A new rapid method of Ion Mobility Spectrometry to measure propofol concentrations to evaluate the predictive performance of a 'Diprifusor' TCI system

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Background and Goal of Study: Due to the technical and methodological problems none of the methods published so far is ready for clinical routine application. In this study, the new ion mobility spectrometer^[1] (IMS, measurement within 1 minute without any pretreatment) was used to quantify propofol. The aim of the present study was to assess the predictive performance of the 'Diprifusor' TCI system.

Materials and Methods: 33 patients with ASA I or II (Ethical Committee of the First Affiliated Hospital of Harbin Medical University) were included undergoing elective abdominal surgery (Divided into three groups by age). A radial artery cannula was inserted for arterial pressure and collection of blood sample (0.5 ml). Propofol and remifentanyl were infused to achieve target effect compartment concentrations of 6 $\mu\text{g ml}^{-1}$ (Schnider model) and 5 ng ml^{-1} (Minto model), respectively. Propofol was maintained at 3.5 $\mu\text{g ml}^{-1}$ after induction. Remifentanyl was maintained at 3.5-7 $\mu\text{g ml}^{-1}$ for analgesia. Blood samples were introduced into the IMS directly without any pretreatment.

Results and Discussion: The values were similar in three groups, with overall median values of 28.6% for MDPE and 40.0% for MDAPE. The measured concentrations (C_m) were higher than the predicted concentrations (C_p). The principal source of performance error is due to pharmacokinetic variability in patients during anaesthesia, blood sampling techniques or different measurement techniques.

Conclusions: The new IMS could be applied to measure the propofol concentrations as a point-of-care monitor in TCI TIVA. The measured concentrations were higher than the predicted concentrations.

References: [1] Wang X, et al. Ion mobility spectrometry as a simple and rapid method to measure the plasma propofol concentrations for intravenous anaesthesia monitoring[J]. Scientific Reports, 2016, 6:37525.

Figure 1. Monitoring of propofol concentrations measured by IMS (red dots), propofol concentrations calculated by TCI system (blue dots), MAP, HR, and BIS. Data are shown as mean $\pm$ SD. IMS, ion mobility spectrometry; TCI, target controlled infusion; BIS, bispectral index; MAP, mean arterial pressure; HR, heart rate; SD, standard deviation of the mean. Time periods: 1: 1 minute before induction; 2: 3 minutes after induction; 3: 5 minutes after induction; 4: skin incision; 5: 30 minutes of surgery; 6: 60 minutes of surgery; 7: 120 minutes of surgery; 8: end of the surgery; 9: 1 minute after stop delivery; 10: 5 minutes after stop delivery; 11: 10 minutes after stop delivery; 12: 15 minutes after stop delivery; 13: 20 minutes after stop delivery.

Figure 2. Box and whisker plots of performance error (%) related to different time periods of all patients. The horizontal line within each box is the median; Lower and upper boundaries are the 25th and 75th percentiles; Vertical whiskers extend over the range; Dots show outliers. Time periods: 1: 3 minutes after induction; 2: 5 minutes after induction; 3: skin incision; 4: 30 minutes of surgery; 5: 60 minutes of surgery; 6: 120 minutes of surgery; 7: end of the surgery; 8: 1 minute after stop delivery; 9: 5 minutes after stop delivery; 10: 10 minutes after stop delivery; 11: 15 minutes after stop delivery; 12: 20 minutes after stop delivery.