

Mild Dyspnea After Scuba Diving : Blood Gas Analysis

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The manifestation of dyspnea, which arises after scuba diving and is called Chokes is serious. Since our facility is located far from the sea area suitable for diving, it is rare for us to treat serious Chokes patients in our facility. However, we see some patients who have mild dyspnea in our facility. We do blood gas analysis for these patients. In this study, we wanted to analyze the dyspnea mechanism after diving.

Subjects

Our subjects were chosen from patients with dyspnea after diving who were treated at our hospital between November 2002 and December 2006. We selected 23 cases in which blood gas analyses could be examined for this study. There were 8 male and 15 female patients, with a mean age of 33.3(from 14 to 49).

Methods

Arterial blood was taken from the patients before treatment for initial diagnosis from the radial artery. The standard value was calculated from the regression equation of Mellengaard; $104.2 - 0.27 \times \text{age}$, and the $\pm 8\text{mmHg}$ (SD) was chosen to be the standard value. PaO₂ measured from this was classified into 3 groups: Excess, Standard and Low. Then, PaCO₂ (35-45mmHg is normal) was analyzed, and the mechanism was analogized by these results. After treatment we examined the blood gas analyses in the 7 patients in the PaO₂ low group. We selected a control group, which had 104 DCI patients with no dyspnea, who attended our hospital from Jan.2003 to Aug.2004. The rates which patients had sensory change or subjective symptoms in their chest or back were compared to each group and the control group. The Fisher exact test was used for static analysis .

Result

Patients' PaO₂ before treatment were excess: 6, standard: 10, and low; 7. When we started ,no patient presented with 70mmHg or less which means respiratory insufficiency. In the PaO₂ excess group, 2 patients had low PaCO₂, and the other 5 patients' PaCO₂ levels were normal. All standard group patients had standard levels of PaCO₂ (Fig.1).

According to the examination of blood gas after treatment in the PaO₂ low group, we found that some patients' PaO₂ deteriorated within a week and all of them improved within several months (Fig.2).

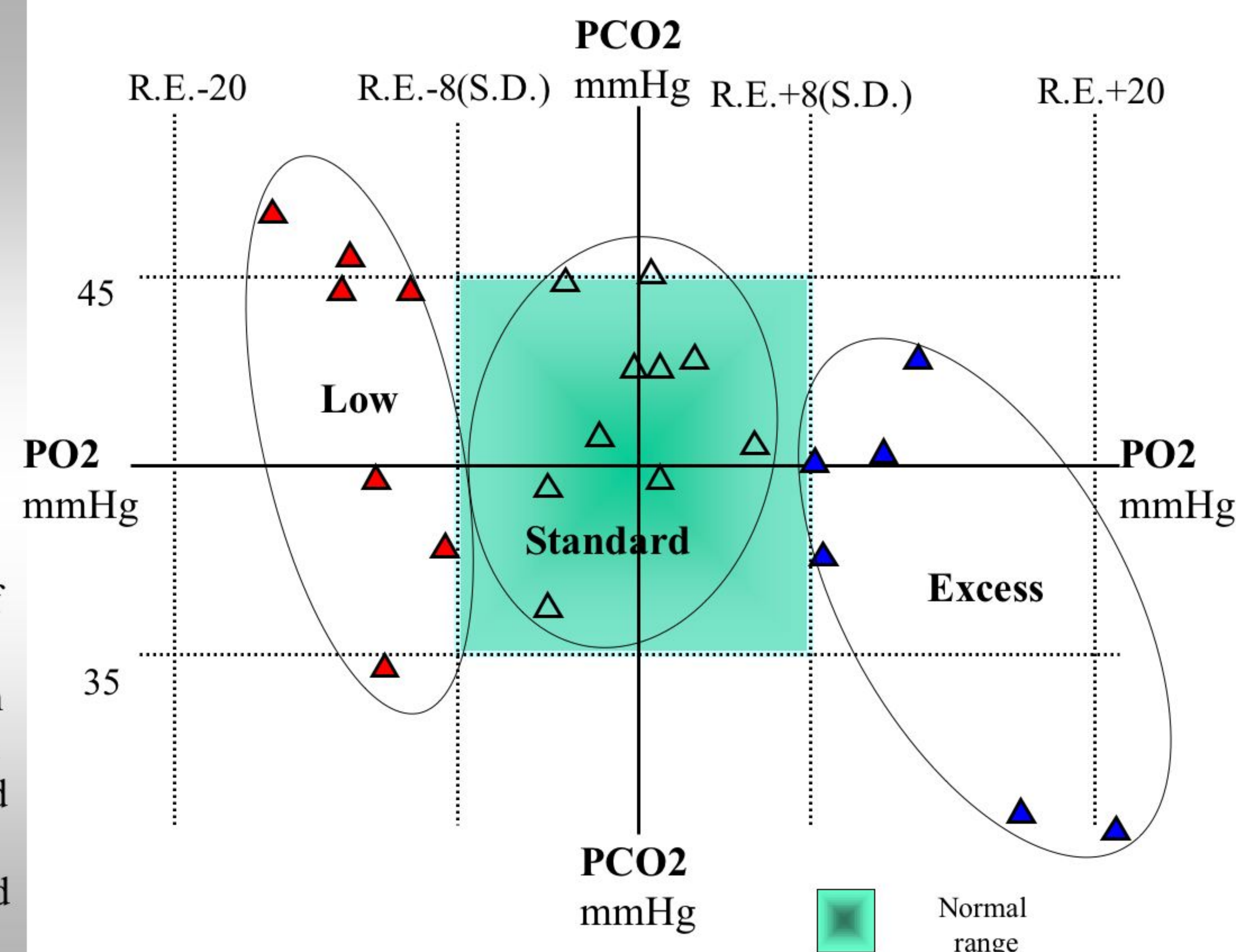


Fig.1; Individual PaO₂-PaCO₂ relationship

All of the patients in the PaO₂ excess group(100%), 8 of 10 in the standard group(80.0%) and 5 of 7 in the low group(71.4%) were found to have complications of sensory change or subjective symptoms in their chests or backs. Compared to the control group's ratio of 38 of 104(36.5%) patients having sensory change or subjective symptoms in their chests or backs, we could find a significant difference to the excess and standard groups (Fig.3). In the PaO₂ low group, 1 patient's PaCO₂ level was in the excess level and 3 patients were in the low level. In the PaO₂ excess group, 2 patients' PaCO₂ level were in the low level.

Discussion

It can be assumed that there are various factors from this result in the cause of dyspnea after diving. Psychiatric problems from the anxiety of chest pain or sensory changes might be a reason for dyspnea in the PaO₂ excess and standard groups. Mechanical failures were indicated in the PaO₂ low group, because the PaO₂ had improved later. Trapped bubbles in the pulmonary capillaries injured vascular endothelial cells and then these caused thrombus and reduction of PaO₂. In some cases, several days or weeks might be required before these thrombus dissolve by fibrinolysis and normal blood flow returns. Since Chokes is considered a serious manifestation, these cases are difficult to be diagnosed as Chokes. However we think that these mechanisms were the same.

Conclusion

There were various reasons: psychiatric and/or a mechanism similar to Chokes, why patients felt dyspnea after diving.

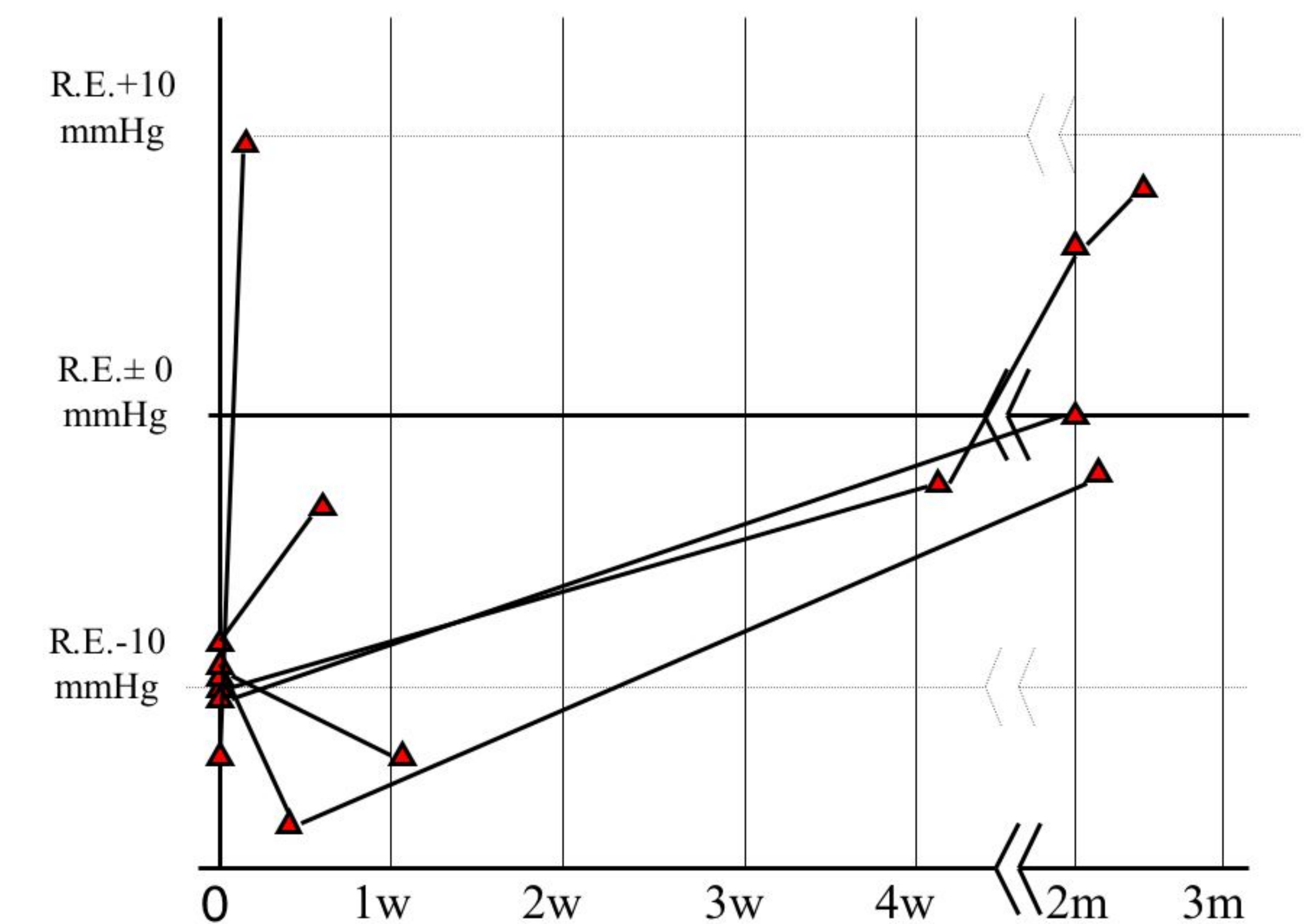


Fig.2; PaO₂ transitions after the 1st recompression therapy in PaO₂ low group

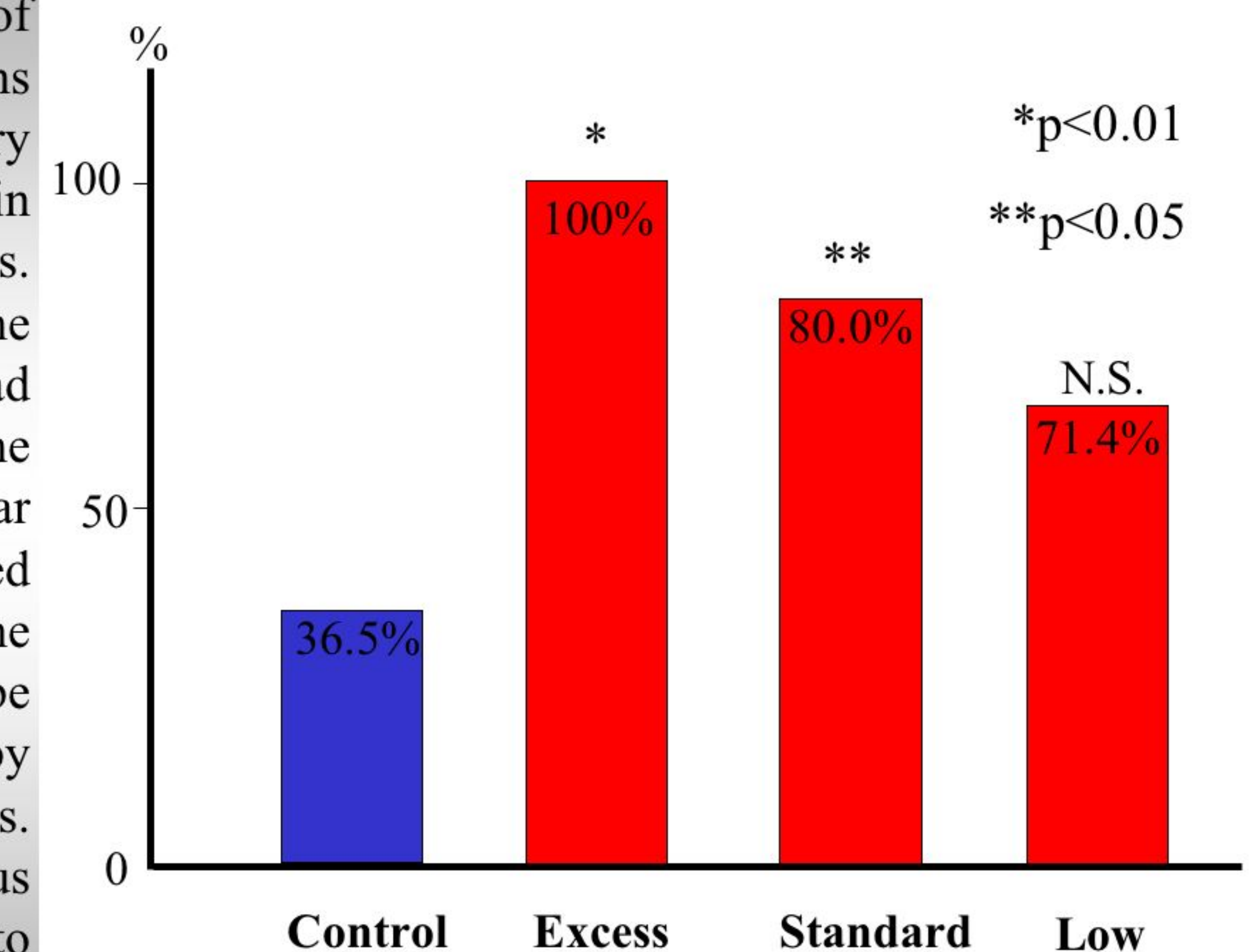


Fig.3; Sensory change or subjective symptoms in the chest or back complication ratio