THE INFLUENCE OF DRY SALT AEROSOL ON THE FUNCTIONAL ACTIVITY OF HORSE NEUTROPHILS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASES

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Keywords: Chronic obstructive pulmonary diseases; horses; halotherapy; phagocytosis

It is known that the cellular link of non-specific protection is affected in the pulmonary diseases of farm animals. Therefore, our aim was to evaluate the influence of halotherapy on the functional activity of blood neutrophils of horses with symptoms of chronic obstructive pulmonary diseases (COPD).

The study was conducted on 12 horses aged 8–14 years with symptoms of COPD manifested during the last two to four years. Chemically pure sodium chloride previously subjected to heat treatment at 100° C for 2–3 minutes was used as an aerosol-forming substance. Sodium chloride concentration of 10 mg/m³ was achieved using the Sola-Vita halogenerator.

After halotherapy sessions, the clinical condition of the horses demonstrated positive changes: the physical activity of the animals increased, auscultation picture in the lungs improved, and abdominal breathing and dyspnea disappeared as early as in the first days of therapy. The number of neutrophils capable of phagocytosis increased 1.62 times ($P \leq 0.05$) compared to the initial level as soon as after the first session of halotherapy and exceeded the same indicator in the reference animals by 1.5 times ($R \leq 0.05$). The quantity of objects they absorbed (PHI) increased by almost 2.0 times ($P \leq 0.05$) compared to the initial value and the level of the reference group.
Therefore, halotherapy had a stimulating effect on the clinical status of the horses and the phagocytic activity of neutrophils in the horses suffering from COPD.

Introduction

Halotherapy is a method of balneological rehabilitation medicine widely used in clinical practice since the mid-80s. Today, specially equipped comfortable salt rooms ("salt caves") are operated not only by major medical centres, but also by beauty salons, fitness centres, and wellness complexes. In horse veterinary medicine, this method is relatively new but definitely promising for the treatment and rehabilitation of horses. It is known that the horse's body, particularly the respiratory system, has a high degree of sensitivity to changes in the basic physical parameters of the environment. This is an anatomical and physiological species-specific feature of horses, which has evolutionary potentiated nature. In describing chronic obstructive pulmonary disease (COPD), most foreign and domestic authors pay particular attention to the creation of an optimal micro-climate for animals. According to some clinical practice data, the conditions of keeping, feeding, and exploitation account for 80% of the therapeutic effectiveness of COPD therapy [3; 6].

It was shown previously that the cellular link of non-specific protection is affected in COPD of horses, as in the case of other animals [1; 2]. Therefore, alongside clinical studies, our aim was to evaluate the influence of halotherapy on the functional activity of blood neutrophils of horses with symptoms of COPD.

Materials and methods

The studies have involved 12 horses aged 8–14 years with symptoms of COPD manifested during the last two to four years. The diagnosis was established by standard methods using endoscopic examination. Animals were divided into 2 groups – experimental and reference – consisting of 6 animals each.
A hermetically polycarbonate-sealed box of standard sizes (3 × 4 m) with the possibility of natural ventilation was used as the experimental halochamber. The room adapted in this way was equipped with a Sola-Vita halogenerator with the concentration sensor. Chemically pure sodium chloride previously subjected to heat treatment at 100° C for 2–3 minutes was used as an aerosol-forming substance. Sodium chloride concentration of 10 mg/m³ was achieved according to the recommendations [4; 5].

The horses from the experimental group were taken to the halochamber and left under observation for 15 minutes. After the session, the horses were waled hand-supported for 30–40 minutes. The reference animals were not given any medical preventive procedures. Before the beginning of the experiment and after the 1st and 10th sessions, blood test was done for both groups of horses in sterile EDTA vacutainers.

The phagocytic activity of neutrophils (PHA) was determined according to S.G. Potapova’s method (1977) with calculation of the phagocytic index (PHI).

Throughout the experiment, the horses of both the experimental and reference groups were subjected to clinical examination, with b.i.d. thermometry, auscultation, and visual assessment of nasal discharges.

All of the experimental results were processed statistically, and differences were determined at level of significance of 0.05.

Study results and discussion

During the experiment, the clinical efficacy for exposure of the respiratory tract of the horse to dry salt aerosol was observed during the first to third sessions of halotherapy. This was manifested in the emergence of relatively abundant nasal discharges in all horses after 7–10 minutes of the session. Discharges continued and somewhat increased during the walking of the horses. The nature of nasal discharges – their consistency, colour, and presence of impurities – varied depending on the initial condition of the horses, as well as on the duration of the halotherapy sessions. Thus, if during the first three days dense, fragmentary nasal discharge was observed while the horse actively snorted during walking, by the
fifth to seventh session of halotherapy, nasal discharges of the animals became transparent and liquid and almost did not cause the snorting effect when moving. Therefore, there was an impression of zero efficacies for the therapy during the second part of the course. However, the clinical condition of the horses improved considerably: the physical activity of the animals increased, auscultation picture in the lungs improved, and abdominal breathing and dyspnea disappeared as early as in the first days of therapy.

The changes in the phagocytic activity of neutrophils in the horses of the experimental and reference groups are presented in the table.

The condition of phagocytic activity for neutrophils in the horses of the experimental and reference groups in the dynamics of halotherapy (M ± m, n=6)

<table>
<thead>
<tr>
<th>indicators</th>
<th>Before the beginning of the experiment</th>
<th>After the first session of halotherapy</th>
<th>After a ten-day course of halotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>experiment</td>
<td>reference</td>
<td>experiment</td>
</tr>
<tr>
<td>PHA, %</td>
<td>22.7±0.82</td>
<td>21.4±0.95</td>
<td>36.7±2.50*</td>
</tr>
<tr>
<td>PHI, units</td>
<td>1.02±0.10</td>
<td>0.9±0.45</td>
<td>1.94±0.77*</td>
</tr>
</tbody>
</table>

*– P ≤ 0.05 compared to the previous determination point.

The data presented in the table shows that dry salt aerosol of sodium chloride has a positive influence on the functional activity of neutrophils, particularly on their phagocytic ability. The number of neutrophils capable of phagocytosis increased 1.62 times (P ≤ 0.05) compared to the initial level as soon as after the first session of halotherapy and exceeded the same indicator in the reference animals by 1.5 times (R ≤ 0.05). After ten days, the number of phagocytically active neutrophils in the horses that received halotherapy remained at the level achieved after the first session, significantly exceeding the indicators of the reference group. In the reference group of animals, the phagocytic activity of...
neutrophils was almost constant (21–22–24%) and did not undergo any significant changes compared to the initial value throughout the experiment.

It should also be noted that halotherapy resulted not only in an increase in the number of neutrophils capable of phagocytosis but also in the quantity of objects they absorbed (PHI), which increased by almost 2.0 times (P ≤ 0.05) compared to the initial value and the level of the reference group.

The data we obtained suggests a positive influence of dry salt aerosol on the indicators of the non-specific resistance of horses, particularly on their macrophage link. It is of fundamental importance for horses because it is changes in neutrophil activity to which most chronic pathologies in this species of animals are attributed [1; 3]. Our observations also indicate a pronounced therapeutic efficiency of sessions of halotherapy: especially noteworthy is the obtaining of mucokinetic effect in the first days. This, undoubtedly, is that very potentiated action, which is sought in standard COPD treatment by medication. It is known that increase in the viscosity of bronchial mucus in horses leads to serious prolonged disorders of external respiration [3]. Medical correction of mucociliary clearance is hindered due to the anatomical and physiological characteristics of animals of this species.

The halotherapy method meets most requirements: the process of controlled halotherapy forms optimal micro-climate parameters, while dry salt aerosol is used as the treatment component. For horses suffering from COPD, the dispersion of the medium, hypoallergenicity, method of penetration of rehydrant into the respiratory tract, and the absence of specific stimuli are of great significance. Sodium chloride used in halotherapy and the special equipment of the halo chamber permit the maintenance of a comfortable micro-climate for horses, while providing a therapeutic effect on the respiratory tract.

Conclusions.

Therefore, in the course of the study we found a significant increase in the phagocytic activity of neutrophils in the horses that received halotherapy sessions. The clinical improvement in the condition of the animals, which was also observed
along with the effects of haloaerosol impact, allow halotherapy to be considered pathogenetically justified and in the field of veterinary medicine.

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Summary.

The INFLUENCE of DRY SALT AEROSOL ON the FUNCTIONAL ACTIVITY of NEUTROPHILS HORSES in CHRONIC OBSTRUCTIVE LUNG DISEASES O.V. Romanova, O.V. Kriachko, A.V. Chervinskaya

It is known that cells of nonspecific protection is suffer due the disease of lung of the farm animals. So the main purpose of our work was to evaluate the impact of halotherapy on the functional activity of blood neutrophils of horses with symptoms of COPD.
Our research was carried out on 12 horses aged 8-14 years with symptoms of COPD which had a manifestation in the last two to four years. Chemically pure sodium chloride was subjected to heat treatment at temperature 100°C for 2-3 minutes before using as an aerosol substances. Halogenerator "Sola-Vita" was used to create the concentration of sodium chloride solution 10 mg/m³.

Clinical condition of the horses has undergone positive changes after sessions of halotherapy: physical activity animals was increased, auscultation picture in the lungs was improved, abdominal breathing and shortness of breath were disappeared already in the first days of therapy. The number of neutrophils, which is capable to phagocytosis increased in 1,62 times (P≤0,05) compared to the initial level after the first session of halotherapy, and in 1.5 times exceeded (R≤0,05) the same indicator at group of control animal. The amount absorbed by them objects (PHI) has increased by almost 2.0 times (P≤0,05) compared to the level start of experiments and the level of the control group.

Thus, halotherapy has had a stimulating effect on the clinical status of the horses and the phagocytic activity of blood neutrophils of the horses, COPD patients.

Key words: chronic obstructive lung disease, horses, halotherapy, phagocytosis