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Comparison of continuous intraarterial blood gas analysis and transcutaneous monitoring to measure oxygen partial pressure during one-lung ventilation

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To the editor: Continuous intraarterial blood gas analysis (CBGA: Paratrend 7; Philips Medical Systems, Best, Netherlands) has been used to observe acute changes in arterial oxygen partial pressure (Pa_{O_2}) during one-lung ventilation. However, recently supply of its sensor becomes impossible. A transcutaneous monitoring device (TMD: TCM 4; Radiometer, Copenhagen, Denmark) can be used to continuously and noninvasively measure oxygen partial pressure transcutaneously, and it is possible that this device will eventually be used instead of CBGA during one-lung ventilation.

We compared the oxygen partial pressure during one-lung ventilation measured by CBGA with that measured by a TMD which was lent to us for this investigation.

Right upper pulmonary lobectomy was planned for a 60-year-old man. A 20-G cannula was placed into the left radial artery and the CBGA sensor was inserted via this cannula. The TMD sensor was attached to the left brachium. After the patient was adjusted to the left lateral position, the CBGA device was calibrated, using blood gas values measured with a blood gas analyzer (ABL735; Radiometer). The CBGA data were recorded (one measure per second) directly into a personal computer, and the TMD data (one measure for each 10-s interval) were initially stored in the measuring device and then imported into the computer after the operation. The oxygen partial pressures measured using CBGA and TMD were compared for each 1-min interval. Figure 1 presents the changes in the two parameters. During the first few minutes, the oxygen partial pressure measured by the TMD increased gradually during the stabilization period. When one-lung ventilation was initiated, both CBGA and TMD oxygen partial pressures decreased suddenly. After the end of the one-lung

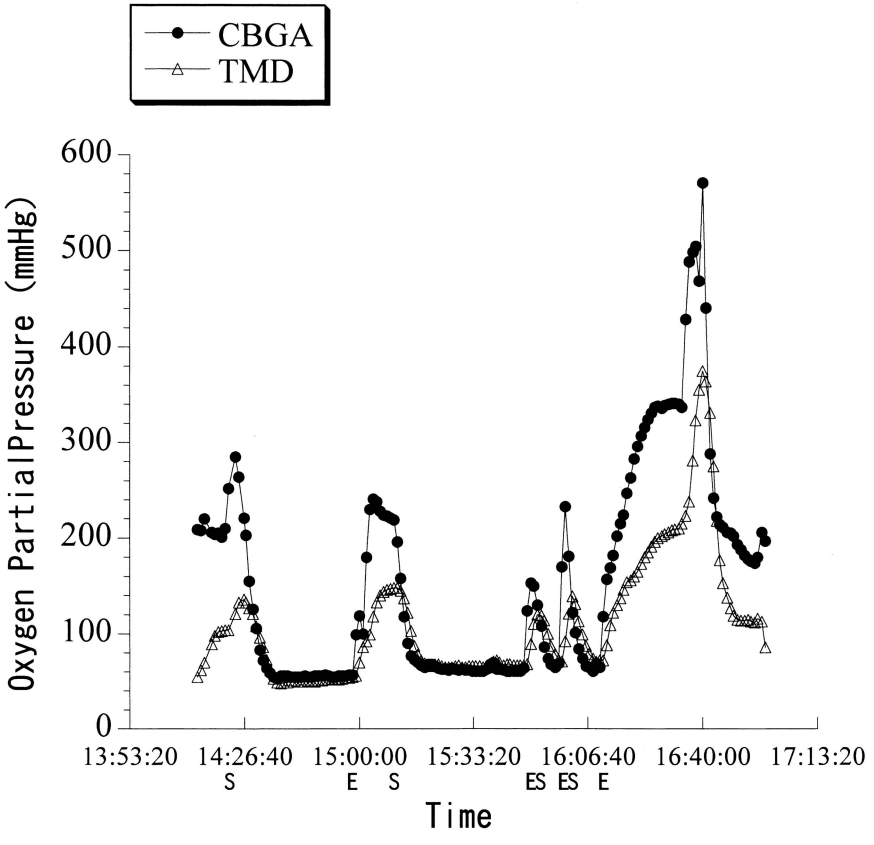

Fig. 1. Changes in oxygen partial pressure, measured by continuous intraarterial blood gas analysis (*CBGA*) and by a transcutaneous monitoring device (*TMD*). On the *abscissa*, *S* denotes the start of one-lung ventilation, and *E* denotes the end of one-lung ventilation

ventilation, both oxygen partial pressures were clearly increased. Such decrease and increase were repeated four times. Oxygen partial pressures over 100 mmHg were generally lower with the TMD compared with CBGA and these differences became greater as the absolute values became higher. Oxygen partial pressures between 50 and 100 mmHg were comparable with the TMD and CBGA.

These results were comparable with those of a previous study that examined these parameters in critically ill patients [1]. The oxygen partial pressure measured with the TMD was significantly less than the Pa_{O_2} and at higher Pa_{O_2} values, greater discrepancies became apparent. This was likely due in part to the diffusion characteristics of oxygen through the skin and to cellular oxygen utilization between capillary loops [2]. Some oxygen transfer may also occur between the arterial and venous circulation proximal to the distal capillary loop, and therefore, the gradient may increase with higher Pa_{O_2} values [2]. Our results are reflective of these characteristics of transcutaneous oxygen partial pressure. When we use the TMD to monitor the changes in oxygen partial pressure during one-lung ventilation, this discrepancy between the oxygen partial pressure monitored with the TMD and that with CBGA should be considered at higher oxygen tensions. The fall in the oxygen partial pressure at the beginning of one-lung ventilation was as fast with the TMD as that with CBGA and could be useful to detect the fall in Pa_{O_2} at the range in which pulse oximeters do not indicate change.

References

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