

THE INFLUENCE OF TREATMENT TACTICS ON THE LEVEL OF QUALITY OF LIFE AND THE CONDITION OF THE NASAL CAVITY IN PATIENTS WITH CHRONIC ATROPHIC RHINITIS PROVOKED BY HARMFUL PRODUCTION CONDITIONS

Andrii V. Lupyr, Oleksii V. Poliakov

Kharkiv National Medical University, Kharkiv, Ukraine

Summary

Introduction. Various types of occupational hazards can cause the development of occupational atrophic rhinitis (AR). Researches determine the high prevalence of professional AR among workers in various fields of production. Drug treatment of RA is an important issue. The effectiveness of the use of autologous platelet-enriched plasma is determined. Determining the possibilities of increasing the effectiveness of treatment of professional AR with platelet-enriched plasma is a very relevant issue of modern medicine.

The aim. To evaluate the use of autologous platelet-rich plasma in occupational chronic AR compared to standard treatment (irrigation with oil solutions).

Materials and methods. 141 patients were examined: I group (32.6 %) received irrigation with oil solutions, II (39.7 %) – injections of platelet-rich plasma, and III (27.7 %) – injections of platelet-rich plasma and irrigation with oil solutions.

Results. Significant ($p < 0.001$) chances of improvement in quality of life levels were found in groups I and II compared to III one month after treatment, based on decreases in the values of the NOSE scale (respectively by 0.946 points and by 5.285 points) and increases values in the SF-36 questionnaire (RE scale and RR by 13.899 points; $p = 0.004$ and by 15.914 points only with combined treatment; MH scale – by 4.028 points and by 17.880 points; VT scale – by 5.136 points; $p = 0.005$ and by 24.158 points). Significant ($p < 0.001$) chances of an increase in nasocytogram indicators were determined in groups I and II compared to III: respectively, the pH of mucus (by 1.029 and by 1.333), the quantitative composition of neutrophils (by 18.958 % and by 21.078 %) and eosinophils (by 3.540 %) combined treatment only) and saccharin test indicators (at 0.3 min; $p = 0.005$ and at 1.696 min).

Conclusions. An improvement in the quality of life and parameters of the nasocytogram and saccharin test was determined when injections of platelet-rich plasma were used (both separately and in combination with irrigation with oil solutions) in patients with occupational chronic AR. Reliable chances of a decrease in NOSE scale values and an increase in SF-36 questionnaire indicators and chances of an increase in nasocytogram and saccharin test indicators were established.

Keywords: occupational chronic atrophic rhinitis, NOSE scale, SF-36 quality of life questionnaire, nasocytogram, saccharin test

INTRODUCTION

Atrophic rhinitis (AR) is a significant global health problem due to its high prevalence, significant financial losses, and negative impact on quality of life and work capacity [1].

Scientists have determined that various types of occupational hazards (dust, gases, smoke, vapors, and others) that can act in the workplace can cause the development of AR through immunological or irritating non-immunological mechanisms [2-4]. This position

is supported by the working group of the European Academy of Allergy and Clinical Immunology, which pointed out the close interaction between the upper and lower respiratory tracts and proposed the appropriate classification of AR subphenotypes, which is similar to occupational asthma [5-7].

In turn, a study conducted in Finland determined that the risk of AR development is particularly high for certain professions (bakers, food industry workers, farmers, veterinarians, livestock breeders, electronic product manufacturers and boat builders, and others) [8].

Other studies [9] indicated the prevalence of occupational AR among chemical laboratory workers (10-42 %), bakers (23-50 %). AR is common in workers working with latex (0.12-20 %) and food products (spices, vegetables, lupine) – 5-54 % [10] and seafood (shrimp, crab, turbot – 5-50 % [1]. Also, a high prevalence of occupational AR was determined among workers exposed to wood dust – 10-78 %, detergent enzymes – 2-19 %, and organic acid anhydrides (production of epoxy resins) – 10-28 % [11]. A high prevalence of occupational AR was also determined among workers who work with polyurethane paints (1-54 %) and among janitors and hotel cleaners (35 %) and hairdressers (8-27 %) [12] and pig farm workers (8-23 %).

Scientists have determined that exposure to certain occupational substances and nicotine abuse and the presence of atopic predisposition are considered the main risk factors for the development of AR [13]. A link between exposure to many occupational hazards and the development of IgE-mediated sensitization, resulting in AR, has been proven.

Drug treatment of AR is an important issue. According to the existing protocols, in case of chronic AR, drugs of general action are prescribed (internal administration of iodine preparations, iron preparations, vitamins of group A, D, B). In addition, biogenic stimulants are prescribed (aloe, placenta preparations, peloidin, and others). Local treatment includes rinsing the nasal cavity with peloidin, salicylic-alkaline solutions, enzyme preparations, iodinol for removing crusts and antimicrobial action. In addition, irrigation with oil solutions is used. Crusts are also removed with the help of long-term tamponade of the nose with turunds with the above solutions.

In recent years, the effectiveness of the use of autologous platelet-enriched plasma has been determined [14].

THE AIM OF THE STUDY

Evaluation of the use of autologous platelet-rich plasma in occupational chronic AR compared to standard treatment (irrigation with oil solutions).

MATERIALS AND METHODS

A randomized controlled single-center prospective case-control study was conducted, which is based on determining the impact on quality of life indicators and nasocytograms of different models of treatment tactics one month after the surgical treatment of chronic AR (tonsillectomy). The study was performed on the basis of the otolaryngology department of the Kharkiv Regional Clinical Hospital.

141 patients were examined, who were divided into three groups: the first group (46 (32.6 %) people) received classical treatment in the form of irrigation with oil solutions as a therapeutic tactic, the second (56 (39.7 %) patients) received injections of platelet-rich plasma into the thickness of the lower concha, and the third (39 (27.7 %) people) received combined treatment in the form of injections of platelet-rich plasma and irrigation with oil solutions.

All patients were fully informed before the start of the study about the voluntariness of their participation in this study and the complete confidentiality of the information received from them. The patients participated in the study of their own free will, which was confirmed by a personal signature in the informed consent. The inclusion criteria were: reaching the age of 18, the presence of chronic AR that was provoked by harmful working conditions (dust), work experience of at least 5 years, consent to participate in the study. Exclusion criteria were: age younger than 18 years, absence of chronic AR that was provoked by harmful working conditions (dust) and work experience of less than 5 years, presence of: diffuse and focal diseases, diabetes and other endocrine pathology, allergic reactions, systemic connective tissue diseases, acute and chronic inflammatory diseases of internal organs, severe decompensated somatic pathology, mental and oncological diseases, acute cardiovascular diseases, thyrotoxic crisis, acute and significant decompensation of carbohydrate metabolism, unsatisfactory physical condition, pregnancy and breastfeeding, chronic alcoholism, refusal to participate in research. The average age of the first group was 52.4 ± 5.4 years, the second – 53.1 ± 4.2 years, and the third – 51.5 ± 4.3 years. The duration of chronic AR from the moment of detection in the first group was 4.5 ± 1.5 years, in the second – 4.7 ± 1.6 years, and in the third – 3.8 ± 1.2 years.

Determination of the quality of life levels was carried out according to generally recognized questionnaires nasal obstruction symptom evaluation (NOSE) and Short Form-36 (SF-36). According to the SF-36 questionnaire, the scales of role functioning caused by the emotional state (RE) were studied; role functioning due to physical condition (RP); mental health (MH) and vital activity (VT). Examination of a smear from the nasal cavity for cell composition (nasocytogram) and saccharin test were performed by generally accepted methods.

Statistical analysis of the obtained results was performed using the IBM SPSS 25.0 application program package for Windows.

Qualitative indicators were described in the form of absolute and relative (%) values. When characterizing the central tendency and the variability of quantitative signs, the median and root mean square deviation were determined.

Comparison of two independent groups of quantitative indicators was performed using the Mann-Whitney U-test.

Associations of indicators with the binomial dependent variable were determined using multiple logistic regression analysis with the calculation of β -coefficients and their 95.0 % confidence intervals (CI). Model quality and multicollinearity testing were evaluated by the Nagelkerke R² test and the Durbin-Watson statistic [15], respectively.

Coding of groups in regression models was as follows: group with standard treatment (irrigation with oil solutions) – reference; the group using injections of platelet-rich plasma and the group with a combination of injections of platelet-rich plasma and irrigation with oil solutions – comparison groups.

The threshold value of the level of significance in the work was taken as $p = 0.05$.

RESULTS

According to the obtained results of associations of treatment tactics with indicators of the quality of life of patients with professional chronic AR, a month after the tonsillectomy, significantly better results of using injections of autologous platelet-rich plasma in the thickness of the lower concha (both separately and in combination with irrigation with oil solutions) were determined compared to standard treatment – table 1.

Table 1

Associations of treatment tactics with indicators of the quality of life of examined patients one month after surgical intervention

| Type of treatment | Beta coefficient | P | 95,0 CI |
|-------------------------------------|------------------|---------|----------------|
| NOSE, points | | | |
| Only plasma | -0,946 | < 0,001 | -1,361--0,530 |
| Irrigation and plasma | -5,285 | < 0,001 | -5,740--4,831 |
| R ² = 0,812; D-W = 1,126 | | | |
| SF-36 RE, points | | | |
| Only plasma | 7,276 | 0,092 | -1,212--15,765 |
| Irrigation and plasma | 13,899 | 0,004 | 4,614-23,185 |
| R ² = 0,06; D-W = 2,080 | | | |
| SF-36 RP, points | | | |
| Only plasma | -2,057 | 0,589 | -9,578-5,463 |
| Irrigation and plasma | 15,914 | < 0,001 | 7,687-24,141 |
| R ² = 0,141; D-W = 1,625 | | | |
| SF-36 MH, points | | | |
| Only plasma | 4,028 | < 0,001 | 1,304-6,752 |
| Irrigation and plasma | 17,880 | < 0,001 | 14,900-20,859 |
| R ² = 0,526; D-W = 1,469 | | | |
| SF-36 VT, points | | | |
| Only plasma | 5,136 | 0,005 | 1,570-8,701 |
| Irrigation and plasma | 24,158 | < 0,001 | 20,258-28,059 |
| R ² = 0,544; D-W = 1,510 | | | |

Notes: R² is the value of the Nagelkerke criterion; D-W is the value of the Durbin-Watson test

According to the NOSE scale, when using injections of platelet-rich plasma compared to standard treatment, the chances of reducing the total score of this scale by 0.946 points were determined reliably ($p < 0.001$) ($\beta = -0.946$; CI = $-1.361--0.530$). When applying a combination of injections of platelet-rich plasma and irrigation with oil solutions, the chances of a statistically significant ($p < 0.001$) reduction in the total score of the NOSE scale were already 5.285 points ($\beta = -5.285$; CI = $-5.740--4.831$).

All this indicated significant improvements in the quality of life of such patients – table 1.

According to the RE scale of the SF-36 questionnaire, with the separate use of injections of platelet-rich plasma, the chances of increasing the total score of the RE scale by 7.276 points were determined ($\beta = 7.276$; CI = $-1.212--15.765$). The obtained results were not statistically significant ($p = 0.092$). Statistically significant ($p = 0.004$) were the chances of increasing the RE scale

index by 13.899 points with combined treatment with injections of platelet-rich plasma and irrigation with oil solutions ($\beta = 13.899$; CI = 4.614-23.185) – table 1.

Defined statistically insignificant ($p = 0.589$) chances of reducing the indicators of the RR scale of the SF-36 questionnaire when using injections of platelet-rich plasma by 2.057 points ($\beta = -2.057$; CI = -9.578-5.463) and statistically significant ($p < 0.001$) chances of their increase – when irrigation with oil solutions is added to injections (by 15.914 points: $\beta = 15.914$; CI = 7.687-24.141) – table 1.

According to the obtained associations of the MH scale of the SF-36 questionnaire, statistically significant ($p < 0.001$) chances of increasing the MH scale indicators were determined both when using injections of platelet-rich plasma separately, and when adding standard treatment to them (respectively by 4.028 points: $\beta = 4.028$;

CI = 1.304-6.752 and for 17.880 points: $\beta = 17.880$; CI = 14.900-20.859) – table 1.

Associations according to the VT scale of the SF-36 questionnaire showed statistically significant odds of increasing the VT scale indicators in the treatment with enriched plasma injections (by 5.136 points: $\beta = 5.136$; CI = 1.570-8.701; $p = 0.005$) and with the combination of injections and oil irrigation solutions (for 24.158 points: $\beta = 24.158$; CI = 20.258-28.059; $p < 0.001$) – table. 1.

Based on the obtained associations of treatment tactics and nasocytogram indicators, better results were determined in treatment with injections of platelet-rich plasma (both separately and in combination with irrigation with oil solutions) in contrast to conventional treatment (irrigation with oil solutions). The best results are determined when, in addition to injections of platelet-rich plasma, irrigation with oil solutions is used – table 2.

Table 2

Associations of treatment tactics with parameters of the nasocytogram of examined patients one month after surgical intervention

| Type of treatment | Beta coefficient | P | 95,0 CI |
|-------------------------------------|------------------|---------|---------------|
| pH slime | | | |
| Only plasma | 1,029 | < 0,001 | 0,908-1,149 |
| Irrigation and plasma | 1,333 | < 0,001 | 1,201-1,465 |
| R ² = 0,769; D-W = 1,651 | | | |
| Neutrophils, % | | | |
| Only plasma | 18,958 | < 0,001 | 16,632-21,284 |
| Irrigation and plasma | 21,078 | < 0,001 | 18,533-23,623 |
| R ² = 0,714; D-W = 1,004 | | | |
| Eosinophils, % | | | |
| Only plasma | 0,030 | 0,870 | -0,325-0,384 |
| Irrigation and plasma | 3,540 | < 0,001 | 3,151-3,928 |
| R ² = 0,757; D-W = 1,313 | | | |
| Saccharin test, min | | | |
| Only plasma | 0,300 | 0,005 | 0,090-0,509 |
| Irrigation and plasma | 1,696 | < 0,001 | 1,467-1,925 |
| R ² = 0,637; D-W = 1,930 | | | |

Notes: R2 is the value of the Nagelkerke criterion; D-W is the value of the Durbin-Watson test

When platelet-rich plasma injections were used compared to standard treatment, the odds of a 1.029 increase in mucus pH were determined; and when adding irrigation with oil solutions – by 1.333 (respectively $\beta = 1.029$; CI = 0.908-1.149 and $\beta = 1.333$; CI = 1.201-1.465). The obtained results were statistically significant ($p < 0.001$) – table 2.

Statistically significant ($p < 0.001$) chances of increasing the quantitative composition of neutrophils by 18.958 % and 21.078 % were found (respectively, treatment with plasma injections – $\beta = 18.958$; CI = 16.632-21.284 and when adding irrigation with oil solutions – $\beta = 21.078$; CI = 18,533-23,623) – table 2.

Statistically insignificant chances of an increase in the number of eosinophils during treatment with plasma

injections were determined (by 0.030 %: $\beta = 0.030$; CI = -0.325-0.384; $p = 0.870$) and statistically significant – when added standard treatment (by 3.540 %: $\beta = 3.540$; CI = 3.151-3.928; $p < 0.001$) – table 2.

Also determined are the chances of increasing the saccharin test indicators by 0.3 min when using plasma injections ($\beta = 0.300$; CI = 0.090-0.509; $p = 0.005$) and when adding irrigation with oil solutions to the injections – by 1.696 min ($\beta = 1.696$; CI = 1.467-1.925; $p < 0.001$). Thus, it was established that the functioning of the mucociliary transport system of patients after surgery was slowed down when using the proposed treatment (especially in the combined version) – table 2

DISCUSSION

The obtained results regarding the reliable improvement of the quality of life and parameters of the nasocytogram and saccharin test when using platelet-rich plasma in patients with chronic AR are fully consistent with other conducted studies (Mostafa H. S. et al.) [14] determined that when treating patients with chronic AR with platelet-rich plasma, their condition significantly improved and the frequency of the most common symptoms decreased. Thus, before the use of platelet-enriched plasma, these patients had: nasal crusts (92.30 %), stench (79.48 %), nasal congestion (76.92 %), anosmia (43.58 %) and nosebleeds (17.94 %); after a month, crusts in the nose (53.84 %), stench (64.10 %), nasal congestion (53.84 %), anosmia (38.46 %) and nosebleeds (17.94 %) were noted. Six months after the use of platelet-rich plasma, the prevalence of symptoms further decreased: nasal crusts (23.07 %), stench (33.33 %), nasal obstruction (35.89 %), anosmia (33.33 %) and epistaxis (7.69 %). In addition, the patients showed an improvement in the sino-nasal test (SNOT-25), which decreased six months after the use of platelet-rich plasma from 40 to 9. Similarly, an improvement in the mucociliary clearance time was noted according to the reduction of the saccharin test from 1980 seconds to 920 seconds six months after using platelet-rich plasma.

Our results are also confirmed by the studies of Kim D. H. et al. [16], who also determined the improvement of nasal symptoms during the study period based on the NOSE and SNOT-22 scales and the saccharin test after the use of platelet-rich plasma. Thus, according to their data, when using platelet-rich plasma, the NOSE (throughout the study) and SNOT-22 (1 month after the injection) were significantly lower compared to the pretreatment level, and the saccharin test values improved up to 3 months after the injections.

Maoua M. et al. [1] in their research also determined the negative impact of occupational rhinitis on indicators of quality of life. They conducted a cross-sectional study in the Department of Occupational Medicine at Farhat Hached Teaching Hospital, Tunisia of patients diagnosed with occupational AR. They assessed quality of life using the Mini-RQLQ questionnaire, and impaired work attendance was measured using the WPAI questionnaire. In total, 414 patients with an average age of 37.82 ± 8.08 years were included in the study. The textile and clothing industry was the most represented industry among the examined patients (65.7 %). The average percentage of missed working time due to illness was 9.98 ± 20.86 %, and the average absenteeism score was 46.7 ± 32.67 %. The overall quality of life score of such patients was 2.71 ± 1.31 . The biggest were limitations in

solving practical problems and limitations of activities. In general, missing working hours was positively correlated with the age of the patients and the scores of eye symptoms; and absence from work and percentage of total activity impairment were positively correlated with significant nasal congestion and daily activity limitation scores.

CONCLUSIONS

On the basis of the conducted studies, improvement of the quality of life and parameters of the nasocytogram and saccharin test was determined when using injections of platelet-rich plasma (both separately and combined with irrigation with oil solutions) in contrast to the usual treatment (irrigation with oil solutions) in patients with professional chronic AR. The results obtained one month after treatment indicate reliable chances of a decrease in NOSE scale values and an increase in SF-36 questionnaire indicators (RE, RR, MH and VT scale) and chances of an increase in nasocytogram and saccharin test indicators.

Prospects for further research. For a more objective assessment of the results, further studies are needed due to a longer period of application of platelet-rich plasma (both alone and in combination with irrigation with oil solutions).

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The authors declare no conflict of interest regarding this article.

COMPLIANCE WITH ETHICAL REQUIREMENTS

The ethical approval was obtained from Bioethics Committee of the Kharkiv National Medical University. All patients provided written consent to participate in research in accordance with the recommendations of the Ethics Committees for Biomedical Research, Ukrainian Health Legislation and the Declaration of Helsinki of 2000, European Community Directive 86/609 On Human Participation in Biomedical Research.

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Резюме

ВПЛИВ ЛІКУВАЛЬНОЇ ТАКТИКИ НА РІВЕНЬ ЯКОСТІ ЖИТТЯ ТА СТАН ПОРОЖНИНИ НОСА У ХВОРИХ НА ХРОНІЧНИЙ АТРОФІЧНИЙ РИНИТ, СПРОВОКОВАНИЙ ШКІДЛИВИМИ УМОВАМИ ВИРОБНИЦТВА

Андрій В. Лупир, Олексій В. Поляков

Харківський національний медичний університет, м. Харків, Україна

Вступ. Різні види професійних шкідливостей можуть викликати розвиток професійного атрофічного риніту (АР). Дослідження визначають високу поширеність професійного АР у працівників різних сфер виробництва. Важливим питанням є медикаментозне лікування АР. Визначається ефективність застосування аутологічної збагаченої тромбоцитами плазми. Визначення можливостей підвищення ефективності лікування професійного АР збагаченою тромбоцитами плазми є особливо актуальним питанням сучасної медицини.

Мета дослідження. Оцінити використання аутологічної збагаченої тромбоцитами плазми при професійному хронічному АР порівняно зі стандартним лікуванням (іригації масляними розчинами).

Матеріали та методи. Обстежено 141 хворого: I група (32,6 %) отримувала іригації масляних розчинів, II (39,7 %) – ін'єкції збагаченої тромбоцитами плазми та III (27,7 %) – ін'єкції збагаченої тромбоцитами плазми й іригації масляними розчинами.

Результати. Констатовано достовірні ($p < 0,001$) шанси на покращення рівнів якості життя в I та II групах порівняно з III через місяць після лікування за зниженнями значень шкали NOSE (відповідно на 0,946 балів і на 5,285 балів) і збільшенням показників опитувальника SF-36 (шкала RE і RP на 13,899 балів; $p = 0,004$ і на 15,914 балів лише при комбінованому лікуванні; шкала MH – на 4,028 балів і на 17,880 балів; шкала VT – на 5,136 балів; $p = 0,005$ і на 24,158 балів). Визначено достовірні ($p < 0,001$) шанси на збільшення показників назоцитограми в I і II групах порівняно з III: відповідно рН слизу (на 1,029 і на 1,333), кількісного складу нейтрофілів (на 18,958 % і на 21,078 %) та еозинофілів (на 3,540 % лише комбіноване лікування) і показників сахаринового тесту (на 0,3 хв; $p = 0,005$ і на 1,696 хв).

Висновки. Визначено покращення якості життя та показників назоцитограми й сахаринового тесту при застосуванні ін'єкцій збагаченої тромбоцитами плазми (як окремо, так і комбіновано з іригаціями масляними розчинами) у хворих із професійним хронічним АР. Встановлено достовірні шанси на зниження значень шкали NOSE і збільшення показників опитувальника SF-36 та шанси на збільшення показників назоцитограми й сахаринового тесту.

Ключові слова: професійний хронічний атрофічний риніт, шкала NOSE, опитувальник якості життя SF-36, назоцитограма, сахариновий тест