Temperature in the Stability of Blood Gases

To the Editor:

We read with interest in the April 1993 issue of Chest the article by Liss and Payne on “Stability of Blood Gases in Ice and at Room Temperature.” Although some authors would agree that the small changes observed in \( P_{O_2} \), \( P_{CO_2} \), and pH when the arterial blood samples were kept at room temperature make it unnecessary to maintain arterial blood in ice if gas analysis is done within 30 min, several comments should be pointed out.

In a previous paper, we analyzed the samples obtained from 23 patients breathing ambient air and from 20 patients with chronic respiratory failure receiving supplementary oxygen to determine variations in the values of arterial blood gases depending on the preservation procedure and on the characteristics of the syringe used. Arterial blood from the same puncture was placed in glass and plastic syringes at room temperature and under ice. Samples were analyzed at baseline and after 15, 30, 60, and 120 min. Because similar results were obtained in both groups, Figure 1 only shows changes observed in patients with chronic respiratory failure. From this data we can see that significant changes in \( P_{O_2} \) may be observed after 15 min. These changes became gradually larger over time. We also saw significant differences when plastic syringes rather than glass syringes were used for analysis. Samples maintained in glass syringes under ice gave the more concordant values during the 2 h after the extraction. Decreased \( P_{O_2} \) and increased \( P_{CO_2} \) with glass syringes at room temperature was ascribed to metabolism, while relatively stable \( P_{O_2} \) with plastic syringes at room temperature suggests decreased \( P_{O_2} \) due to metabolism, counterbalanced by an increase in the oxygen content of the blood due to diffusion of oxygen into the syringe.

Thus, because for \( P_{O_2} \) no clear cutoff of delay may be recommended, we believe that to minimize errors of accuracy in standard arterial blood gas analysis, the sample should be evaluated as soon as possible. If this is not possible within 15 min, the sample should be kept in ice. Variations have to be borne in mind when plastic instead of glass syringes are used for analysis, so references about the degree of permeability to gases must be available from the manufacturer if a plastic syringe is used.

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REFERENCES


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Doctors Izquierdo-Alonso and Rodriguez-GMorro actually present data that support our conclusion that the use of ice is unnecessary for arterial blood gas syringes if the analysis is performed within 30 min. Although the slope of the lines on the graphic representation of their serial measurements of \( P_{O_2} \) suggest significant differences, the mean value of \( P_{O_2} \) in glass syringes in patients with respiratory failure changes from 67.8 to 69.5 mm Hg in 30 min. The error in measurement of the Clark \( P_{O_2} \) electrode is ±2 mm Hg, and I can recall that during training we were required to measure the same sample in triplicate and then round off the decimal point to the nearest whole number because of the inability of the electrode to render precision to less than one whole number. Although the light emitting diode on a modern machine gives a pH to three decimal places and arterial gas tensions to two places, there is a pretense of precision that is not borne out by the electrode technology. Furthermore, no three arterial blood gas machines measure the same tensions in three identical specimens as quality assurance data surely show.

Although there are differences between glass and plastic syringes, between ice and no ice, and between laboratory machines and technicians, the inherent error of the electrodes of ±2 mm Hg makes the difference between 67.8 and 69.5 mm Hg after 30 min clinically meaningless.

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