

A CONVERSION FORMULA TO CORRECT FOR PULSE OXIMETER DESATURATIONS OBTAINED WITH DIFFERENT AVERAGING TIMES

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Study objectives: Pulse oximetry has gained widespread use in neonatology and intensive care medicine to measure arterial oxygen saturation (SpO₂) continuously. The SpO₂ values are usually obtained by averaging over preceding measurements. As the averaging time, usually between 2 to 16 seconds, affects the number of desaturations, it is necessary to have a conversion formula to compare results obtained using different averaging times.

Methods: Oxygen saturation was recorded for 168 hours in fifteen infants with a mean number 60.9 desaturations < 90 % per hour for using a pulse oximeter (Radical, Masimo). The raw data were reprocessed using 7 different averaging times between 2 and 16 seconds to determine the number of desaturations (D) below the threshold values of 80%, 85% or 90% for 7 different minimal desaturation durations (>0, >5, >10, > 15, > 20, >25, >30 seconds).

Measurements and results: We found a linear relationship between the logarithm of the desaturation rate and the logarithm of the averaging time. Based on this linear relationships the conversion formula is: $D_2 = D_1 * (T_2 / T_1)^c$, where D_2 is the desaturation rate for the desired averaging time T_2 and D_1 is the desaturation rate for the original averaging time T_1 , where the exponent c depends on the desaturation threshold and the minimal desaturation duration. The median percentage error was found to be 2.5%.

Conclusion: A formula is presented to convert between the numbers of desaturations measured with different averaging times for different desaturation thresholds and minimal durations.