

Can we predict when a patient regains consciousness by estimated effect-site concentration of propofol at loss of response in TIVA?



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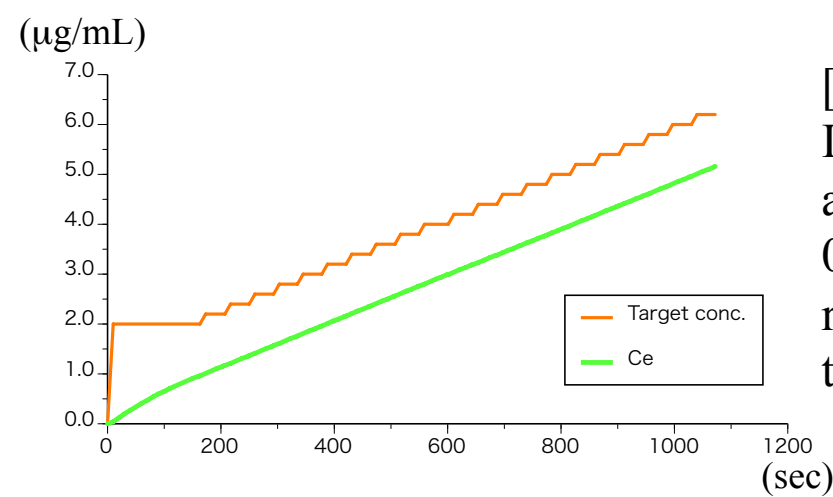
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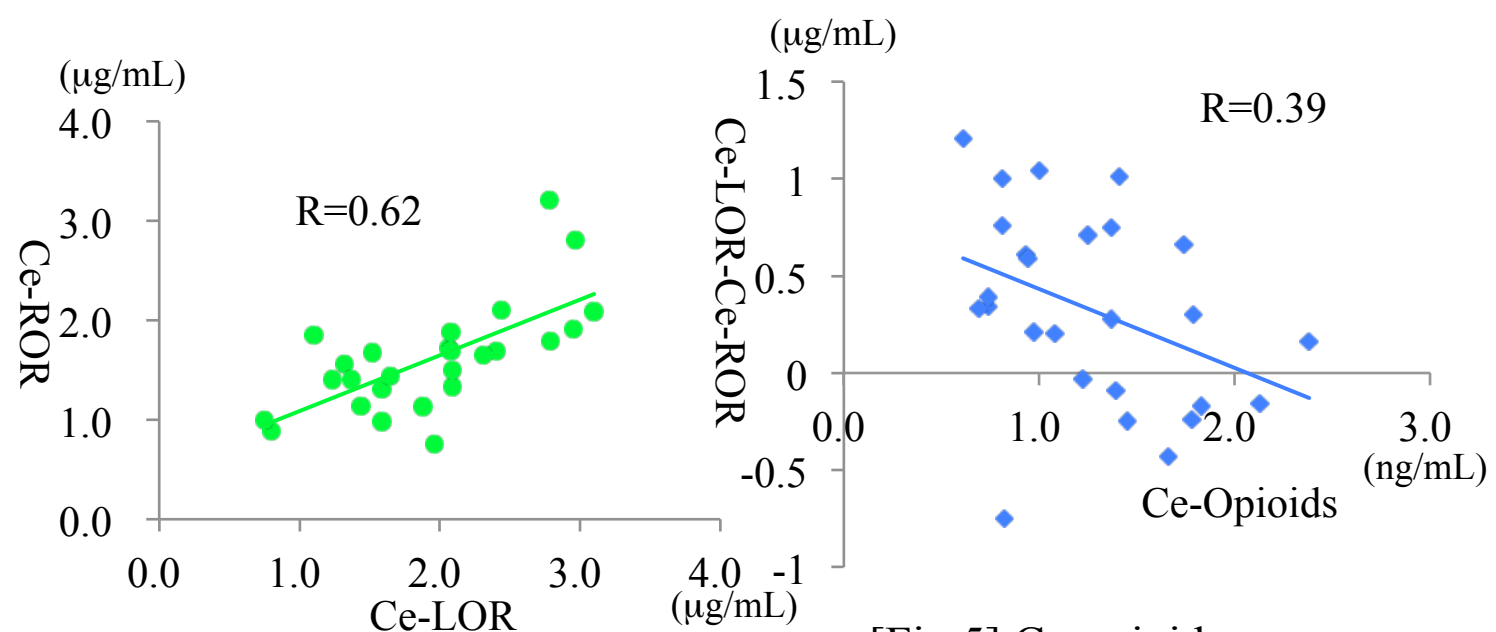
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Background: We previously showed that we could estimate required concentration propofol for maintenance of anesthesia from the effect-site concentration (Ce) of propofol at loss of response (Ce-LOR) [Fig.1]. Iwakiri H, et al. showed that Ce-LOR and Ce at recovery of response (Ce-ROR) were similar in volunteer study [Fig.2]. Then we made a hypothesis that we also could predict Ce at recovery of response (Ce-ROR) from Ce-LOR. Then we compared Ce-LOR and Ce-ROR in surgical patients under total intravenous anesthesia. We also investigated the influence of opioid concentration at recovery of response.

Materials and Methods: After approval of the ethical committee of our institute and obtained written informed consent from the participants, we enrolled 26 female patients (aged 33-65) who were scheduled mastectomy for breast cancer. Besides the standard monitors, we used BIS monitor (BIS-XP) and all raw EEG packet as well as EEG derived parameters were recorded on a computer using our original software "BSA for BIS". Propofol was infused using TCI pump (TE-371; TERUMO, TOKYO, JAPAN). Target concentration was adjusted so that Ce of propofol was gradually increased (about 0.3 µg/mL/min) and Ce-LOR was determined [Fig.3]. After insertion of LMA, anesthesia was maintained by propofol and remifentanyl. For transitional opioid, fentanyl 0.1 mg was administered near the end of surgery. We defined Ce-Opioids as the sum of Ce of fentanyl (Ce-Fen) and Ce of remifentanyl (Ce-Remi) at recovery of response. We compared Ce-LOR and Ce-ROR. We also compared the difference of Ce-LOR and Ce-ROR, and Ce-Opioids.



[Fig.3] Method of Ce control: Initial target was 2.0 µg/mL, and target was increased by 0.2 µg/mL every when Ce reached just 1.0 µg/mL below to the target Cp.



[Fig.4] Ce-LOR vs. Ce-ROR

[Fig.5] Ce-opioids vs. Ce-LOR-Ce-ROR

Results: Average of Ce-ROR was 1.61±0.55 µg/mL (Mean±SD) and it was slightly but significantly lower than that of Ce-LOR; 1.94±0.66 µg/mL. The correlation coefficient between them was 0.62 [Fig.4]. And Ce-Opioids had little influence on the difference of Ce-LOR and Ce-ROR. Correlated co-efficient between Ce-opioids (Ce-fentanyl + Ce-remifentanyl) and the difference between Ce-LOR and Ce-ROR was 0.39 [Fig.5].

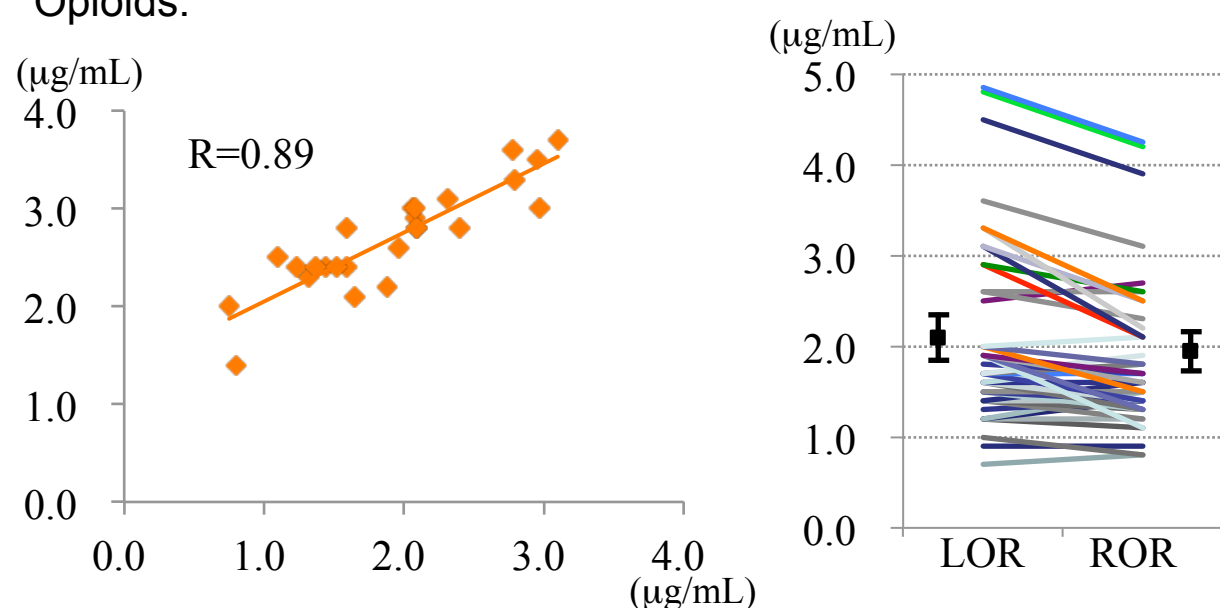
Discussion: The correlation coefficient between Ce-LOR and Ce-ROR was not so high, which indicated that we could not precisely predict when the patient regain response to verbal commands. Of course, patients with high Ce-LOR tended to regain response at rather high Ce of propofol. Considering the report in volunteer study by Iwakiri, et al., wound pain and Ce-opioids would be the considerable cause of this uncertainty.

It is known that Ce-LOR decreased when opioid was co-administered (Schraag S, et al.). In the current study, all participants received similar surgery, so their wound pain was not so widely differed. Then we expected that Ce-Opioids had some influence on Ce-ROR. However, as shown in Fig.5, Ce-Opioids had little effect on the relation between Ce-LOR and Ce-ROR. One possible cause would be the estimation error of TCI system.

Conclusion: Although Ce-ROR was fairly well correlated with Ce-LOR, we could not precisely predict when a patient regains consciousness from Ce-LOR. Furthermore Ce-Opioids had little influence on the relation between Ce-LOR and Ce-ROR.

References

1. Iwakiri H, et al. *Anesth Analg* 2005;100:107-10
2. Kang H, et al. *J Anesth* 2017;31:502-9
3. Schraag S, et al. *Anesth Analg* 2006;103:902-7



[Fig.1] Ce-LOR vs. Ce-Maint (presented at EuroAnaesthesia2016)

[Fig.2] Ce-LOR vs. Ce-ROR (by Iwakiri, et al. 2005)

	Mean ± SD (range)
Age (yr)	52.8 ± 9.0 (33-65)
Weight (kg)	55.3 ± 7.9 (43.0-70.0)
Height (cm)	158.8 ± 4.1 (151.5-167.0)

[Table 2] Demographic data