**CO03   FEATURES FROM PUPILLARY REFLEX DILATION AND NEURAL NETWORKS CLASSIFICATION OF REMIFENTANIL EFFECT**

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**Introduction:** In previous studies (1,2) a relation between the amplitude of dilation in the pupillary reflex dilation (PRD) curve and the remifentanil effect-site concentration (RemiEC) was observed. In this study we aim to model the PRD curve and determine which features, besides amplitude of dilation, are best to discriminate the pharmacodynamic effect of remifentanil.

**Methods:** PRD measurements obtained using Algiscan (IDMED, France) in patients undergoing general anesthesia with remifentanil and propofol TCI, following Ethics Committee approval and patients’ informed consent. This data was then modeled using an ordinal differential equation model, considering a 5 seconds tetanic stimulus, and one second step stimuli to account for time varying properties of the PRD, resulting in a model of nine transfer constants. Model parameters were obtained minimizing error using the simplex search method, constraining the search to a maximum of iterations. Features extracted from the modeled curve consisted of baseline pupil diameter, maximum pupil reflex diameter, delay between stimulus onset and peak dilation, percentage of dilation from baseline, maximum pupil diameter variation (first differences) and delay, minimum pupil diameter variation (fastest descent) and delay, area under the curve (AUC), AUC with baseline removal (AUCb).

Correlation analysis was applied to reduce dimension, and the extracted features introduced in a neural network to estimate the analgesic dose according to RemiEC classes 0, 0-2ng/ml and >2ng/ml. The NN was trained in 70%, and tested in 30% of the data. Data analysis was performed using Octave and IBM SPSS Statistics.

**Results:** 1294 PRD measurements from 86 patients were initially included. Due to data loss, a final set of 1264 PRD records were analyzed.

An example of a modeled curve is shown on Figure 1. Table 1 presents dataset summary.

Table 2 present the results for the classification of RemiEC groups, using the trained NN and features extracted from the modeled PRD. We obtained a correct classification of 72,3% in the training set, with best results for the groups remifentanil 0ng/ml (80,0%) and remifentanil>2ng/ml (88,1%), showing the difficulty in differing intermediate effects that are constrained by interpatient variability regarding drugs' effect-site concentration.

**Discussion and Conclusion:** We were able to produce a robust model of the PRD while extracting features from this curve. Our data suggests these features can be used to better predict the remifentanil effect. Besides, these results also corroborate PRD as an useful measurement to detect the remifentanil dose-dependent blunting effect to nociceptive stimuli such as a tetanic stimulation. Classification results are limited since effect-site concentrations were used as estimates of effect, which may be hindered by interpatient variability and PKPD models' limitations.

**Reference(s):** 1. Br J Anaesth. 2003;91(3):347-352. 2. J Clin Monit Comput. 2020;34(2):319-324.



