

## THE EEG DURING AWAKENING FROM ANAESTHESIA IN INFANTS

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### Introduction

Processed EEG monitoring of consciousness, developed in adults, may not be reliable in infants.(1) The normal EEG of infants is different to that in adults and EEG data from infants during anaesthesia are sparse. Are there characteristics of the EEG that could be used as a monitor of anaesthesia depth and to indicate whether or not an infant will awaken? Davidson and colleagues found that mean EEG power decreased before awakening in children older than 6m anaesthetised with various drug combinations.(2) This study analyses EEG data from infants awakening from sevoflurane anaesthesia and searches for characteristic patterns.

### Methods

The study was approved by the local ethics committee and parents gave written informed consent. All infants were anaesthetised with sevoflurane in oxygenated air and mechanically ventilated via tracheal tubes. Analgesia was appropriate for the surgery. Silver cup scalp electrodes were applied to record EEG from frontal and centro-parietal montages. Recording began after surgery had ended. Sevoflurane administration was continued at surgical levels for one minute and then turned off. Infants were unstimulated except for tickling a foot continuously until awake. EEG was recorded using a Grass Telefactor "Aura 10-20" system connected to a PC. Analogue filters limited data to between 0.3 and 70 Hz. The input range was +2 to -2 millivolts, digitisation was 400 Hz and signal resolution was 0.06 OV. Off-line, raw signals were visually inspected for obvious oscillations, patterns and non-EEG artefacts and analysed with discrete Fourier transformation using Matlab signal processing software. Signal power was calculated for epochs of 6s; frequency band resolution was 1Hz. Events were recorded by a video time-linked to the EEG. Data capture ended when infants were awake for one minute. Criteria for awakening had been developed in a previous study by consensus with 30 consultant anaesthetists.

### Results

Fourteen infants were studied. Visual inspection showed two obvious phases. After awakening started there were large changes in the baseline, bursts of EMG activity and other nonphysiological artefacts. Before awakening signals were constant and 2 patterns were obvious that were associated with age. The youngest infants had low amplitude signals (<10 OV) whereas the oldest infants had appreciable amplitude (>50 OV) in mixed frequencies between 3 and 20 Hz; this pattern was prominent during anaesthesia but decreased after sevoflurane had been turned off. Visualisation of power spectrum arrays confirmed these observations. In 8 infants older than 52 w (postmenstrual age (PMA)) the power within 5-20Hz frequency bands decreased after sevoflurane was turned off and almost disappeared approximately one minute before awakening began.

### Discussion

In infants older than 52 w PMA, there were characteristic power spectrum changes

before awakening from sevoflurane anaesthesia that may be a useful warning of awakening. These findings are similar, but in reverse, to those described during induction of propofol anaesthesia in adults.(3)

### **References**

1. Davidson AJ. Measuring anesthesia in children using the EEG. *Paediatr Anaesth* 2006 Apr;16(4):374-87.
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3. Koskinen M, Mustola S, Seppainen T. Relation of EEG spectrum progression to loss of responsiveness during induction of anesthesia with propofol. *Clinical Neurophysiology* 2005 Sep;116(9):2069-76.