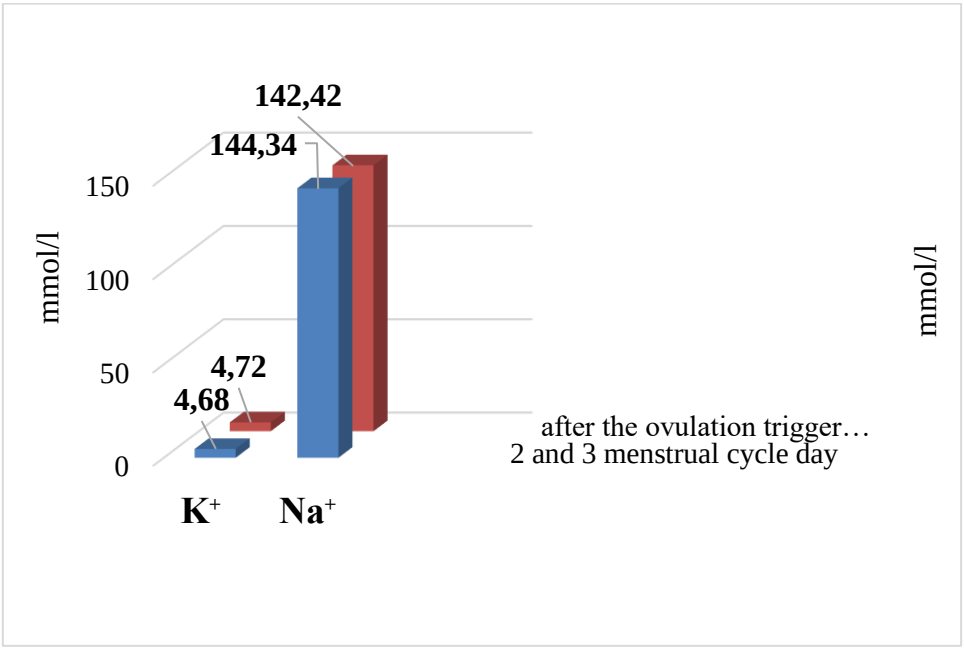

Fig. 1. The results of the electrolytes study in patients with ovarian hyperstimulation syndrome

Conclusions.

1. Consequently, when using the standard protocols of the controlled ovarian stimulation at the in vitro fertilization, the patients developed an electrolyte imbalance. It involved increasing potassium and sodium level in patients with the standard protocols of the controlled ovarian stimulation and decreasing potassium level in patients who received the combination therapy.

2. The sodium increase in patients of the control group and the sodium decrease in patients who received the combination therapy were observed.

3. The risk of developing ovarian hyperstimulation syndrome was determined in patients of the main group.

4. Some significant differences were noticed in patients receiving the combination therapy. Their potassium and sodium levels the next day after the ovulation trigger introduction were lower than those ones of the same group on the second and third menstrual cycle day.

5. In accordance with the analysis, the ovarian hyperstimulation syndrome was detected only in patients of the main group with the standard ovulation induction protocols. This syndrome was not observed in patients receiving the combination therapy.

References:

Veropotvelyan P. A practical approach to the patient maintenance with ovarian hyperstimulation syndrome. Medical aspects of woman health.

2016;8:42-51.

Ivakhnenko E. Dynamics of blood and urine plasma electrolytes at the observation stages in different infusion therapy types in patients with infectious-toxic shock. Emergency medicine. 2015;4:28-31.

Gozhenko A. Preventive mechanisms of water-salt metabolism regulation through the prism of the

functional system theory. Bukovyna Medical Journal. 2012;3:80-83.

Podzolkova N. M., Yu. A. Deck. Modern understanding of polycystic ovary syndrome. Farmateka. 2016;3:8-15. https://pharmateca.ru/ru/archive/article/32693

Duchenko E. The furoxane effect on water-salt metabolism in extracellular hyperhydration of the body. A young scientist. 2016;6:284-288.

Shcherbakova L.N., Ivanova N.V., Bugerenko A.E. Prevention of the development of ovarian hyperstimulation syndrome in the program of in vitro fertilization // Russian Medical Journal. 2015;1:28-31. https://cyberleninka.ru/article/n/preduprezhdenie-razvitiya-sindroma-giperstimulyatsii-yaichnikov-v-programme-ekstrakorporalnogo-oplodotvoreniya/viewer

Dziuba D. Water-electrolyte imbalance and its correction. Acute and urgent conditions in medical practice. 2017;3:17-21.

Kulikov A. Intensive therapy of ovarian hyperstimulation syndrome. Anesthesiology and resuscitation. 2015;1:73-76. https://cyberleninka.ru/article/n/intensivnaya-terapiya-sindroma-giperstimulyatsii-yaichnikov-klinicheskie-rekomendatsii/viewer

Shlapak I. Dehydration syndrome. Acute and urgent conditions in medical practice. 2015;6:15-19.

Practice Committee of the American Society for Reproductive Medicine, Prevention and treatment of moderate and severe ovarian hyperstimulation syndrome: a guideline, Fertil Steril. 2016;106:1634-1647.

Shvets M. Mechanisms of hormonal systems regulating water-salt metabolism. Clinical & Experimental Pathology. 2017;3:103.

Galushko O. A basic minimum of knowledge about the clinical water-electrolyte metabolism physiology. Rational pharmacotherapy. 2018;1:18-22.

Shelestova L. P. Disorders of bone-mineral metabolism and their correction with women who have body weight deficiency at pregravid stage and during pregnancy. Zaporozhye medical journal. 2017;5:618-622.

Khmil M. S. Modern approaches to the treatment of infertility in women with polycystic ovarian syndrome in assisted reproductive technology programs. Current issues of pediatrics, obstetrics and gynecology. 2020;1: 108-115.

Abuzeid M., Warda H., Joseph S. et al. Outpatient management of severe ovarian hyperstimulation syndrome (OHSS) with placement of pigtail catheter. FVV in ObGyn. 2014;1:31-37.

Tehrani H. The effect of calcium and Vitamin D supplementation on

menstrual cycle, body mass index and hyperandrogenism state of women

with polycystic ovarian syndrome: A clinical trial study. J. Res. Med. Sci.

2014;19:875-880.

Humaidan P., Nelson S.M., Devroey P. et al. Ovarian hyperstimulation syndrome: review and new classification criteria for reporting in clinical trials. Human Reproduction. 2016;6:1997-2004.

Timmons D., Montrief T., Koyfman A., et al. Ovarian hyperstimulation syndrome: a review for emergency clinicians. American Journal of Emergency Medicine. 2019;8:1577-1584.

Information about author:

Відомості про автора: Лецин Д.В., аспірант кафедри акушерства, гінекології та репродуктивної медицини факультету післядипломної освіти, Запорізький державний медичний університет.

Сведения об авторе: Лецин Д.В., аспирант кафедры акушерства, гинекологии и репродуктивной медицины факультета последипломного образования, Запорожский государственный медицинский университет.

Information about author: Letsin D.V., Postgraduate student, Department of Obstetric, Gynecology and Reproductive Medicine of FPE, Zaporizhzhia State Medical University.

Лецин Денис Валерійович

аспірант кафедри акушерства, гінекології та репродуктивної медицини ФПО

Запорізький державний медичний університет

69001, м. Запоріжжя, вул. Дивногорська, буд. 5, т. (066)3238015