LETTER TO THE EDITOR

Required decrement time to predict time of awaking in effect-site concentration can be estimated by using that in predicted blood concentration displayed on the commercial TCI pump

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To the Editor:

A target-controlled infusion (TCI) pump with a built-in Diprifusor™ (Astrazeneca, London, UK) can show the required decrement time (RDT) to a certain concentration of propofol (expected waking concentration, ExWC) for the assistant to estimate the required time to awakening. However, it is not the RDT in effect-site concentration (ESC) but that in predicted blood concentration (pCb). Actually, what we really want to know is the RDT in ESC, not that in pCb.

We calculated the differences between RDT in pCb and that in ESC using TIVAtrainer (available at http://www.eurosiva.org/; accessed on 1 May 2010) under 87 conditions. The patient was assumed to be a 40-year-old man with height of 170 cm and weight of 70 kg. It was assumed that anesthetic management was maintained using propofol at one of three target concentrations (low concentration of 2 μg/ml, medium concentration of 4 μg/ml, or high concentration of 6 μg/ml) with one of three durations (short duration of 2 h, intermittent duration of 4 h, or long duration of 6 h). Each concentration of propofol was supposed to decrease with time after stopping administration.

However, because pCb decreases more rapidly than ESC, differences between the RDT to a certain concentration (ExWC) in pCb and that in ESC occur. We measured each RDT (one being the RDT in pCb and others being the RDTs in ESC) to 11 ExWCs (3.9–0.6 μg/ml, every 0.3 μg/ml; except 3.9–2.1 μg/ml in the low concentration group because ExWC is higher than the concentration during assumed administration of propofol) in each of nine anesthetic conditions, and calculated the difference between RDT in pCb and that in ESC using the following formula: RDT in ESC minus RDT in pCb.

Results are shown in Fig. 1. Differences in RDT are within the range of 64–301 s and show no marked tendency overall. However, if we observe differences in RDT according to the concentration of propofol during assumed administration of propofol, differences in RDT each have a peak at ExWCs of 0.9 μg/ml in the low concentration group, 2.1 or 1.8 μg/ml in the medium concentration group, and 3.3 or 3.0 or 2.7 μg/ml in the high concentration group. The effect of duration of assumed administration of propofol on differences showed no particular tendency.

Although this study is only a pharmacokinetic study and actual RDT depends on many conditions such as coexisting anesthetics, cardiac output, and amount of blood loss, we can estimate the RDT in ESC using the RDT in pCb displayed on the TCI pump. Moreover, although the subjects were volunteers, as it was reported that ESC of propofol at recovery of response varies individually and is similar to ESC of propofol at loss of response (LOR) [1, 2], the combination of RDT in pCb, ESC of propofol at LOR, and data obtained in the present study may make the estimation of waking time more accurate. Under the present conditions, the RDT in ESC is longer than that in pCb by only less than 302 s.

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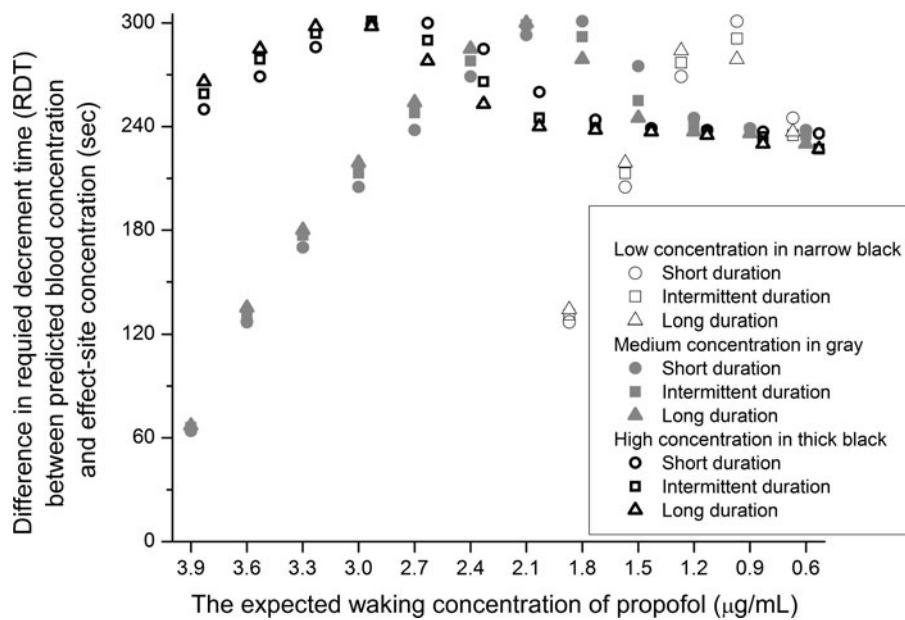
Fig. 1 Differences in required decrement time (RDT) between predicted blood concentration (pCb) and effect-site concentration (ESC) at each expected waking concentration (ExWC) of propofol. Differences between RDT in pCb and that in ESC changed with ExWC of propofol. Differences increased to each peak (0.9, 2.1–1.8, and 3.3–2.7 μg/ml, respectively) and decreased with decrease in ExWC of propofol in each concentration group. The effect of duration on differences showed no particular tendency. *Circles*, short duration of anesthetic management (2 h); *squares*, intermittent duration of anesthetic management (4 h); *triangles*, long duration of anesthetic management (6 h); *marks with narrow black edge*, low concentration during anesthetic management (2 μg/ml); *closed marks in gray*, medium concentration during anesthetic management (4 μg/ml); *marks within thick black line*, high concentration during anesthetic management (6 μg/ml)

References

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