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LETTER TO THE EDITOR

The range of values of "variable α" when predicting plasma concentrations and/or effect site concentrations of remifentanil is huge

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To the Editor:

Plasma concentrations and/or effect site concentrations (ESCs) of intravenous anesthetics in a steady state can be predicted and expressed by the following equation:

$$\text{Concentration (ng/ml)} = \alpha \times \text{dose (μg/kg/min)}, \quad (1)$$

$$\alpha = \frac{\text{Weight(kg)}}{\text{Cl}_1\text{(L/min)}}, \quad (2)$$

where Cl_1 is metabolic clearance. If, like propofol [1], Cl_1 varies in proportion to body weight and is not affected by other parameters such as height and lean body mass (LBM), then the value of α will be constant in all patients. Predicting the concentration of remifentanil is useful during continuous infusion, since remifentanil rapidly reaches a steady state. The Cl_1 of remifentanil, which was determined by a previous study with volunteers classified as having an American Society of Anesthesiology (ASA) physical status 1 or 2, is affected by age and LBM, and α is therefore a variable that depends on the patient's characteristics [3], and the exact extent of the range is not well known. LBM was calculated using the following formula [2, 3]:

$$\text{Cl}_1\text{(L/min)} = 2.6 - 0.0162 \times (\text{age} - 40) + 0.0191 \times (\text{LBM} - 55).$$

Moreover, LBM was calculated from gender, weight (in kg), and height (in cm) as follows:

$$\text{Males : LBM} = 1.1 \times \text{weight} - 128 \times (\text{weight/height})^2$$

$$\text{Females : LBM} = 1.07 \times \text{weight} - 148 \times (\text{weight/height})^2.$$

We calculated "variable α" using Eq. 2 for 3,630 patients (males and females with a range of weights covering every 5 kg from 40 to 90 kg, a range of heights covering every 5 cm from 140 to 190 cm, and a range of ages covering every 5 years from 20 to 90 years. The relationship between BMI and "variable α" is shown in Fig. 1. Values of "variable α" vary for the same BMI, but they tend to increase with increasing BMI. The maximal and minimum values of α are 63.80 (female, 140 cm, 90 kg, 90 year old) and 15.35 (male, 190 cm, 40 kg, 20 year old), respectively. It is therefore clear that the range of α is huge. Moreover, since the values of "variable α" and/or the range of these values can vary depending on the patient's condition (such as their cardiac output), race, and concentration of co-administered general anesthetics, the range of α in the patients may be much larger than the range of α calculated from healthy volunteers.

Calculating Eq. 2 might be preferable to performing a brief assessment from the administered dose when the ESC is predicted, because of the wide range of values of "variable α."

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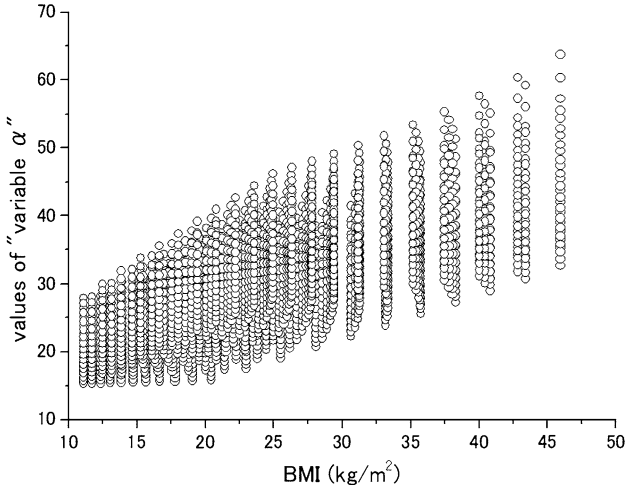

Fig. 1 Relationship between BMI and "variable α." The values of "variable α" for 3,630 patients are plotted against BMI. The values of "variable α" vary for the same BMI, and tend to increase with increasing BMI. *BMI* body mass index

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