The role of new medical technologies in the relief of chronic pelvic pain and the rehabilitation of reproductive function

Irwa V. Kabulova*, Larisa V. Tsallagova
North Ossetian State Medical Academy, 362025, Russia, Vladikavkaz, Pushkinskaya str. 40

* Corresponding author: akusherstvo_1@mail.ru

Abstract
The low efficacy of ongoing conventional therapy and a significant decrease in the quality of life in patients with reconstructive plastic surgery (RPO) on the pelvic organs (PO) due to tubal-peritoneal infertility (TPI) and chronic nonspecific salpingo-oophoritis (CNSO) requires searching for new, promising methods of non-drug treatment, in particular, taking into account the regional characteristics of the Republic of North Ossetia-Alania and its natural resources. One of the main ways to increase the efficacy and intensify the treatment of this category of patients is the use of natural factors, namely, sulfide waters of the local Redant-4 deposit, which have a number of anti-inflammatory effects. Purpose of the study is to assess the role of non-drug technologies using magnetic infrared-laser therapy and balneological factors of the local deposit in the rehabilitation of the reproductive function in patients undergoing reconstructive plastic surgery due to TPI and CNSO. Material and methods. 235 women with impaired reproductive function, who underwent laparoscopic reconstructive plastic surgery on the pelvic organs (RPO on PO) due to tubal-peritoneal infertility (TPI) and CNSO, whose average age was 28 ± 7 years, were examined. 2 groups were formed by the method of blind sampling: the main group consisted of 139 women with RPO on PO due to TPI and CNSO, who, along with conventional therapy, received magnetic IR-laser therapy and had sulfide baths; the comparison group included 96 women with RPO on PO due to TPI and CNSO, whose treatment was carried out by conventional methods of drug therapy. The conventional treatment included along with antibiotic therapy the use of ecological adaptogens (aloe, aiplac), immune modulators (polyoxidonium), vitamin therapy (vitamin E 100 mg / day for 3 months and B vitamins), drugs to eliminate disorders in the intestinal and vaginal flora (antifungal agents: fluconazole, tergynan, acylact for 7-14 days). The patients of the studied groups were observed before their treatment and 1-12 months after the treatment. All patients underwent a clinical and functional examination. Statistical processing of the material was carried out using the package Statistica for Windows. Results. A control examination of patients of both groups showed a more pronounced positive effect on the course of a number of clinical symptoms in the postoperative period in the main group of patients who received magnetic IR laser therapy and had sulfide baths of the North Ossetian deposit in the complex of therapy. As a result of the physiotherapy treatment, the pain syndrome was eliminated in 107 of 139 patients (77%) who complained of pain before their treatment. A decrease in pelvic pain after the course of treatment was noted in 46 patients (33%). It should be noted that in the majority of patients 94 (68%), who received sulfide balneotherapy, a decrease in the formation of repeated adhesions of the pelvis was revealed during the procedures, the effectiveness of the regression of the adhesive process was found throughout the observation. It was detected that against the background of the proposed non-drug technology in the rehabilitation treatment of patients with RPO on PO due to TPI and CNSO, a significant increase in the effectiveness of treatment of this pathology (89%), improvement in the quality of life of patients as well as restoration of fertility has been achieved. Conclusions. The use of the method of sulfide balneotherapy in patients with RPO on PO due to TPI and CNSO allows shortening the duration of their next treatment and achieving the maintenance of positive dynamics and duration of regression of the adhesive process of the pelvis.

Keywords
Tubal-peritoneal infertility, CNSO, Hydrogen sulfide baths, Magnetic IR-laser therapy

Imprint

It is reported by present-day health care system that we observe a growth in the rate of nonspecific pelvic inflammatory diseases (PID) complicated by tubal-peritoneal infertility and miscarriage, despite

Submitted: 23.05.2022; Accepted: 18.06.2022; Published online: 20.08.2022
the latest achievements in diagnostics and treatment of these diseases and the advancements in design and production of antibacterial drugs [1]. An important aspect of therapy of this category of the patients, in addition to diagnostic and treating reconstructive plastic surgery on the pelvic organs, is to treat the inflammation process and rehabilitate the reproductive function. Among the post-surgery complications the most significant are the residual stable pain syndrome (21-80%), disorders of the reproduction function (75-82%) both due to alterations in the endocrine status and the tubal-peritoneal factors, disorders in the psycho-emotional area and impaired life quality [2].

The low efficacy of ongoing conventional therapy and a significant decrease in the quality of life in patients upon reconstructive plastic surgery (RPO) on the pelvic organs (PO) due to tubal-peritoneal infertility (TPI) and chronic nonspecific salpingo-oophoritis (CNSO) requires searching for new, promising methods of non-drug treatment, in particular, taking into account the regional characteristics of the Republic of North Ossetia-Alania and its natural resources [3, 4, 5]. One of the main ways to increase the efficacy and intensify the treatment of this category of patients is the use of natural factors, namely, sulfide waters of the local Redant-4 deposit, which have a number of anti-inflammatory effects. In this connection, a topical issue is the use of magnetic IR- laser therapy to treat chronic pelvic inflammatory diseases that produces an effect of the regeneration and recovery of cells and tissues in an organism upon a damage by microbial agents and traumatic processes [6, 7].

All the above has been found as a prerequisite for studying the efficacy of the application of sulfide balneotherapy as a combined treatment of patients with reproductive function disorders.

**Purpose of the study**

The purpose of our study has been to assess the role of non-drug technologies using magnetic-infrared-laser therapy and balneological factors of the local deposit in the rehabilitation of the reproductive function in patients undergoing reconstructive plastic surgery due to TPI and CNSO.

**Material and methods**

235 women with impaired reproductive function (due to TPI and CNSO) and pelvic pain of various intensities, aged from 23 to 42 years, were subjected to our dynamic data examination.

All patients were divided into 2 groups considering the actual treatment measures taken.

The main group consisted of 139 women with RPO on the pelvic organs due to TPI and CNSO, who, along with conventional therapy, received magnetic IR-laser therapy and had hydrogen sulfide baths; the comparison group included 96 women with RPO on PO due to TPI and CNSO, whose treatment was carried out by the conventional methods of drug therapy. The conventional treatment included along with antibiotic therapy the use of ecological adaptogens (aloe, Apilac), immune modulators (Polyoxidonium), vitamin therapy (vitamin E 100 mg / day for 3 months and B vitamins) and medical drugs to eliminate disorders in the intestinal and vaginal flora (antifungal agents: Fluconazole, Tergynan, Acylact for 7-14 days).

The physiotherapeutic exposure has been provided by applying the hardware & software system CAP-ELM-01 Andro-Gyn developed and manufactured by Yanininvest Ltd. (Moscow, Russia). This equipment has been employed to carry out magnetic infrared laser therapy and color rhythmic therapy, which are involved to enhance the therapeutic effect under the minimized load on a human organism. The hydrogen sulfide balneotherapy has been provided as general baths and vaginal irrigations with procedure duration up to 10 minutes at a thermal water temperature from 37 to 42°C.

The patients of the studied groups were observed before their treatment and 1-12 months after their treatment, and in doing so the long-term outcomes have been assessed in 215 patients (91,4%) within 3-12 months after the treatment completion on the basis of the follow-up out-patient consultations.

All patients underwent a clinical and functional examination.

Under the gynecologic examination, the condition of the skin surface and the visible mucosa of the external genitalia, vagina and vaginal-cervical region was assessed; during the bimanual examination evaluated have been pain feeling and enlargement of the uterus and the adnexa as well as their motion tenderness.

Pelvic ultrasound testing (UT) before treatment as well as a dynamic assessment of the efficacy of the treatment in all patients was carried out with the use of Aloka SSD-1400. The transvaginal echography is actually a screening method of the reliable noninvasive diagnostics. The sonography is capable of diagnosing with inflammatory diseases in the pelvic area, detecting swollen or fluid-filled fallopian tubes (hydro- and
pyosalpinx), revealing pelvic processes, alterations in the ovary structure and the endometrium.

The Doppler ultrasonography was applied to measure flow rates in the uterine arteries. It is currently a common knowledge that it is just the Doppler ultrasound test that is the simplest, most safe and reliable technique of the noninvasive diagnostics of blood vessel damage that may be also used for the purpose of a dynamic assessment of the efficacy of the medication treatment. The Doppler ultrasonography was completed by us on day 5-8 of the menstrual cycle as well as before and after the treatment.

Hysterosalpingography (HSG) in order to assess the anatomical condition of the uterus, the fallopian tubes and their patency, detect possible abnormalities and congenital anomalies in patients with RPO on PO due to TPI and CNSO and reveal an adhesion process in the pelvic area has been conducted on day 16-24 of the menstrual cycle with the use of water-soluble contrast agents; then we have made a set of hysterosalpingograms of the pelvic cavity. Following this way, pregnancy has been considered as an absolute contraindication to this procedure.

The diagnostic laparoscopy to evaluate the anatomical condition of the fallopian tubes, the uterus and the ovaries have been carried out in 62 patients by applying the laparoscopic instrument manufactured by Karl Storz after completion of the sonographic scanning and hysterosalpingography.

In order to define the immune system potential in serum, we have utilized the flow cytometry as the immune cell phenotyping involving monoclonal antibodies with CD markers for different lymphocyte subpopulations, and phagocytosis was measured according to the presence of fluorescently labeled bacteria within phagocytes.

Statistical processing of the obtained data was performed by the generally accepted methods of parameter- and nonparameter-referred statistical data processing with the standard applied software STATGRAFICS FOR WINDOWS, the Russian software STADIA and the software EXCEL. For the purpose of the analysis of the obtained statistics data, we have employed the Student-Fisher t test with the applicable criteria of significance in variances in the test results obtained (p).

**Results and Discussion**

In accordance with the formulated purpose, we examined and treated 235 patients who underwent RPO due to TPI and CNSO in the early and late postoperative periods. Our attention was drawn to the high percentage (61%) of extragenital diseases and surgical interventions suffered by the patients. It was revealed that 63% of the patients had a history of various gynecological diseases and surgical interventions. 62% of them had colpitis of various etiologies; 45% had cervical erosion; 57% had abortions, 34% had spontaneous miscarriages; 13% underwent surgery to remove retention ovarian cysts; 5% of them had tubal pregnancy was surgically treated; 4% required surgery treatment of ovarian apoplexy; 23% of the patients underwent the caesarean section procedure; opening of an abscess of the Bartholin gland was recorded for 2% of the patients. The causes of the inflammatory process in 37% of the women were abortions; in 20% of the cases they included pathological childbirth and complications of the postpartum period; in 24% of the patients they were caused by sudden hypothermia, and in 10% of the patients it was provoked by surgical interventions (appendectomy, tubectomy, caesarean section).

The main complaints of the observed women were pain in the lower abdomen and the lumbosacral region, disorders in their menstrual, generative functions, changes in their general well-being. 87% of the observed women had pain in the lower abdomen and lumbosacral region of varying intensity, mostly of achining nature, unrelated to the phases of the menstrual cycle; 56% of them had pain radiating to the anus and inner thighs. In 48% of the patients, it appeared periodically, in 51% of the cases it was reported to be permanent.

Menstrual irregularities were reported in 71% of the examined women, and they appeared already 6 months - 3 years after the onset of the disease, and the most common forms of the disorder were algomenorrhea, hypomenorrhea, and menstrual irregularity. The reproductive function was impaired by the primary and secondary infertility in 189 females (81%) and due to early pregnancy losses recorded in 46 examined women (19%); 102 patients (43%) had a history of pregnancy.

To assess the morphofunctional state of the pelvic organs, the patients under observation underwent ultrasound test of the internal organs. In all patients no increase in the size of the uterus was recorded. The thickness of the endometrium in all cases of the examination corresponded to the phase of the cycle and did not exceed the normal values for the respective
phase of the cycle in which the ultrasound test was performed. There were no changes in the configuration of the uterus reported, and its contour was clear and uniform. Most often, in the examined females, the ultrasound examination determined the heterogeneity of the structure of the ovaries, an increase in their sizes, fuzzy contours, and polymorphism of the follicles. Adhesions in the form of echo-negative inclusions of an elongated linear shape, mainly in parametrical, paraovarian areas or in the retrouterine space, were diagnosed in almost all patients.

Hysterosalpingography, performed in all patients with infertility in order to clarify the anatomical features of the uterus and the fallopian tubes, revealed an adhesive process in the pelvis in 47% of the patients, and obstruction of the tubes either on one or both sides was found in 53% of the patients. The X-ray tests confirmed the extent and severity of the local changes and contributed to the detection of tubal-peritoneal infertility. A comparative analysis was carried out between the main group (139 patients), who, in order to rehabilitate and improve the effectiveness of the treatment of pain after RPO on PO due to TPI and CNSO, received the non-drug methods of treatment, including magnetic infrared-laser therapy and hydrogen sulfide baths of the North Ossetian deposits, and a comparison group (96 patients) who did not undergo physiotherapeutic methods of treatment. The use of magnetic infrared-laser therapy and the hydrogen sulfide baths made a positive effect on the course of a number of clinical symptoms of the disease. In the main group, as a result of the treatment, the pain syndrome was eliminated in 107 patients (77%). Mitigation of pelvic pain after the course of treatment was noted in 46 patients (33%). The pain intensity remained at the same level in 10 patients (10.4%). It should be noted that in the majority of patients composed by 94 females (68%) who received magnetic infrared-laser and balneotherapy, a reduction in their pain intensity was reported already from the beginning of physiotherapy procedures (3-4 days), and the full disappearance of pain was recorded by the end of their treatment. In parallel, fatigue, irritability, emotional lability, sleep disturbances, headaches decreased or fully disappeared, while their working capacity and mood was improved.

In the comparison group, the pain syndrome was eliminated in 56 patients (58%), decreased in 22 females (23%), remained at the same level in 30 female individuals (31%). The analgesic effect of treatment in that group of patients was manifested in most cases in the periodic nature of pain. Along with the improvement of the general condition and the manifestation of a pronounced analgesic effect produced by physiotherapy in the main group, a positive dynamics of other clinical symptoms of the disease was observed during the treatment. A favorable effect on the menstrual function was noted in 84 of 139 patients (60.4%) of the main group. With dysmenorrhea, hypomenorrhea, the normalizing effect of the treatment was found to be equally pronounced in both groups. It was revealed that the recovery of the proper rhythm of menstruation in a greater percentage of cases (68.5%) was observed in the main group after the complex treatment. In the comparison group, the normalization of the menstrual function was reported in 32 of 96 patients (33%).

We studied the state of various parts of the immune system status in the patients who received magnetic infrared-laser therapy and spa treatment in the context of their complex treatment during the postoperative rehabilitation period (see Table 1 herein).

### Table 1

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Before treatment</th>
<th>After treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main group</td>
<td>Comparison group</td>
</tr>
<tr>
<td>T-lymphocytes (CD+3, %)</td>
<td>47.2±0.5</td>
<td>60.3±1.1</td>
</tr>
<tr>
<td></td>
<td>48.4±1.3</td>
<td></td>
</tr>
<tr>
<td>T-helpers (CD+3CD+4, %)</td>
<td>25.4±0.6</td>
<td>38.4±1.5</td>
</tr>
<tr>
<td></td>
<td>27.1±1.8</td>
<td></td>
</tr>
<tr>
<td>T-cytotox. (CD+3 CD+8%)</td>
<td>25.3±0.8</td>
<td>32.0±7.5</td>
</tr>
<tr>
<td></td>
<td>28.9±0.9</td>
<td></td>
</tr>
<tr>
<td>B-lymphocytes (CD19+, %)</td>
<td>23.4±0.7</td>
<td>17.2±1.7</td>
</tr>
<tr>
<td></td>
<td>23.8±1.5</td>
<td></td>
</tr>
<tr>
<td>Phagocytosis (granulocytes) %</td>
<td>55.2±0.3</td>
<td>75.0±2.3</td>
</tr>
<tr>
<td></td>
<td>65.4±1.6</td>
<td></td>
</tr>
</tbody>
</table>

In a comparative analysis of the indicators of the immune and interferon status, the phagocytic activity, we found that in the patients after the staged therapy, there was a significant increase in the level of the T-lymphocytes from 47.2±0.5 to 60.3±1.1 and the normalization of the B-lymphocytes from 23.4±0.7 to 17.2±1.7 in comparison with the group of those patients who received the conventional anti-inflammatory treatment. Against the background of magnetic infrared laser therapy and spa treatment, there was also an increase in the neutrophil phagocytic activity from 55.2±0.3 to 75.0±2.3.

According to the bimanual study at the end of the course of treatment, it was found that previously de-
Protected changes in the uterine appendages were absent in 106 of 139 patients (76%) of the main group. In the comparison group, a positive dynamics was recorded in 40% of the cases. The follow-up of patients for 12 months after their treatment revealed the stability of the achieved analgesic effect in the main group of the patients. Thus, the results of the studies indicate a pronounced analgesic, anti-inflammatory and absorbable effect produced by the magnetic infrared-laser and sulfide therapy.

The study of the long-term results showed that when using a course of magnetic infrared-laser therapy and hydrogen sulfide balneotherapy, the number of patients with relapses of the adhesive process within 12 months was 10 of 139 patients (7%) in the main group and 22 of 96 patients (23%) in the comparison group, respectively. In the patients after laser and balneotherapy, the positive dynamics of the clinical manifestations of the pelvic inflammatory process was maintained throughout the entire observation period. Pains were reported to be somewhat tougher after 7-9 months, but even after 10-12 months they did not reach the same intensity. When comparing the average values of the pain syndrome severity indicators, there were no significant differences in the indicators in the main group, however, the pain syndrome score in the comparison group was more static in the long-term period and changed to a lesser extent than in the patients of the main group (p<0.05).

We studied the main indicators of the effectiveness of rehabilitation therapy in the patients with RPO on PO due to TPI and CNSO, and that implied the onset of pregnancy and its favorable course. During the year, 16% of the patients in the comparison group became pregnant due to the use of assisted reproductive technologies (artificial insemination-AI). In the main group, 46 patients (33%) became pregnant against the background of the staged treatment without assisted reproductive technologies, and 16 patients (12%) against the background of AI at their own insistence. Pregnancy in the main group occurred in 62 patients (45%), against 18 women (19%) in the comparison group. An analysis of the outcomes of pregnancies and childbirth showed that in the comparison group only 54% of healthy, full-term children were born, while in all patients of the main group pregnancy ended on time in 84% of the cases. In the main group, 78% of the healthy children without signs of asphyxia, prematurity and intrauterine infection were recorded.

Thus, the study revealed statistically significant differences in the duration of the relapse-free period and recovery of fertility in the group of patients who received sulfide balneotherapy in combination with conventional therapy of reproductive disorders in the form of TPI and CNSO. The rehabilitation therapy scheme used in the patients with reproductive disorders of infectious and inflammatory genesis improved the quality of life, significantly increased the effectiveness of treatment with the onset of pregnancy reported in 46% of the cases, improved pregnancy outcomes with an increase in the number of timely births and a simultaneous decrease in the number of premature births.

Conclusions

The use of magnetic infrared-laser and the balneotherapy course with hydrogen sulfide waters of the North Ossetian deposit in the rehabilitation treatment of this category of patients with complications such as pain, infertility and miscarriage is pathogenetically justified and effective. The complex rehabilitation for the patients with the reproductive disorders of infectious and inflammatory genesis using magnetic infrared-laser therapy and sulfide waters of the local deposit contributed to the improvement of the quality of life, significantly increased the effectiveness of treatment with the onset of pregnancy in 45% of the cases, improved the pregnancy outcomes with an increase in the number of timely births and a simultaneous decrease in the number of premature births.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

References

1. Afanaseva AN. Restoration of microflora after antibiotic therapy is the key to preserving the biodiversity of the human microbiome in particular and health in general. StatusPraesens. 2017;5:73-80. [in Russian]


