

## **Oxybarotherapy of uterine infertility**

### **Oxybaroterapia niepłodności maciczopochodnej**

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**Słowa kluczowe: hiperbaria, choroby, niepłodność**  
**Key words: hyperbaria, disease, infertility**

#### **Abstrakt**

W pracy podjęto problem Oxybaroterapii niepłodności maciczopochodnej, jako propozycji bezpiecznej uzupełniającej metody poprawy płodności. Przedstawiono możliwości zastosowania hiperbarii tlenowej i nowe kierunki jej zastosowania. Wskazania terapii hiperbarycznej są stale

modyfikowane i dostrzega się nowe pola jej zastosowań. Opisano projekt wykorzystania hiperabii tlenowej na świecie i wskazano na możliwość zaimplementowania terapii do Polski. Przedstawiono korzyści wynikające z zastosowania terapii uzupełniającej, jaką jest hiperbaria tlenowa w leczeniu par z upośledzoną płodnością maciczoależną.

## **Abstract**

The problem of oxybarotherapy of uterine infertility was proposed as a proposition of a safe complementary method of fertility improvement. The possibilities of using hyperbaric therapy and new directions of its application have been presented. Indications of hyperbaric therapy are constantly modified and new fields of its applications are noticed. A project for the use of aerobic hyperbole in the world was described and the possibility of implementing therapy to Poland was indicated. The benefits of supplementary therapy, which is oksybaroterapy in the treatment of couples with impaired uterine fertility, are presented.

## **Introduction**

Infertility (sterilitas) is defined by the World Health Organization (WHO) as being unable to get pregnant despite having regular sexual intercourse (4-5 a week), maintained for more than 12 months without using any contraceptive methods. Women who experience difficulty in getting pregnant often feel depressed, which can lead to depression <sup>1</sup>. The scale of this phenomenon in our country is based on estimates obtained from studies and research of the European Society of Human Reproduction and Embryology (ESHRE), 10-15% of couples are estimated to be infertile in Poland which allows to conclude that it affects about 1 million Polish marriages in reproductive age. For comparison, in America it is as many as six million couples. In addition, it also turns out that only 19% of infertile couples seek specialist medical help. Appropriate preparation of the endometrium during the menstrual cycle is necessary for conception, due to its role in embryo implantation. In fact, implant failure is the most common problem associated with in vitro fertilization. Endometrium thickness of the 10mm is considered the most beneficial for the implantation of a fertilized egg. With a thickness of 7 mm or less, implantation of the fertilized egg is unlikely. Women are then advised to take high doses of estrogen or use other pharmacological substances, such as pentoxifylline, to increase peripheral blood flow. However, many women not only suffer the negative effects of hormone therapy but also discontinue therapy, fearing fetal damage.

1 V. Skrzypulec, K. Nowosielski, A. Drosdzol, R. Kowalaczyk. Endokrynologia Polska 2005; 6(56): 964-969.

## **Oxybarotherapy in the treatment of uterine infertility**

Oxybarotherapy can bring beneficial therapeutic effects. Hyperbaric oxygen therapy deals with the impact of 100% pure oxygen on the body in the conditions of increased atmospheric pressure <sup>2</sup>. **Hyperbaric oxygen therapy is the delivery of increased oxygen to damaged tissues and organs.** Under normobaric conditions, plasma transports only 0.0003 ml of oxygen per liter of blood, while with the supply of 100% oxygen in the hyperbaric chamber, this value increases up to 0.68 ml<sup>3</sup>. Oxybarotherapy in some diseases is used as the basic form of therapy, while in the majority of others it is treated as a supportive or alternative treatment <sup>4</sup>.

Hyperbaric oxygen therapy is a safe and very effective adjuvant therapy for women applying for treatment of uterine infertility which means with insufficient thickness of the endometrium. In order to improve the factors contributing to the increase of the chance of implantation of a fertilized egg, women undergo hyperbaric oxygen therapy. Hyperbaric oxygen therapy has been shown to improve uterine blood supply and thickness of the endometrium. Recent medical research conducted at a research center in Serbia showed good results in the increase of the thickness of endometrium during treatment in a hyperbaric chamber. The results of treatment of uterine infertility and male infertility research from international research centers are presented below.

## **Treatment of uterine infertility using oxygen hyperbaric therapy in the world**

At University Hospital for Gy and OB, Narodni front, School of Medicine, Univerisity of Belgrade, Serbia, 32 patients were treated in a multi-seat hyperbaric chamber at 2.1 to 2.3 ATA for 70 minutes, 7-10 days in sequence from day 2 to 5 of the menstrual cycle. The evaluation of effects of hyperbaric oxygen therapy has been carried out. An improvement in oxygenation and blood supply of the uterus, better response of stimulated ovaries, better quality of embryos and higher pregnancy rate has been noticed<sup>5</sup>. An increase in the thickness of the endometrium, on average up to 11 mm, was found. The thickness of the endometrium during ovulation after hyperbaric treatment has tripled. It was noted that the endometrial thickness effect was sustained in the next monthly menstrual cycle. Doppler examination of uterine arteries and vascular mapping after applying hyperbaric oxygen therapy showed the formation of new capillaries of the endometrium, especially after 4-6 weeks after HBO therapy. Oxygen used at higher pressure seems to have a beneficial effect on achieving a better result of pregnancy implantation by improving endometrial susceptibility for implantation, which makes hyperbaric oxygen therapy considered as the treatment of choice<sup>6</sup>.

2 A. Sieroń, G. Cieślak, *Zarys medycyny hiperbarycznej*, wyd. II α-medica 2007 Bielsko-Biała, s. 23.

3 Ibidem

4 Ibidem

5 A.M. Jovanovic. Hyperbaric Oxygenation Therapy in Infertility Patients. *Crit Care Obst & Gyne.* 2016, 2:1. doi:10.21767/2471-9803.100012.

6 Ibidem

## **Treatment of male infertility using oxygen hyperbaric therapy in the world**

At the University of Belgrade, patients with male sterility were also treated. In this group, also as a result of identical hyperbaric treatment, after two months of treatment increased spermatogenesis was noted. The results obtained suggest a beneficial effect of hyperbaric oxygen therapy on the viability and motility of sperm. Prolongation and postponement of hyperbaric oxygen therapy effects were verified by spermogram- semen analysis after 70 to 90 days after the end of treatment with results of good spermatogenesis induction thanks to elimination of reactive oxygen species and avoiding infection due to hyperoxia.<sup>7</sup>

## **An application of the oxygen hyperbaric treatment of infertility in the world**

There are many factors that affect the fertility of women and men and the chance of becoming pregnant. The Belgrade Clinic's experience clearly indicates that combined hormone therapy and hyperbaric therapy have a positive effect on infertility treatment and can increase the chance of having children.

## **Discussion**

For a long time the prevailing view is that medically assisted procreation procedures require the adoption of relevant laws and the introduction of functional institutional solutions. It is also underlined that these regulations should ensure a high level of applied procedures, respect the rights and protect the interests of the persons being treated and take into account the well-being of children born after applying infertility treatment techniques<sup>8</sup>.

According to the World Health Organization (WHO), disease is a denial of health and health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. After adapting this definition on International Conference of Population and Development in Cairo, this definition was expanded for reproductive health as: a state of full physical, mental and social well-being in all matters related to the reproductive system<sup>9</sup>. It should be added that the WHO not only counts infertility to diseases in the general sense of the word but also postulates to include it as a social disease, that is, to a group of diseases that are widespread, chronic, difficult to cure, requiring long, regular medical care, limiting human ability to perform basic life tasks, which are a big problem not only for the individual but also for the whole society<sup>10, 11, 12, 13</sup>.

7 Ibidem

8 Por. m.in. Założenia regulacji prawnej dotyczącej wspomaganiej medycznie prokreacji, stanowisko końcowe sformułowane przez grupę ekspertów biorących udział w pracach tzw. Komisji Gowina w osobach: prof. dr hab. E. Bartnik, prof. dr hab. J. Hołówka, prof. dr hab. Z. Szawarski, prof. dr hab. J. Zaremba, prof. dr hab. E. Zielińska, Warszawa, październik 2008 r. (dalej: stanowisko ekspertów).

9 E. Zielińska: Opinia sporządzona 21 maja 2015 r. na zlecenie Biura Analiz Sejmowych (druk sejmowy nr 3245/VII kad.); na temat rządowego projektu ustawy o leczeniu niepłodności; Zeszyty Prawnicze Biura Analiz Sejmowych Kancelarii Sejmu nr 4(48) 2015 s. 183–196

10 Por. szerzej C. Łepecka-Klusek, A.B. Pilewska-Kozak, Niepłodność w świetle definicji choroby podanej przez WHO, „Medycyna Ogólna i Nauki o Zdrowiu” 2012, t. 18, nr 2, s. 162–165 oraz wskazane tam materiały źródłowe.

Assuming that in vitro fertilization is one of the infertility treatment accepted in the light of the current state of medical knowledge, it may be considered whether it would be advisable to introduce a modern method of hyperbaric oxygen therapy into the clinical procedures for supporting the treatment of one of the forms of infertility - uterine infertility. According to the authors of this report, it brings social and medical benefits. In this type of infertility it is possible to achieve high treatment results by combining two conventional methods of treatment: hormonal stimulation and hyperbaric oxygen therapy. Currently, hormonal treatment is a recognized and widely used in the world (also in Poland) method of infertility treatment but not always bringing satisfactory results. As the first reports indicate, the use of hyperbaric oxygen therapy to support traditional treatment may determine a new quality of infertility treatment.

## Conclusion

The use of hyperbaric oxygen therapy and its indications are evaluated. New trends in HBOT therapy are noticed. Unfortunately, in the literature there is a deficit of scientific studies that address the described medical problem. Available scientific reports are very promising but still insufficient. Scientific reports should be treated as having a character of a medical experiment. Therefore, it is necessary to tighten cooperation with recommended centers using the therapy and verification of the obtained results by expanding the research and performing more extensive research, for example on an animal model. It is worth mentioning the extremely important question of the importance of research, from a social and ethical point of view. Due to the limited access to scientific studies addressing a given topic and a small number of data the authors' doubts that the effects of the therapy on the fertilized egg cell and potential future embryonic development are caused by the influence of hyperbaric oxygen therapy. Smaller doubts concern the support of male infertility treatment regarding sperm. In conclusion, it should be clearly stated that the results of the application of oxybarotherapy in the treatment of couples with impaired uterine fertility are very promising. Therapy seems to be safe and minimally invasive. Due to the unsatisfactory results of hormonal treatment, the introduction of hyperbaric oxygen therapy as a method supporting the standardized treatment of fertility impairment seems to be fully valid. For this purpose, research on the effectiveness of the described method of supporting infertility treatment should be extended and subjected to international discussion to those recommending the placement of oxybarotherapy and broadening the indications for its use.

11 Гоженко, А.И. Очерки теории болезни. Одеса. 2010. = Gozhenko, A.I. Ocherki teorii bolezni. Odesa. 2010. = Gozhenko, A.I. [Essays of the theory of disease]. Odesa. 2010.

12 Запорожан, В.М., Гоженко, А.И. Від біоетики до ноетики. Вісник НАН України. 2004; 12: 22-29. = Zaporozhan, V.M., Gozhenko, A.I. Vid bioetiki do noetiki. Visnik NAN Ukraïni. 2004; 12: 22-29. = Zaporozhan, V.M., Gozhenko, A.I. [From bioethics to noo-ethics]. Visnik NAN Ukraïni. 2004; 12: 22-29.

13 Билецкий, С.В., Гоженко, А.И. Гипоксически-гиперкапнические тренировки в кардиологии. Черновцы. 2007. = Bileckij, S.V., Gozhenko, A.I. Gipoksicheski-giperkapnicheskie trenirovki v kardiologii. Chernovcy. 2007. = Bileckij, S.V., Gozhenko, A.I. [Hypoxic-hypercapnic exercises in cardiology]. Chernovcy. 2007.

Not without significance is the fact that decisions of Polish payer - National Health Fund (*pol. Narodowy Fundusz Zdrowia*), who is contracting hyperbaric treatment in Poland, are based on such recommendation.

## Conclusions

Initial conclusions are as follows:

1. Oxybarotherapy has a beneficial effect on pregnancy implantation by improving endometrial susceptibility.
2. Oxybarotherapy accelerates the growth of the endometrium, improves its blood supply and oxygenation.
3. Oxybarotherapy has a beneficial effect on sperm cell viability and motility.
4. The inclusion of oxybarotherapy as a supporting method for improving fertility should be considered in Poland.

## Literature

1. Bartnik E., Hołówka J., Szawarski Z., Zaremba J., Zielińska E. Założenia regulacji prawnej dotyczącej wspomaganie medycznie prokreacji, stanowisko końcowe sformułowane przez grupę ekspertów biorących udział w pracach tzw. Komisji Gowina. Warszawa, październik 2008 r.
2. Jovanovic A.M. Hyperbaric Oxygenation Therapy in Infertility Patients. *Crit Care Obst & Gyne.* 2016; 2:1. doi:10.21767/2471-9803.100012.
3. Łepecka-Klusek C., Pilewska-Kozak A.B., Niepłodność w świetle definicji choroby podanej przez WHO. *Medycyna Ogólna i Nauki o Zdrowiu*, 2012; 18(2): 162–165.
4. Sieroń A., Cieślak G. *Zarys medycyny hiperbarycznej*, wyd. II  $\alpha$ -medica 2007 Bielsko-Biała. 23.
5. Skrzypulec V., Nowosielski K., Droszól A., Kowalaczyk R. Sexual dysfunctions in selected endocrinopathies. *Endokrynologia Polska.* 2005; 6(56): 964-969.
6. Zielińska E. Opinia sporządzona 21 maja 2015 r. na zlecenie Biura Analiz Sejmowych (druk sejmowy nr 3245/VII kad.); na temat rządowego projektu ustawy o leczeniu niepłodności; *Zeszyty Prawnicze Biura Analiz Sejmowych Kancelarii Sejmu.* 2015; 4(48): 183–196.
7. Гоженко, А.И. Очерки теории болезни. Одеса. 2010. = Gozhenko, A.I. Ocherki teorii bolezni. Odesa. 2010. = Gozhenko, A.I. [Essays of the theory of disease]. Odesa. 2010.
8. Запорожан, В.М., Гоженко, А.И. Від біоетики до ноетики. *Вісник НАН України.* 2004; 12: 22-29. = Zaporozhan, V.M., Gozhenko, A.I. Vid bioetiki do noetiki. *Visnik NAN*

Ukraïni. 2004; 12: 22-29. = Zaporozhan, V.M., Gozhenko, A.I. [From bioethics to noo-ethics].  
Visnik NAN Ukraïni. 2004; 12: 22-29.

9. Билецкий, С.В., Гоженко, А.И. Гипоксически-гиперкапнические тренировки в кардиологии. Черновцы. 2007. = Bileckij, S.V., Gozhenko, A.I. Gipoksicheski-giperkapnicheskie trenirovki v kardiologii. Chernovcy. 2007. = Bileckij, S.V., Gozhenko, A.I. [Hypoxic-hypercapnic exercises in cardiology]. Chernovcy. 2007.