

CORRESPONDENCE

Is arterialized earlobe blood PO_2 an acceptable substitute for arterial blood PO_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 (PCO_2) but not for oxygen tension (PO_2), and rightly state that "arterialized earlobe blood PO_2 is not a reliable mirror of arterial PO_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 pH, 1–2% for PCO_2 and 2–4% for PO_2 [4]. However, these recent guidelines do not give recommendations about arterialized earlobes 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 PCO_2 and pH. In contrast, differences in PO_2 exceeded the acceptable error, with underestimation of arterial PO_2 by arterialized earlobe 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 interval (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

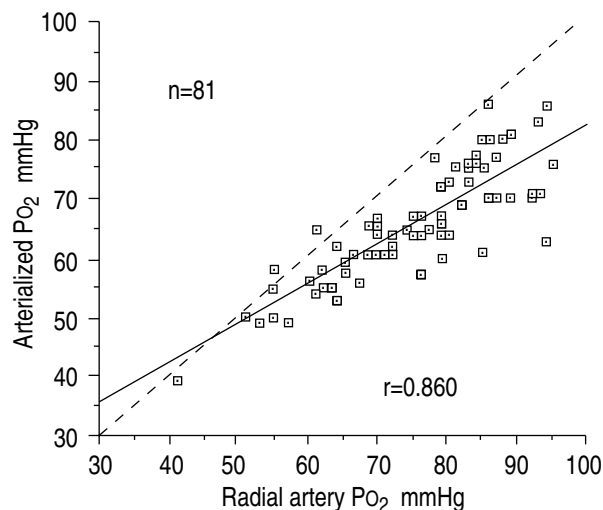


Fig. 1 – Correlation between radial artery and arterialized earlobe blood oxygen tension (PO_2). The dotted line is the line of identity. (1 mmHg=7.5006 kPa).

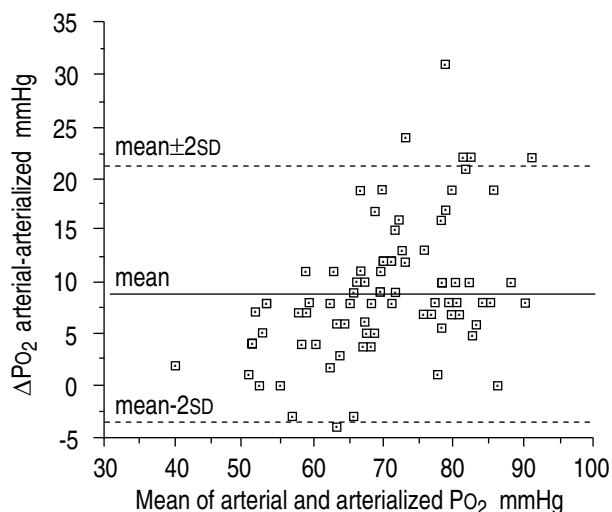


Fig. 2 – Bland and Altman diagram: for each couple of samples, difference in oxygen tension (ΔPO_2) is plotted against the mean oxygen tension (PO_2). The 95% confidence interval is 9.0 ± 12.7 mmHg (1.2 ± 1.7 kPa) (mean±2SD of the differences). (1 mmHg=7.5006 kPa).

is probably greater with the capillary earlobe compared to arterial needle sampling. Furthermore, with long-term oxygen therapy, accurate measurement of arterial oxygen tension (PaO_2) is essential, and the most accepted criterion at inclusion and follow-up is $PaO_2 \leq 7.3$ 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 arterio-venous 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 ($P_{\bar{v},O_2}$) are decreased, so that the underestimation of P_{a,O_2} 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 GAULTIER *et al.* [9] have documented the lack of systematic difference in oxygen tension between arterial and arterialized earlobe blood in this age group.

References

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