

Short report

Reprint

Comparative efficiency of oxygen therapy in patients (smokers and non-smokers) with chronic obstructive pulmonary disease

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Abstract: The decrease in clinical efficacy of oxygen therapy takes place in patients suffering from chronic pulmonary obstructive disease who continue smoking even if the intensity of smoking is getting lower. It is explained by the damage of oxygen utilization regardless of normalization of arterial blood saturation indices and perfusion oxygen saturation indices in blood flow.

Keywords: chronic obstructive pulmonary disease, smoking, oxygen therapy, microcirculation.

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Introduction

Oxygen therapy can variously influence our organism, but the most important thing is that it compensates hypoxia in tissues, and also in patients with chronic pulmonary obstructive disease (COPD) [1-4]. In patients with respiratory failure during oxygen administration its tension in an alveolar air and blood plasma increases. This is the reason of oxyhemoglobin concentration increasing in arterial blood. Nevertheless many patients with COPD keep on smoking having lung pathology [1, 5, 6]. Nicotine is not just a drug leading to fast addiction, but it is also a potential pharmacological agent [7]. It stimulates thrombocytes and fibrinogens production which block blood vessels. This finally leads to peripheral blood flow disorders because of the intensive tissue oxygen consumption. [3]. As the researching displays, microcirculation reduces to 19% after two cigarettes [3, 7].

Our study aimed to research influence of smoking on the efficiency of oxygen therapy in patients with COPD.

Material and Methods

58 patients with severe COPD were examined. They have been smoking for 20 years 20 packs of cigarettes and more per month. All of them were men at the age of 45.8±3.6 years; they all were comparable in co-morbidity spectral range. 31 of the patients have given up smoking after verification of COPD (group I) during the examination. The non-smoking period was 4 years minimum. The other 27 patients kept on smoking (group II). They smoked an average of 13.2±2.1 cigarettes per day.

Before admission to hospital the patients of the both groups had been examined in the period of the main disease recurrence before and on a background of the slow oxygen therapy (3 l/min). To estimate the condition of microcirculation the method of laser Doppler flowmetry with spectral analysis of wavering (feature-packed diagnostic laser equipment "LAKK-M" (Lasma LLC, Russia)

was used). The aim was to determine an average mean perfusion (M, perf. u.), capillary blood saturation (SO₂, %), erythrocyte volume fraction (Vr, mm³), perfusion oxygen saturation index of microcirculation (SOM = SO₂ / M, c.u.), tissue oxygen cost index (U = SpO₂ / SO₂, c.u.), arterial blood saturation in right hand finger-pads (SpO₂).

Results and Discussion

The study displayed that the patients from the groups I and II had different reactions to the oxygen therapy despite the similarity of symptoms and recrudescence severity level. So, in patients of the group I peripheral microcirculation parameters increased (p<0.05) and were constant during the therapy. The peripheral microcirculation dynamics in group II was different because of oxygen (Table).

As the table shows in patients from the group I there have been fixed a resurrection of arterial blood homeostasis in an hour after the therapy. Perfusion oxygen saturation index of microcirculation increased within 1 and 2 hour to 21.3% and 38.3% respectively (p<0.05), which have led to an increase of tissue oxygen cost index within 2 hours (19.1% on the average; p<0.05). An improvement of tissue oxygen perfusion was confirmed by a heart rate fall from 98 up to 74 bpm (2.4%; p<0.05) on the background of reducing blood perfusion volume.

In patients of the groups I and II perfusion oxygen saturation index of microcirculation increased with increase of the oxygen therapy length. Besides there was a development of capillary blood saturation, tissue oxygen cost index and perfusion volume (M и Vr) within 2 hours after the beginning of the treatment. This probably was caused by microvascular spasm and blood circulation. These changes in vasculature reaction to oxygen inhaling can be determined by changes in endothelium vasomotion under the influence of smoking and lipid peroxidation process peculiar to heavy smokers.

Table. Peripheral microcirculation parameters in patients with COPD who gave up smoking (group I) and keeping on smoking (group II).

| Indicator | Before oxygen therapy | | After starting oxygen therapy | | | |
|--|-----------------------|-----------|-------------------------------|----------|---------------|----------|
| | group I | group II | After 1 hour | | After 2 hours | |
| | | | group I | group II | group I | group II |
| M, perf. u. | 18.2±0.8 | 21.6±0.9 | 15.5±0.7 | 18.4±0.7 | 12.2±0.5 | 10.2±0.6 |
| SO ₂ , % | 85.6±1.3 | 85.8±1.4 | 84.6±1.4 | 85.6±1.3 | 79.2±1.5 | 90.3±1.2 |
| SpO ₂ | 89.8±0.1 | 89.6±0.2 | 98.8±0.1 | 98.1±0.2 | 98.9±0.1 | 98.2±0.1 |
| Vr, mm ³ | 18.3±0.5 | 20.3±0.5 | 16.6±0.3 | 18.4±0.3 | 12.1±0.2 | 9.1±0.2 |
| SOM=SO ₂ / M, c.u. | 4.7 | 4.0 | 5.7 | 4.6 | 6.5 | 8.8 |
| U= SpO ₂ / SO ₂ , c.u. | 1.05 | 1.04 | 1.15 | 1.15 | 1.25 | 1.08 |
| Heart rate, bpm | 98.6±2.2 | 102.8±2.6 | 86.4±2.4 | 85.4±2.1 | 74.1±3.2 | 96.3±3.3 |

Conclusion

So, in patients keeping on smoking with COPD we have fixed reducing of the efficiency of oxygen therapy even if they smoked less. This is connected to oxygen extraction disorders even on the background of high arterial blood saturation and perfusion oxygen saturation of microcirculation.

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