



The Effects of Sleep-Deprivation, Caffeine, and Alcohol on Surgical Dexterity

Paramita Das MS, MD; Tarini Goyal; Daniel James Guillaume MD, MSc

University Of Minnesota



Introduction

We hypothesized that sleep deprivation, caffeine intake and alcohol consumption the night prior to simulated neurosurgery may impact performance on a virtual reality neurosurgical stimulator

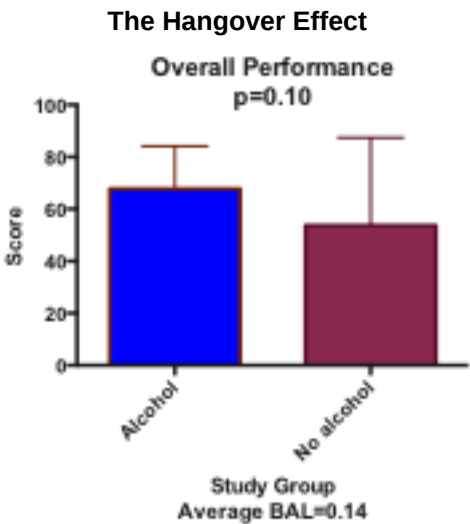
Methods

Trainees and faculty practiced a simulated bimanual microsurgical task on the NeuroTouch Neurosurgical simulator until it was mastered. Blood alcohol levels were measured following alcohol consumption. The module was repeated the following morning. Residents were also encouraged to repeat the task following sleep-deprivation and caffeine intake. A questionnaire documenting sleep, caffeine, and alcohol intake was completed with each use. Performance metrics included: task duration, left or right hand with excessive force, number of incorrect or correct fibers cut, and overall score.

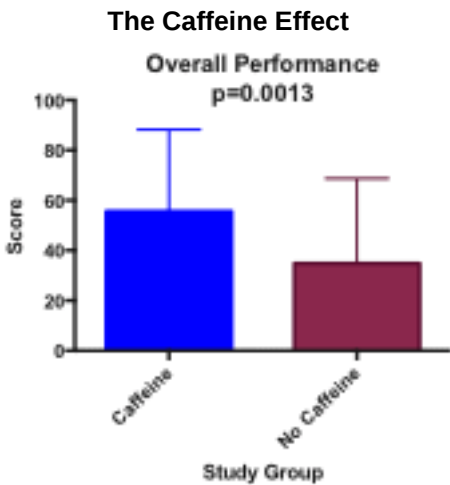
NeuroTouch Neurosurgical Simulator



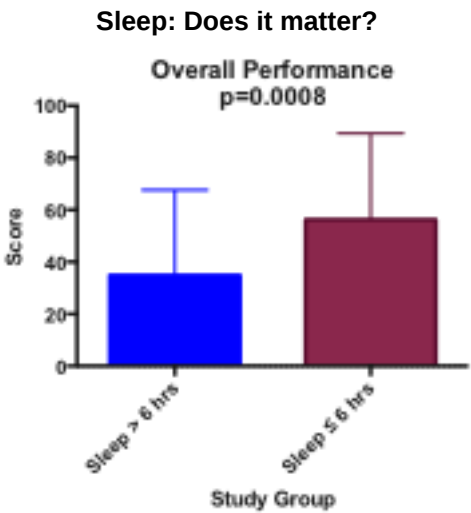
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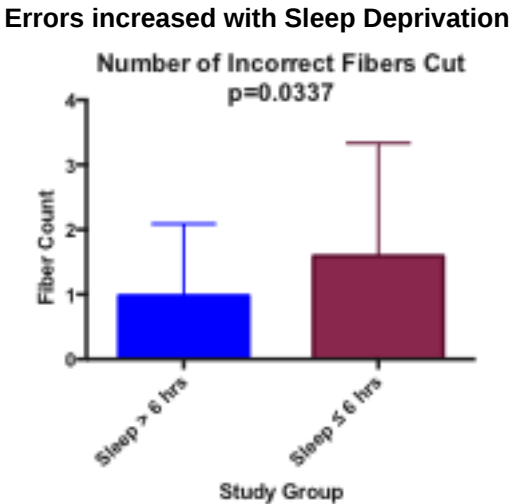
There was no significant differences between performance for the users who drank alcohol the night before and those that did not.



Although overall performance was higher in the caffeine group they also used more excessive force and there were more incorrect fibers cut.



Those that slept greater than six hours had worse performance overall but did use excessive force when completing the task and cut more incorrect and correct fibers.



Although overall performance was improved there were greater number of incorrect fibers transected during arachnoid dissection.

Results

Sleep deprivation had no effect on task duration or left hand excessive force. The sleep deprived group had significantly higher use of right hand excessive force. Those that slept < 6 hours had higher numbers of both correct and incorrect fibers cut (0.9796 ± 0.1584 versus 1.591 ± 0.2148 , $P = 0.0337$). The only differences in the caffeine groups were excessive force with the right hand was higher in the no caffeine group ($3.039 \text{ s} \pm 0.6494$) versus the caffeine group ($1.267 \text{ s} \pm 0.1636$), $P \text{ value}=0.0025$, and there was significantly higher numbers of fibers cut. In the participants who consumed alcohol, the average BAL was 0.14 and 0.005 the night prior and morning of the task respectively. There was no statistical difference in any measures in the alcohol versus non-alcohol groups.

Conclusions

Alcohol consumption the evening prior to simulated microneurosurgery did not change performance. Caffeine increased the force used as well as the fibers cut. Sleep deprived participants although performing overall better also cut more incorrect fibers. We acknowledge that simulator performance may not predict operative performance and our study may have failed to show more differences due to low numbers of participants.