CORRESPONDENCE

Is arterialized earlobe blood \( P_O_2 \) an acceptable substitute for arterial blood \( P_O_2 \)?

To the Editor:

We read with great interest the paper by Sauty et al. [1] in the February issue of the Journal. They found that arterialized earlobe blood samples are in good agreement with arterial blood samples for carbon dioxide tension (\( P_CO_2 \)) but not for oxygen tension (\( P_O_2 \)), and rightly state that "arterialized earlobe blood \( P_O_2 \) is not a reliable mirror of arterial \( P_O_2 \)" in adults patients.

Numerous studies have already been published on this topic, as reviewed by Sauty et al. [1] and by Hughes [2] in the accompanying editorial. Most of the studies conclude that the earlobe method is accurate enough to replace arterial blood samples for clinical purposes, and recommend its use in routine practice. Therefore, it seems important to us to provide the readers with some additional data that confirm and emphasize the aforementioned contention of Sauty et al. [1].

During the last decade, many papers (e.g. 14 in 1994–1995), were devoted to quality control of arterial samples, as underscored in the guidelines of the International Federation of Clinical Chemistry (IFCC) [3–5]. Many laboratories are included in national quality control networks based on arterial samples. Current recommendations are that the error allowable is 0.02 units for \( P_O_2 \) and 1–2% for \( P_CO_2 \) and 2–4% for \( P_O_2 \) [4]. However, these recent guidelines do not give recommendations about arterialized earlobe samples.

The arterialized earlobe technique was introduced more than 20 yrs ago in our pulmonary function laboratory, although it has not been re-evaluated since then. Therefore, like Sauty et al. [1], we deemed it of interest to compare blood gases obtained simultaneously in a continuous series of 81 pairs of arterial and arterialized earlobe samples. Our protocol was similar to that used by Sauty et al. [1] except for the vasodilator cream (Finalgon®; K. Thomae, Biberach an der Riss, Germany). We found that the differences were acceptable for \( P_CO_2 \) and \( P_O_2 \). In contrast, differences in \( P_O_2 \) exceeded the acceptable error, with underestimation of arterial \( P_O_2 \) by arterialized earlobe blood despite a highly significant correlation of 0.860 (fig. 1). Plotting the data according to Bland and Altman [6], we found a bias (mean of the differences) of 1.2 kPa (9.0 mmHg) and a 95% confidence inter-val (mean±2SD of the differences) of 1.2±1.7 kPa (9.0±12.7 mmHg) (fig. 2). Both bias and confidence intervals were larger than those reported by Sauty et al. [1], 0.6±1.0 kPa (4.4±7.4 mmHg).

The main advantages and drawbacks of the methods have already been discussed [1, 2]. It should be emphasized that the risk for technicians and nurses of transmission of bloodborne viruses was not fully appreciated when the arterialized earlobe technique was advocated in 1965 [7]. We submit that the risk for the technicians is probably greater with the capillary earlobe compared to arterial needle sampling. Furthermore, with long-term oxygen therapy, accurate measurement of arterial oxygen tension (\( P_a.O_2 \)) is essential, and the most accepted criterion at inclusion and follow-up is \( P_a.O_2 \leq 7.3 \) kPa (55 mmHg). An error of 0.7 kPa (5 mmHg) is allowed, so that patients with 8.0 kPa (60 mmHg) are accepted for long-term oxygen therapy by insurance carriers in
the USA but errors ≥0.7 kPa (5 mmHg) may lead to medicolegal problems [8]. Finally, it has been pointed out [1, 2] that the errors are due mainly to large arteriovenous difference and low flow at the earlobe. It is likely that during exercise testing in patients, both cutaneous capillary blood flow and mixed venous oxygen tension (Pv,0₂) are decreased, so that the underestimation of Pₐ,0₂ is potentially increased.

We conclude, like Sauty et al. [1], that arterial and arterialized earlobe oxygen tension are not interchangeable in adult patients. Quality control guidelines should include this recommendation. This conclusion may not be valid in children, since Gaullier et al. [9] have documented the lack of systematic difference in oxygen tension between arterial and arterialized earlobe blood in this age group.

References