Internal carotid artery injury

Injury of the internal carotid artery during endoscopic endonasal skull base surgery is a feared and perilous scenario.

The catastrophic and rare nature of an internal carotid artery (ICA) injury during endonasal surgery limits training opportunities. Cadaveric and animal simulation models have been proposed, but expense and complicated logistics have limited their adoption. Three-dimensional (3D) printed models are portable, modular, reusable, less costly, and proven to improve psychomotor skills required for managing different lesions. In this study we evaluate the role of a simplified laser-sintered model combined with standardized training in improving the effectiveness of managing an ICA injury endoscopically. METHODS:

A 3-mm defect was created in the parasellar carotid canal of a laser-sintered model representing a sphenoid sinus. Artificial blood was directed to simulate the copious bleeding arising from an ICA injury. Twenty otolaryngologists and 26 neurosurgeons, with varying training and experience levels, were individually asked to stop the “bleeding” as they would in a clinical scenario, and provided no other instructions. This was followed by individualized formative training and a second simulation. Volume of blood loss, time to hemostasis, and self-assessed confidence scores were compared.

At the end of the study, time to hemostasis was reduced from 105.49 seconds to 40.41 seconds ($p < 0.001$). The volume of blood loss was reduced from 690 to 272 mL ($p < 0.001$), and the confidence scores increased in 95.7% of participants, from an average of 3 up to 8.

This ICA injury model, along with a formal training algorithm, appears to be valuable, realistic, portable, and cost-effective. Significant improvement in all parameters suggests the acquisition of psychomotor skills required to control an ICA injury. [1)].

The intercarotid distance (ICD) is thus a major parameter, determining the width of the surgical corridor in TSS. The purpose of the study is to investigate changes in ICD at different levels of the ICA during and after TSS using high definition intraoperative MRI (3T-iMRI).

Pre-, intra- and 3 months postoperative MRI images of 85 TSS patients were reviewed. ICD was measured at the horizontal (ICDC4h) and vertical (ICDC4v) intracavernous C4 segment as well as at the C6 segment (ICDC6). Association between ICD change at different levels and time points were compared and potential factors predicting ICD reduction were analyzed.

ICD decreased intraoperatively at all three segments of ICA by -3% (median decreases: ICDC4h: -0.5 mm, ICDC4v: -0.7 mm ICDC6: -0.4 mm). At 3 months postoperative MRI, ICD reduced by a further -4%, -2% and -4% respectively (median decreases ICDC4h: -0.7, ICDC4v: -0.4 mm, ICDC6: -0.5 mm). Postoperative narrowing in ICD occurred independent of further resection after 3T-iMRI. ICD change correlated between different levels of the ICA indicating a uniform shift perioperatively. Preoperative ICD was significantly associated with the intraoperative reduction in ICDC4v and ICDC6.

Serra et al. have demonstrated a uniform narrowing in ICD at different levels of the ICA during and after TSS adenoma resection. Surgeons should be aware of this change since it determines the width of the surgical corridor and can thus influence the ease of surgery [2)].

The article of AlQahtani et al. discusses perioperative strategies to prevent or manage an internal

carotid artery injury to optimize outcomes. Meticulous preoperative planning is crucial in preventing its occurrence and minimizing its consequences. An effective plan of action relies on a well-prepared protocol, availability of proper instruments and devices, and an experienced multidisciplinary team. Intraoperative control of hemorrhage and stabilization of the patient's cardiovascular status is followed by an angiography and endovascular treatment whenever possible. Close clinical and radiologic monitoring of the patient prevents early and late complications [3].

Endovascular Extraction of a Needle from the Internal Carotid Artery: A Novel Approach to a Controversial Dental Misadventure [4].

1)
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