Symposium

Symposium on Chronic Respiratory Failure*

Moderators

Hiroshi Sasamoto, M D
Professor, School of Medicine, Tokai University, Isehara

Makoto Murao, M D
Professor, Hokkaido University, School of Medicine

(1) Chronic Respiratory Distress—Clinical Significance of Arterial Blood Gas Abnormalities

Tetsuro Yokoyama, M D
Associate Professor of Medicine, Department of Medicine, School of Medicine, Keio University, Tokyo, 160

This statistical study was conducted to describe the present status of "chronic respiratory distress" mainly with reference to the arterial blood gas abnormalities. The author follows in this study the concept that the respiratory distress be the condition under which the patient's abnormal arterial blood gases (O₂ and/or CO₂) restrict her physical capacity of behavior. The term "chronic" refers to the period not less than a month.

SUBJECTS AND METHODS:

The author studied 2983 cases, upon whom arterial blood gas study was performed in the recent ten years at Keio University Hospital, Tokyo, Japan. Among them 1116 cases were further studied on their ventilatory capacity, which was assessed in terms of %VC and FEV₁%. Percent ratio of FEV₁ against predicted vital capacity was defined as the "index". Arterial blood specimen was collected from the brachial artery maintaining the subject, who breathed room air, on supine position under steady state. Measurements for PO₂, PCO₂ and pH were done as soon as the sampling was performed. Alveolar PO₂ was estimated on the alveolar equation assuming the gas exchange ratio to be 0.83 and then alveolar-arterial PO₂ difference (AaDO₂) was calculated.

Diagnosis was given on the clinical basis and on some cases it was further confirmed on open-chest biopsy, surgery or autopsy. Pulmonary fibrotic changes, if the genesis be identified, were classified and specified in the tables. The "bronchiolitis syndrome" refers to the patients, who are accompanied...
by symptoms and laboratory data suggestive to any damage localized in the distal part of the lungs.

RESULTS:

1) Arterial O₂ Tension
Mean and standard deviation (SD) for the arterial PO₂ obtained on 2983 cases were 75.0±27.1 TORR. One thousand four hundred eighteen and four cases (49.7%) demonstrated PO₂ below 75 TORR, 110 (37.2%) below 70 TORR and 243 (8.2%) revealed PO₂ below 50 TORR. Prevalence of the cases accompanied by PO₂ below 75 TORR exceeded 70% in pulmonary embolism, pneumonitis of various types, pulmonary fibrotic changes, pulmonary emphysema, lung cancer and in cardiac diseases.

2) Arterial CO₂ Tension
Arterial PCO₂ obtained on 2983 cases was 40.42±24.72 TORR. PCO₂ for 159 healthy subjects was 39.20±4.15 TORR. Among the subjects with PO₂ below 75 TORR the numbers of the cases whose PCO₂ maintained below 35 TORR were larger than that of the cases whose PCO₂ exceeded over 45 TORR.

Table 2. Classified numbers of cases with arterial oxygen tension below 75 TORR in terms of arterial CO₂ tension. Figures in the parenthesis indicate the prevalence. *LOC FIB: localized fibrotic change of the lungs. **DIF FIB: diffuse fibrotic change of the lungs. ***IAT FIB: pulmonary fibrotic change caused by BLEOMYCIN treatment or irradiation therapy. ****OCC FIB: occupational pneumoconiosis. **SYST FIB: pulmonary fibrotic change accompanied by the systemic diseases.

Table 1. Classified numbers of cases, mean and standard deviation for the arterial PO₂ and prevalence of depressed arterial PO₂. Figures in the parenthesis indicate prevalence. *LOG FIB: localized fibrotic change of the lungs. **DIF FIB: diffuse fibrotic change of the lungs. ***IAT FIB: pulmonary fibrotic change caused by BLEOMYCIN treatment or by irradiation therapy. ****OCC FIB: occupational pneumoconiosis. **SYST FIB: pulmonary fibrotic change accompanied by the systemic diseases.
3) Alveolar-Arterial $O_2$ Tension Difference

On 2983 cases $AaDO_2$ was 26.45±3.14 TORR. Among the cases observed included were 159 healthy subjects whose $AaDO_2$ was 6.86±6.04 TORR. $AaDO_2$ obtained on 1484 cases, whose $Po_2$ was lower than 75 TORR, was 38.10±32.01 TORR. Consistently large $AaDO_2$ was found on the patients associated with pneumonitis, diffuse fibrotic changes, pneumoconiosis, lung cancer, pulmonary sarcoidosis, pulmonary embolism, and with cardiac diseases.

Among 2983 cases 31 demonstrated $AaDO_2$ greater than 20 TORR in addition to arterial $PO_2$ over 90 TORR and 44 cases were accompanied by $AaDO_2$ less than 10 TORR even though their $Po_2$ was lower than 75 TORR.

4) Arterial Blood Gases and Ventilatory Impairment

Out of 330 cases with index below 35 192 (58.1%) demonstrated $Po_2$ below 75 TORR. Among 124 emphysematous cases 93 (75.0%) demonstrated index below 35 and among them 54 were accompanied by arterial $O_2$ tension below 75 TORR. On the 109 fibrotic cases 53 (48.6%) demonstrated index below 35 and out of them 33 revealed arterial $Po_2$ below 75 TORR. 41.4% of the cases with restrictive impairment and 62.9% of the cases with combined ventilatory impairment and 51.7% of the cases with obstructive impairment also demonstrated $PO_2$ lower than 75 TORR. On 426 subjects whose ventilatory capacity remained within normal range only 96 (23.0%) demonstrated normal ventilatory capacity. $PCO_2$ for these 85 cases was 33.70±8.50 TORR.

CONCLUSION:

1) Different prevalence of arterial hypoxemia was noted among the diseases.

2) Arterial blood gas abnormalities did not show any significant correlation with degree of ventilatory impairment.

3) Among the cases associated with arterial hypoxemia abnormally low arterial $PCO_2$ was found much frequent as compared with abnormally high $PCO_2$.

4) $AaDO_2$ was found essential to assess the impaired gas exchange in the chronic respiratory distress.