Changes in brain activation during sedation induced by Dexmedetomidine

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Objective: Dexmedetomidine (DEX) has been widely used as a sedative, acting as an α2-adrenergic agonist on autoreceptors, presynaptic receptors and postsynaptic receptors without risk of respiratory depression. Although consciousness impairment is closely related to disturbances of brain function in different frequency bands, the time-varying DEX effects on cortical activity in specific frequency bands has not yet been studied.

Methods: We attached thirty-two electrodes to the standard 10-20 international placement after selecting EEG cap that matched the head circumference of the participant best. EEG was recorded to maintain the impedance of all electrodes below 5 kΩ. EEG Data were stored on a PC at a sampling rate of 2048 Hz during the study. After obtaining the baseline EEG recordings for 5 min with eyes closed, We administered 0.5 mcg/kg loading bolus of DEX over 10 min After that, The DEX infusion was then changed at a rate of 0.5 mcg/kg/hr until unconsciousness was obtained. We used electroencephalography (EEG) to analyze differences in cerebral cortex activity between the awake and sedated states, using electromagnetic tomography (standardized low resolution electromagnetic tomography (sLORETA)) to localize multiple channel scalp recordings of cerebral electric activity to specific brain regions.

Results: Cortical activity changes were followed in different frequency bands after inducing DEX sedation. The results revealed increased activity in the cuneus at delta-band frequencies, and in the posterior cingulate cortex at theta frequencies, during awake and sedated states induced by DEX at specific frequency bands. Differences in standardized low resolution cingulate gyrus were found in beta1 frequencies (13-18 Hz), and in the cuneus at gamma frequencies. Relative to the awake state, decreased activity was found in the fusiform gyrus in the alpha frequency bands, and was most prominent during DEX-induced sedation, which was lateralized to the left.

Conclusion Cerebral cortical activity was significantly altered in various brain areas during DEX sedation, including parts of the default mode network and common midline core in different frequency ranges. These alterations may elucidate the mechanisms underlying DEX sedation