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Fidelity study of a new synthetic simulator for endoscopic third ventriculostomy

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Introduction: Endoscopic third ventriculostomy (ETV) is an effective but technically demanding procedure with significant risk. Current simulators including human cadavers, animal models and virtual reality systems are expensive, relatively inaccessible and can lack realistic sensory feedback. We have constructed a realistic low cost, reusable brain simulator for ETV and evaluated it for fidelity.

Methods: A brain silicone replica mimicking normal mechanical properties of a 4-month-old child with hydrocephalus was constructed, encased in the replicated skull and immersed in water. Realistic intraventricular landmarks included the choroid plexus, veins, mamillary bodies, infundibular recess, and basilar artery. The thinned out third ventricle floor which dissects appropriately, is quickly replaceable. Standard neuro-endoscopic equipment including irrigation is used. Bleeding scenarios are also incorporated. The simulator was tested for fidelity by means of questionnaires (5-point Likert-type items) with 16 neurosurgical trainees (PGY 1-6) and 9 pediatric and adult neurosurgeons.

Results: The simulator is portable, robust, and sets up in minutes. Over 95 % of participants agreed or strongly agreed that the simulator's anatomical features, tissue properties and bleeding scenarios were a realistic representation of that seen during an ETV. Participants stated that the simulator helped develop the required hand-eye coordination and camera skills, and was a valuable training exercise.

Conclusions: A low-cost reusable silicone-based ETV simulator realistically represents the surgical procedure to trainees and neurosurgeons. It can develop the technical and cognitive skills for ETV including dealing with complications.