Transforming Neurosurgery Education: Roll-Out of a National Immersive Operative Simululator

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Disclosures

• DAS—Surgical Simulations LLC – Member
• DRC—Surgical Simulations LLC – Member
• KLT – Surgical Simulations LLC – Member
• AW – No Disclosures
• SJH – No Disclosures
• AAK – No Disclosures
• NRS – No Disclosures
Introduction

A. The Sagittal Sinus Injury Simulator is a 20-minute immersive simulator designed to train neurosurgical residents in the operative diagnosis and management of serious surgical complications.

B. The simulator has been included as a core component of the Society for Neurological Surgery PGY-2 bootcamps from 2017-2019
Methods

- Residents enrolled in the study are fitted with wrist HR monitors.
- They undergo the simulated surgery with a faculty proctor.
- At predetermined timepoints they are subjected to stress stimuli designed to mimic intra-operative complications.
- At the end of the case, a short survey is administered.
- HR and survey data were compared across locations and years of the bootcamp.
Variable HR responses to stress stimuli. Some trainees had very little variation in HR (A) compared to others who experienced tachycardia in response to stress stimuli (B, C). Some residents experienced bradycardia in response to stimuli (D). Overall, 76% of trainees experienced tachycardia during the simulation.
Dichotomous HR response to bleeding stimulus

Mean HR changes to stress stimuli. A) Average HR tracing across trainees. B) Significant increase in HR in response to bleeding stimulus. C) Average Peak HR after bleeding and embolic stimulus is elevated compared to mean HR. D) Baseline HR of bradycardic responders is significantly elevated above other cohorts.
Survey data show high resident satisfaction with simulator

Resident survey responses to simulator. Overall, residents agreed the simulator was a useful tool (A) and rated the simulator with high satisfaction (B). Responses improved over time with iterative improvement of the simulator.
Survey data informed efforts to improve simulator between years.
Discussion

• Largest biometric study of neurosurgical residents to-date
• The simulator is capable of generating a tachycardic stress-response in majority of trainees.
• A small subset of trainees experienced fear-response bradycardia during simulation. The significance of this is unclear.
• The survey data indicate an overwhelmingly positive response to simulated surgeries.
• The survey data are sensitive enough to inform changes to improve the simulator.
• Additional surgical simulations should be considered to advance neurosurgical training.
Summary Points

- Neurosurgical simulators can be successfully implemented on a nation scale.
- Tachycardic responses to stress stimuli indicate that immersive simulation is capable of emulating OR stress.
- Resident trainees are overall in favor of neurosurgical simulators to enhance training.