

Which Sevoflurane Wash-In Rates Towards 1.0 MAC Ensure Adequate Anesthetic Depth After a Standardized Intravenous Induction Before Surgical Incision?

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Background: After intravenous (IV) induction of anesthesia, inhaled agent wash-in has to be titrated in such a manner that the combined effects of this agent and remaining opioid and propofol continue to ensure loss of consciousness (LOC) prior to incision. We assessed the effect of different sevoflurane wash-in rates on anesthetic depth.

Methods: Anesthesia was induced with sufentanil (0.2 µg/kg), followed 4 min later by propofol (1-2 mg/kg, depending on age), and rocuronium (0.6 mg/kg) in 33 ASA PS I-III patients. After tracheal intubation, sevoflurane wash-in towards 1 age-adjusted minimal alveolar concentration (MAC) was controlled to occur exponentially with a time constant of 2.5, 5.0, or 11.1 min, depending on the anticipated time of incision: FAST, MEDIUM, or SLOW, respectively. The effect-site MAC (MAC_e), sufentanil effect site concentration (CeSuf), Noxious Stimulation Response Index, Bispectral Index (BIS), and Brice questionnaire defined 3 probabilities of LOC (P_{LOC}): *extremely high*, i.e. MAC_e > 0.63 and CeSuf > 0.17 ng/mL or NSRI < 50 and BIS < 65; *high*, i.e. 50 < NSRI < 70 and BIS < 65 or NSRI < 50 and BIS > 65; and *insufficient*, i.e. NSRI > 50 and BIS > 65 or recall elicited by the Brice questionnaire.

Results: The end-expired sevoflurane concentration rose towards 1 MAC with a time constant (95 % confidence interval) of 2.6 (2.6; 2.7), 5.7 (5.3; 6.2), and 10.9 (9.6; 12.6) min in groups FAST, MEDIUM, and SLOW, respectively. 0.63 MAC_e was reached at 9.8 [9.8; 9.8], 12.3 [12.3; 12.6], and 18.5 [18.3; 18.7] min (median and interquartile range), for groups FAST, MEDIUM, and SLOW, respectively, with CeSuf > 0.17 ng/mL at the moment 0.63 MAC_e was reached in all but 2 patients in group SLOW. Before reaching 0.63 MAC_e, P_{LOC} was high to extremely high in group FAST and MEDIUM patients, but insufficient in group SLOW, even though the modified Brice questionnaire did not elicit any recall.

Conclusion: An exponential end-expired sevoflurane wash-in rate towards 1.0 MAC with a time constant ≤ 5.7 min but not ≥ 10.9 min ensures hypnosis after IV induction with propofol (1-2 mg/kg), preceded 4 min earlier by sufentanil (0.2 µg/kg). Integrating these patterns into automated low-flow target controlled algorithms may help optimize anesthetic agent delivery.

Keywords: pharmacokinetics, inhaled agents, sevoflurane, synergy, anesthetic depth