Brain bioelectrical function and cerebral oxygenation during neonatal anaesthesia with two different opioid drugs - pilot clinical study.

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BACKGROUND AND AIMS

Preterm newborns are often in need of surgical treatment, which is strictly connected with administration of anesthetics. One of the most commonly used drugs in newborn anesthesia are opioids. Their pharmacological action might cause hypotension, respiratory failure and depression of the central nervous system [1,2].

Still there is a limited number of studies evaluating influence of an anesthesia on a preterm newborn. One of the most commonly used opioids are fentanyl and remifentanyl. They have different pharmacokinetics (table 1.) [3,4] and they might have different effect on brain function.

There are two new methods of brain function monitoring. Amplitude integrated electroencephalography (aEEG) which allows to continuously monitor electric brain function. Near Infrared Spectroscopy (NIRS) monitors brain tissue oxygenation.

The aim of our study is to use these two methods combined with classical pulseoxymetry to monitor preterm newborns during anaesthesia.

METHODS

Preterm patients born between 2015 and 2016 requiring photocoagulation or ranivizumab injection due to retinopathy of prematurity were included into the study.

Patients were assigned to one of the two groups. Group one received remifentanyl during the anaesthesia and group two received fentanyl. Each patient was mechanically ventilated during the procedure and was extubated after it, when patients own breathing was present and spontaneous movement reappeared.

Each patient was monitored with aEEG, NIRS and pulseoxymetry. For aEEG we used CCFM Digitrack (Elmiko, Poland). From aEEG following parameters were studied: mean aEEG voltage and interburst intervals (IBI). For brain oxygenation (NIRS) we used INVOS 5100C (Covidien, USA). For pulseoxymetry we used NONIN, which is integrated with aEEG transducer (USA). Length of ventilatory support after the procedure was also analyzed. Each patient was monitored for 5 minutes before the surgery, during the surgery and for 1 hour and 30 minutes after the procedure. During surgery 25 minutes of stable signal was chosen. Time after procedure was divided into 3 epoch (30minutes each) for the analysis.

	Fentanyl	Remifentanyl
Onset	Almost immediate	1-3 minutes
Duration	0,5-1 hour	3-10 minutes
Metabolism	Rapid via blood and tissue esterases	Hepatic, primarily via CYP3A4 by N-dealkylation (to norfentanyl) and hydroxylation to other inactive metabolites
Half elimination	2,4 hours	5,4 minutes

Table 1. Comparison of drugs used in the study

RESULTS

15 patients had been included into group 1 and 13 into group 2. Patients in group 2 had longer time on mechanical ventilation after the procedure (505min. vs. 172 min. $p=0,004$).

For saturation and brain oxygenation there were no differences between groups before, during and after the procedure (Figure 1).

Patients in the group 1 had significantly higher heart rate in first 30 minutes after the surgery ($p=0,004$) and in last 30 minutes ($p=0,03$) (Figure 1.).

Patients in group 2 had lower mean voltage in first 30 minutes after the procedure ($p=0,008$) and during last 30 evaluated minutes ($p=0,04$) (Figure 1).

Considering IBIs there were no differences between groups before ($p=0,155$) and during the procedure ($p=0,055$).

After the surgery, in all three phases there were significant differences between the groups. Patient that received fentanyl had more IBIs after the surgery.

CONCLUSIONS

Infants receiving remifentanyl needed 3 times less time on mechanical ventilation after the surgery when compared to fentanyl. They had also higher aEEG voltage and more continuous signal after the procedure. Difference in heart rate requires further investigation.

Figure 1. Comparison of saturation, pulse, brain oxygenation and mean aEEG voltage between groups.

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