

DOI: <http://doi.org/10.17816/2313-8726-2024-11-1-77-82>



# Magneto-infrared-light-laser therapy and ozone therapy in the complex treatment of salpingo-oophoritis after medical abortion

Asiyat E. Esedova, Albina Yu. Islamova

Dagestan State Medical University, Makhachkala, Russia

## ABSTRACT

**Background.** Complications following artificial abortion can lead to reproductive dysfunction and gynecological diseases, endocrine disorders, infertility, and miscarriage. One of the most important tasks of practical healthcare is the introduction of safer abortions and an adequate rehabilitation system, including early, as well as ultrasound, diagnostics of emerging complications, into the practice of obstetricians and gynecologists.

**Materials and methods.** The study included 124 female patients (average age, 34.8±1.7 years) who applied for pregnancy termination in the first trimester. The women were divided into three groups. Group 1 included 52 (42.0%) female patients who received magnetic-infrared-light-laser and ozone therapy to prevent complications following a medical abortion in a complex of therapeutic measures with antibacterial drugs. Group 2 included 24 (19.3%) patients who had dysbiosis, allergic reactions, and drug disease and who used magnetic-infrared-light-laser and ozone therapy without antibiotics to prevent postabortion complications. The control subgroup comprised 48 (38.7%) patients who did not receive treatment for the prevention of complications.

**Results.** A more rapid change in the size of the uterus toward normalization was noted in women in groups 1 and 2 who received preventive measures. In addition, 1 (2.0%) patient in group 1, 1 (4.1%) in group 2, and 3 (6.2%) in the control group had an exacerbation of bilateral chronic salpingo-oophoritis.

**Conclusions.** The use of modern technologies (magnetic-infrared-light-laser and medical ozone therapy) with and without antibacterial therapy as preventive measures has a positive effect on uterine contractility and reduces the risk of inflammatory complications in the first months following artificial termination of pregnancy. Ultrasonography of the pelvic organs and laser biophotometer can be used as diagnostic tests and can assess the development of complications following a medical abortion.

**Keywords:** medical abortion; magnetic-infrared-light-laser; ozone therapy; ultrasound of the pelvic organs; laser biophotometry.

## To cite this article:

Esedova AE, Islamova AY. Magneto-infrared-light-laser therapy and ozone therapy in the complex treatment of salpingo-oophoritis after medical abortion. *V.F. Snegirev Archives of Obstetrics and Gynecology*. 2024;11(1):77–82. doi: 10.17816/2313-8726-2024-11-1-77-82

Received: 03.10.2023

Accepted: 04.02.2024

Published: 27.03.2024

DOI: <http://doi.org/10.17816/2313-8726-2024-11-1-77-82>

# Магнито-инфракрасная-светолазерная терапия и озонотерапия в комплексном лечении сальпингоофорита после медицинского аборта

А.Э. Эседова, А.Ю. Исламова

Дагестанский государственный медицинский университет, Махачкала, Россия

## АННОТАЦИЯ

**Введение.** Осложнения после производства искусственного аборта приводят к нарушениям репродуктивной функции и развитию гинекологических заболеваний, эндокринных нарушений, бесплодию, невынашиванию беременности. Одной из важнейших задач практического здравоохранения является внедрение в практическую деятельность акушеров-гинекологов более безопасных аборт и адекватной системы реабилитации, включающих раннюю, в том числе ультразвуковую, диагностику формирующихся осложнений.

**Материалы и методы.** В исследование включены 124 женщины, обратившиеся для прерывания беременности в I триместре, средний возраст которых составил  $34,8 \pm 1,7$  года. Женщин разделили на 3 группы: в 1-ю основную группу вошли 52 (42,0%) женщины, которым для профилактики осложнений после медицинского аборта в комплексе лечебных мероприятий с антибактериальными препаратами применяли магнито-инфракрасную-светолазерную и озонотерапию; во 2-ю основную группу вошли 24 (19,3%) пациентки, которым в связи с дисбактериозом, аллергическими реакциями, лекарственной болезнью для профилактики послеабортных осложнений применяли магнито-инфракрасную-светолазерную и озонотерапию без антибиотиков. Контрольную группу составили 48 (38,7%) женщин, которым не проводилась профилактика осложнений.

**Результаты.** Отмечено более быстрое изменение размеров матки в сторону нормализации у женщин 1-й и 2-й основной группы, которым проводились профилактические мероприятия. Кроме того, у 1 (2,0%) пациентки 1-й основной группы, у 1 (4,1%) пациентки 2-й основной группы и у 3 (6,2%) пациенток контрольной группы имело место обострение двухстороннего хронического сальпингоофорита.

**Заключение.** Применение современных технологий (магнито-инфракрасная-светолазерная терапия и медицинский озон) в комплексе с антибактериальной терапией и без неё в качестве профилактических мероприятий оказывает положительное влияние на сократительную способность матки и позволяет снизить риск осложнений воспалительного характера в первые месяцы после искусственного прерывания беременности. УЗИ органов малого таза и лазерная биофотометрия могут быть применены в качестве диагностического теста и оценки развития осложнений после производства медицинского аборта.

**Ключевые слова:** медицинский аборт; магнито-инфракрасная-светолазерная терапия; озонотерапия; УЗИ органов малого таза; лазерная биофотометрия.

## Как цитировать:

Эседова А.Э., Исламова А.Ю. Магнито-инфракрасная-светолазерная терапия и озонотерапия в комплексном лечении сальпингоофорита после медицинского аборта // Архив акушерства и гинекологии им. В.Ф. Снегирёва. 2024. Т. 11, № 1. С. 77–82. doi: 10.17816/2313-8726-2024-11-1-77-82

## INTRODUCTION

Complications of artificial termination of pregnancy are associated with a variety of adverse outcomes, including reproductive, gynecological, and endocrine disorders, infertility, and miscarriage [1–3]. Consequently, one of the most significant considerations for obstetricians and gynecologists is providing their patients with safe methods of abortion and adequate rehabilitation options. This encompasses the early diagnosis of complications, including the use of ultrasonography [4–6].

Ultrasonography is a readily accessible diagnostic tool currently used in obstetrics and gynecology to obtain important medical information [7–9]. A transvaginal ultrasound is an imaging procedure used to diagnose a pregnancy as early as 5–7 days of period delay. At this time, a gestational sac is visualized in the intrauterine cavity; its diameter in millimeters is approximately equivalent to the number of days of delay. Ultrasound may usually visualize a developing embryo and detect its heartbeat as early as 5–6 weeks after conception. A post-abortion pelvic ultrasound provides a comprehensive examination of the intrauterine cavity and uterine appendages, aimed at detecting retained products of conception [10, 11].

A laser biophotometer is a device that measures the intensity of tissue-reflected laser light at specific wavelengths [12]. The method allows for objective treatment follow-up on a case-by-case basis with high diagnostic significance by assessing visually unchanged structures. Biophotometers are based on algorithms that regulate laser light characteristics. The optical properties of body tissues can be influenced by a number of factors, with the most pronounced effect being that of variations in blood supply resulting from inflammation, thermal exposure, and other factors [13, 14]. Abnormalities in a specific organ may affect its optical properties, which eventually return to normal during recovery.

It is essential to measure the impact of laser light exposure on a biological object [15–16]. The main characteristics of incident light that are currently considered include wavelength, output power, laser beam diameter and distribution, and exposure time.

## MATERIALS AND METHODS

The study included 124 women (mean age:  $34.8 \pm 1.7$  years) who sought a first trimester abortion. The participants were divided into three groups. Treatment group 1 ( $n=52$ , 42.0%) received preventive treatment for post-abortion complications, which consisted of antibacterial therapy in combination with magnetic infrared laser (MIL) therapy and ozone therapy. Treatment group 2 ( $n=24$ , 19.3%) included patients with dysbiosis, allergy, or drug disease, who were not advised to use antibiotics and received a combination of MIL and ozone therapy. The control group consisted of 48 women (38.7%) who did not receive any interventions to prevent

post-abortion complications. The patients were randomly assigned to study groups.

The patients underwent standard clinical examination and pelvic ultrasound. A laser biophotometer with an integrating recording camera was used to measure the laser light reflection of the uterine appendages.

## RESULTS

Prior to surgical termination of pregnancy, an ultrasound examination was performed in all subjects to assess the gestational age, identify an embryo in the gestational sac, determine the embryo's heartbeat, and assess concomitant pelvic abnormalities. The gestational age was determined by measuring either the diameter of the gestational sac or the length of the embryo.

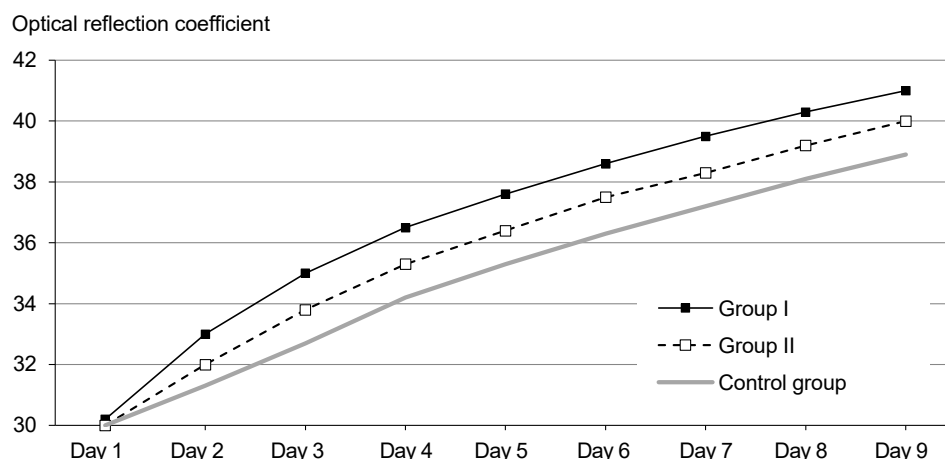
In approximately half of all cases (50.9%), ultrasound-guided surgical procedures were employed. With uterine evacuation, the endometrial echo complex (EEC) exhibited a gradual shift from a round/oval to an elongated and slit-shaped configuration, accompanied by a gradual decrease in the anteroposterior dimensions of the uterus. Following the complete evacuation, the EEC pattern corresponded to a hyperechoic and often non-uniformly thickened strip with ultrasonic amplification.

On Day 7 or 8 post-abortion, 97 patients (78.2%) had a follow-up pelvic ultrasound to assess the intrauterine cavity, anteroposterior dimensions, and uterine contents.

A comparative analysis of ultrasound images demonstrated that postoperative uterine dilation was observed in 4 patients (7.8%) in Group 1 who received MIL therapy + ozone therapy in combination with antibiotic therapy, 2 patients (8.3%) in Group 2 treated who received MIL therapy + ozone therapy without antibiotics, and 9 control patients (18.8%). Uterine dilation can be generally explained by the presence of liquid in the uterus, which may include liquid blood, blood clots, and decidual residues. In patients from Groups 1 and 2 who received preventive treatment, the uterine dimensions returned to normal faster than in control patients.

Moreover, one patient in Group 1 (2.0%), one patient in Group 2 (4.1%), and 3 control patients (6.2%) experienced aggravation of chronic bilateral salpingo-oophoritis. Ultrasound examination revealed that the fallopian tubes were dilated, diffusely thickened, and elongated, with heterogeneous contents and increased sound conductivity. The ovaries were enlarged and slightly hyperechoic; the follicular apparatus (follicles) was not visualized. Furthermore, there was tenderness to transducer pressure on the ovaries. One-half of these patients had free fluid accumulation within the rectouterine pouch.

At Visit 2 (1 month post-abortion), no patients from Groups 1 and 2, compared to 6 control patients (12.5%), had signs of uterine dilation, which was identified as an evident risk factor for chronic endometritis. Given the patients' expressed desire to preserve their fertility, a second cycle



**Fig. 1.** Dynamics of the optical reflection coefficient of complications after medical abortion.

of MIL therapy + ozone therapy was performed using the approved treatment schedule for the prevention of chronic endometritis.

We used the biophotometric method for recording the optical reflection from the uterus and uterine appendages. It was found that the mean reflection coefficient decreased by 28% to  $29.8 \pm 2.5$  AU (normal  $42.7 \pm 3.2$  AU) on Day 1 post-abortion.

On Day 4 or 5, the reflection coefficients in Groups 1 and 2 changed insignificantly, with an increase by 3.0% and 2.6%, respectively, but no more than  $30.1 \pm 1.4$  AU, compared to control patients whose values remained largely unchanged until Day 6 or 7. The reflection coefficients in Groups 1 and 2 demonstrated a notable shift as early as Day 7 or 8 post-abortion, compared to Day 9 or 10 in control patients.

Biophotometric monitoring reliably demonstrated a significant difference in the complicated course of the post-abortion period between the study patients (Fig. 1).

On Day 4 or 5, the combination therapy of post-abortion complications resulted in a reduction of the reflection coefficients to 26.7 AU in two patients (3.9%) from Group 1, three patients (8.3%) from Group 2, and nine control patients (18.8%). This reduction was accompanied by clinical deterioration, including fever and pain syndrome. These patients required antibacterial therapy for the aggravation of pelvic inflammatory disease. All patients continued the combination of MIL therapy + ozone therapy.

The biophotometric analysis revealed the patterns associated with treatment failures. The lack of clinical improvement and persistence of inflammatory signs were evidenced by a significant decrease in the reflection coefficients to  $28.2 \pm 2.6$  AU, which required more aggressive treatment strategies.

## CONCLUSION

The data available from patients' medical histories and clinical, laboratory, and instrumental assessments suggest that the risk of post-abortion complications is attributed to a number of factors. Advanced technologies, such as magnetic

infrared laser therapy in combination with ozone therapy, with and without antibacterial therapy, improve uterine contractility and reduce the risk of inflammatory complications in the initial post-abortion period. Pelvic ultrasound and laser biophotometers can be used as reliable diagnostic tools to determine the probability of post-abortion complications.

## ADDITIONAL INFO

**Authors' contribution.** Both authors made a substantial contribution to the conception of the work, acquisition, analysis, interpretation of data for the work, drafting and revising the work, final approval of the version to be published and agree to be accountable for all aspects of the work.

**Funding source.** This study was not supported by any external sources of funding.

**Competing interests.** The authors declares that there are no obvious and potential conflicts of interest associated with the publication of this article.

**Ethics approval.** The study was approved by the Local Ethics Committee of Dagestan State Medical University (Protocol No. 12 dated December 22, 2022).

**Consent for publication.** All the patients who participated in the study signed the necessary documents on voluntary informed consent to participate in the study and the publication of their medical data.

## ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ

**Вклад авторов.** Оба автора внесли существенный вклад в разработку концепции, проведение исследования и подготовку статьи, прочли и одобрили финальную версию перед публикацией.

**Финансирование.** Авторы заявляют об отсутствии внешнего финансирования при проведении исследования.

**Конфликт интересов.** Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи.

**Этическое утверждение.** Проведение исследования одобрено Локальным этическим комитетом Дагестанского государственного медицинского университета (протокол № 12 от 22 декабря 2022 г.).

**Информированное согласие на публикацию.** Все пациентки, участвовавшие в исследовании, подписали необходимые

документы о добровольном информированном согласии на участие в исследовании и публикацию их медицинских данных.

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## AUTHORS INFO

**\*Albina Yu. Islamova**, graduate student;  
address: V.I. Lenin Square, 1, Makhachkala, 367012,  
Russian Federation;  
ORCID: 0009-0004-9778-1727;  
e-mail: isaev.doc@mail.ru

**Asiyat E. Esedova**, MD, Dr. Sci. (Medicine), Professor,  
Head of the Department;  
ORCID: 0000-0003-4125-3197;  
e-mail: umanovaaalbina@mail.ru

## ОБ АВТОРАХ

**\*Исламова Альбина Юсуповна**, аспирант;  
адрес: 367012, Махачкала, площадь им. В.И. Ленина, д. 1,  
Российская Федерация;  
ORCID: 0009-0004-9778-1727;  
e-mail: isaev.doc@mail.ru

**Эседова Асият Эседовна**, д-р мед. наук, профессор,  
зав. кафедрой;  
ORCID: 0000-0003-4125-3197;  
e-mail: umanovaaalbina@mail.ru

\* Corresponding author / Автор, ответственный за переписку