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**REALLY GOOD STUFF**

# A circulating cadaveric simulation model for neurosurgery residents

## 1 | WHAT PROBLEMS WERE ADDRESSED?

Simulation models are an essential part of any surgical training programme.

Skull base neurosurgery requires special skills and a long and difficult learning curve. Surgical exclusion of an aneurysm may be necessary in an emergency situation and must be part of every neurosurgeon's skill set. If training is inadequate, the functional or even vital consequences can be significant. Surgical training on a model that simulates circulation within the arterial circle at the base of the skull is invaluable for training young neurosurgeons. It enables future surgeons to deal with critical situations (including vascular ones) in a safe simulation environment.

## 2 | WHAT WAS TRIED?

We have developed an anatomical model to recirculate the arterial circle at the base of the skull. Our model was successfully validated on five anatomical subjects.

Each dissection was performed on a fresh subject in the anatomy laboratory.

After a cervical incision, the common carotid arteries were dissected, cannulated and connected to the SIM LIFE perfusion system. The external carotid arteries were ligated to limit cutaneous or meningeal bleeding on the approach.

A fronto-orbital-pterional craniotomy was performed and the parasellar region approached after opening the Sylvian fissure under an operating microscope.

The primary objective was to enable the resident to perform a fronto-orbital-pterional approach and then, under the operating microscope, to dissect the Sylvian valley under conditions as close as possible to reality.

Arterial pulsations enabled residents to experience the mechanical and pulsatile constraints of arteries *in vivo*.

The second objective was to cope with the intraoperative rupture of an arterial aneurysm, simulated by a proximal vascular wound

deliberately made with micro-scissors (carotid termination, A1 or M1 segments). Blood flow could be modulated according to blood pressure and artificial heart rate.

The resident was able to control the haemorrhage proximally by placing a clip on the portal artery.

This model was put into practice for three neurosurgery residents over a 6-month period. Each resident was supervised by a senior neurosurgeon throughout the dissection.

## 3 | WHAT LESSONS WERE LEARNED?

Thanks to this simulation model, the residents were able to practice this approach and cope with the vital emergency situation in the event of a vascular wound.

Under safe conditions, they were able to learn exposure techniques for the anterior and middle floors of the skull base, opening of arachnoid cisterns to limit cerebral retraction and proximal vascular control techniques in case of arterial rupture.

This model makes close to reality intraoperative conditions possible, without endangering patients.

The next step is to extend this model to a larger number of residents.

Being confronted with massive intraoperative bleeding (vascular neurosurgery and skull base surgery) requires rapid reactivity, which training under stimulation conditions can help to acquire.

This reliable, reproducible simulation model appears to be beneficial in the training of a young neurosurgeon.

## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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