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Persistent train-of-four fade in myasthenia gravis patients after sevoflurane anaesthesia

Editor—We read with great interest the article by Nitahara and colleagues[1] showing concentration-dependent inhibitory effects of sevoflurane on neuromuscular transmission in myasthenia gravis (MG) patients which was more prominent in patients with a pre-anaesthetic T4/T1<0.9. In their study, T4/T1 returned to baseline value in all patients at the end of anaesthesia. The importance of monitoring pre-anaesthetic T4/T1 ratio in MG patients has been previously mentioned in a study showing significantly lower atracurium requirements in patients with pre-anaesthetic T4/T1<0.9.[2] We also investigated T4/T1 ratio as a predictor for early extubation in 11 MG patients using sevoflurane and remifentanil without concomitant use of neuromuscular blocking agents. Interestingly, five patients, of whom only one patient showed pre-anaesthetic T4/T1<0.9, had persistent T4/T1<0.9 at the end of anaesthesia, even when the end-tidal sevoflurane concentration was below 0.3%. Of the five patients, two had pre-anaesthetic T4/T1>0.9, had T4/T1<0.8 and did not meet the extubation criteria (inspiratory force >25 cm H_2O and vital capacity of at least 10 ml kg^{-1}), and could not be extubated in the operating room. These two patients had similar characteristics as the other nine patients, including serum anti-acetylcholine receptor antibody titre, except that they had bulbar symptoms and a more severe grade of MG.[3] Sevoflurane may be a suitable anaesthetic agent for MG patients owing to the concentration-dependent inhibitory action on neuromuscular transmission with rapid reversibility after discontinuation.[1 2] However, as we observed, persistent fade can occur at the end of sevoflurane anaesthesia, regardless of the presence of pre-anaesthetic fade, hindering early extubation even when no neuromuscular blocking agents were used. The association of MG severity and recovery of fade needs to be validated in a further study and we recommend monitoring post-recovery T4/T1 ratio as well, during sevoflurane anaesthesia without the use of neuromuscular blocking agents in MG patients to avoid unnecessary risk of respiratory compromise and delay in extubation.

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Editor—We appreciate the interest of Dr Kwak and colleagues in our article.[1] In our study, the train-of-four ratios (TOFRs) of some patients with fade or non-fade did not return to a value ≥0.9. At the end of anaesthesia, although mean TOFR returned to values not significantly different from baseline in all three groups, TOFRs were <0.9 in three of 10 patients with baseline TOFR≥0.9 and in three of six patients with baseline TOFR<0.9. It is unclear whether the fade at the end of anaesthesia in MG patients was due to the residual neuromuscular effect of sevoflurane. We extubated all patients with fade since the inspiratory force and vital capacity met the extubation criteria. It has been reported that during partial neuromuscular block, although impairment of inspiratory flow and upper airway obstruction still occurs,[4] forced vital capacity and inspiratory force recovery to an acceptable level at TOFR>0.6.[4 5] Recently, TOFR≥0.9 has become a standard for safe recovery from the neuromuscular blocking drugs in patients without neuromuscular disease. However, if we set the extubation criteria at a TOFR above 0.9 in MG patients, we would keep many patients intubated after operation. In our institute, we extubate if the patient is fully awake and inspiratory force and vital capacity meet the criteria. Respiratory conditions are closely monitored after extubation. To our knowledge, no standard TOFR level has been established for safe recovery with regard to extubation in MG patients.

Postoperative respiratory insufficiency in MG patients may not only be caused by residual neuromuscular effect of inhalation anaesthetics, other intraoperative factors such as surgical invasion and the i.v. anaesthetics used, which cannot be measured by TOFR, can also affect postoperative respiratory function. In our study, anticholinesterase and steroids were continued until the morning of surgery. Preoperative control of MG symptoms may also influence the postoperative respiratory conditions. It is difficult to speculate what will be the postoperative respiratory conditions simply from the preoperative TOFR from single peripheral muscles.

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Stroke volume variation obtained with FloTrac/Vigileo™ fails to predict fluid responsiveness in coronary artery bypass graft patients

Editor—Recently, a new cardiac output monitoring device (Vigileo™, Edwards Lifesciences, Irvine, CA, USA) has been introduced in clinical practice which is based on arterial pulse contour lacking the necessity of external calibration.[1] This device offers the possibility of a nearly beat-to-beat measurement of cardiac output, stroke volume, and stroke volume variation (SVV). In patients undergoing coronary artery bypass grafting (CABG), this system has been demonstrated to measure cardiac output with clinically acceptable accuracy.[2] However, the reliability of SVV measured with this system in predicting fluid responsiveness is unknown. We therefore studied 18 CABG patients monitored with a FloTrac/Vigileo™-system (using software version 01.01) to analyse whether this new device is suited for functional preload monitoring.

Fourteen male and four female patients [67 (7) yr, 79 (9) kg, 174 (9) cm, mean (SD), and BSA range 1.69–2.20 m^2] undergoing CABG surgery were included in this study. The study was approved by the institutional review board. All patients had given written informed consent. Stroke volume index (SVI) was measured with transpulmonary thermodilution (PiCCO™, Pulsion Medical Systems, Munich, Germany) before and after a volume load (VL) of 10 $ml \cdot kg^{-1}$ hydroxyethyl starch 6% 1 h after arrival of the patients on the intensive care unit. In addition, central venous pressure (CVP) and SVV were recorded. Patients were mechanically ventilated (volume control) with a tidal volume of 8 $ml \cdot kg^{-1}$ ($F_{I_{O_2}}$ 0.4, PEEP 5 cm H_2O) maintaining normocapnia. According to the available literature, fluid-responders were defined by an increase in SVI$\geq$12% subsequent to the VL.[3] Statistical analysis was performed using SPSS version 15.0 (SPSS Inc, Chicago, IL, USA). Pearson's correlation analysis was used to describe the linear relation between preload parameters before a VL and the change in SVI (ΔSVI) induced by that VL. The ability to predict fluid responsiveness was quantified for each preload parameter by calculating the area under the receiver operating characteristic (ROC) curve.[4] A P-value of <0.05 was considered statistically significant.

Nine patients did not respond to the fluid load. The correlation coefficient for the relationship between ΔSVI and CVP prior to the volume load was 0.244 (P=0.329), and between ΔSVI and SVV 0.452 (P=0.069). ROC analysis showed that both preload indicators failed to predict fluid responsiveness. The area under the ROC curve for CVP and for SVV were 0.685 (P=0.185) and 0.660 (P=0.268) respectively.

The failure of CVP in predicting fluid responsiveness is in accordance with increasing evidence that static preload indicators are not suited for functional haemodynamic monitoring.[5] In contrast, a growing number of clinical studies have clearly demonstrated the ability of dynamic preload indicators (including SVV) to accurately predict the response of an individual patient to a volume challenge.[6 7] In contrast to these reports, we found SVV (obtained with the FloTrac/Vigileo™ system) failed to predict fluid responsiveness. This finding might be attributed to the fact that in our system, the first software generation (version 01.01) was implemented. This version operates with a re-calibration interval of 10 min, which is probably too long to accurately measure changes in respiratory variations in the arterial pressure curve. In fact, by employing shorter re-calibration intervals in a newer software version, the accuracy of the FloTrac/Vigileo™ system in measuring cardiac output had been markedly improved.[8] Therefore, our findings warrant further investigation whether the application of shorter re-calibration intervals will allow using the FloTrac/Vigileo™ system for functional haemodynamic monitoring.

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