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LETTER TO THE EDITOR

Importance of model fitting when a non-commercial TCI system was used: taking Kataria's parameter as an example

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To the Editor:

When using a non-commercial target-controlled infusion (TCI) system, it is important to confirm that the patient matches the population in the study on which the pharmacokinetic parameters were determined. The anesthesiologist who operates the system is responsible for the proper functioning of that system, and we should not expect a fail-safe system such as that provided by a commercial TCI pump with a built-in Diprifusor (AstraZeneca, London, UK). In this letter, we wish to alert the readers of the *Journal of Anesthesia* to the importance of this point, using Kataria's parameter as an example [1].

We were planning anesthetic management using propofol TCI for a 2-year and 11-month-old boy (weight 11 kg, height 85 cm) because his father was suspected to have had malignant hyperthermia. TCI using a syringe pump (Graseby 3500; Graseby Medical Ltd, Watford, Herts, UK) operated by STANPUMP software (available at http://opentci.org/doku.php; accessed 1 Mar 2010) with Kataria's parameter can be easily used because the parameter is preinstalled in the free software, in contrast to the necessity of a special device [2] or new programming for "Paedfusor" [3] or other parameters. The day before the surgery we performed a test run to determine whether the TCI system would work properly because two physical characteristics of the patient did not match those of the population on which the previous study had been based, although the values were near the lowest values. We were able to input the physical characteristics without any rejection; however, when it was assumed that administration of propofol would start at the concentration of 5 μg/mL, the simulation showed an abnormal infusion rate and concentration of propofol, and the syringe pump started operating at a very high speed. The infusion rate after the initial dose was 776 μg/kg/min; it increased quickly, exceeding the initial dose 180 s after the initial administration, reached 15,000 μg/kg/min by 190 s after starting administration, and then remained constant. The predicted concentration of propofol reached 5 μg/mL 10 s after starting administration and remained constant until 190 s but started decreasing 200 s after starting administration, eventually falling below zero, and kept decreasing (Fig. 1).

The reason for this phenomenon is that the rapid peripheral volume (V2) was calculated as a minus quantity (−0.72). V2 was calculated by the following equation [1]:

$$\mathrm{V2} = \mathrm{weight\,(kg)} \times 0.78 + 3.1 \times \mathrm{age\,(year)} - 15.5.$$

Based on this equation, if the patient's age is 2 years and his weight is <11.9 kg, V2 is a minus quantity.

Since the "Paedfusor" system reported by Absalom and Kenny [3] can cover a wide range of ages or weights and the characteristics of the present patient fitted the model, malfunction of the syringe pump would not have occurred if Paedfusor had been used. If we had had enough time, it would have been better to look for a model that fits the characteristics of our patient and to perform programming for TCI with the appropriate parameters.

Our test run demonstrates the need to confirm whether the patients match the population in the study on which the pharmacokinetic parameters were determined. It is

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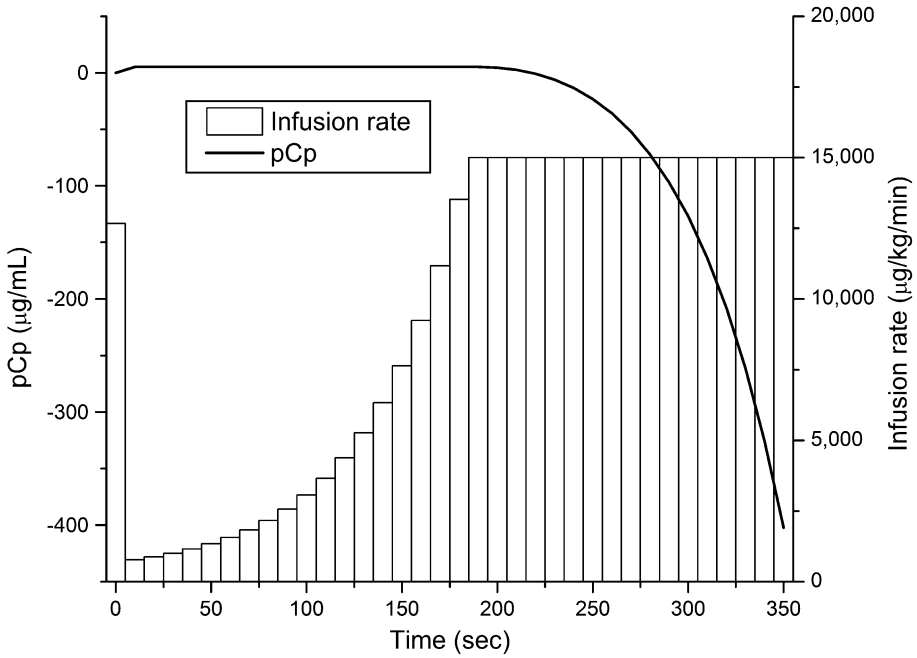

Fig. 1 Infusion rate and predicted plasma concentration of propofol. The infusion rate of propofol decreases after the initial dose, then increases rapidly, remaining at a very high dose. The predicted plasma concentration (*pCp*) of propofol increases immediately to 5 μg/mL and remains constant until 190 s. However, the pCp starts decreasing, falls below zero, and continues to decrease rapidly

therefore essential to be aware of the importance of model fitting and the risk of model non-fitting when we use a non-commercial TCI system.

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