Simulation Training for Vascular Emergencies in Endoscopic Sinus and Skull Base Surgery

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KEYWORDS

• Carotid artery injury • Hemostasis • Endoscopic • Transsphenoidal • Simulation

KEY LEARNING POINTS

At the end of this article, the reader will:

- Be able to identify the major sources of morbidity when internal carotid artery (ICA) injury occurs.
- Be able to describe the ICA vascular catastrophe model.
- Be able to describe the key endoscopic surgical techniques to control the surgical field during an ICA injury.
- Be able to outline the surgical techniques to achieve hemostasis during endoscopic carotid artery injury.
- Be able to describe the late complications following carotid artery injury and how may they be avoided.
- Know if training in vascular emergencies can improve patient outcomes.

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INTRODUCTION

Why is endoscopic simulated training for vascular complications required?

- There is a paradigm shift from external approaches to endonasal.
- Endoscopic approaches are becoming the standard of care for resection of pituitary tumors.
- Endoscopic resections are common, increasing the chance of experiencing a vascular emergency.
- Increasingly advanced surgical pathologies are endoscopically resected.
- Research into internal carotid artery (ICA) rupture management is required.

The last 20 years has seen a paradigm shift from traditional external approaches to the skull base to a completely endoscopic endonasal approach, made possible with the advent of improved technological developments, surgical instrumentation, and an improved understanding of the endoscopic endonasal anatomy. The advantages of endoscopic techniques over traditional external approaches include improved visualization, reduce hospital admission times, avoiding minimal sacrifice of intervening structures, and avoiding external skin incisions.[1]

Transsphenoidal pituitary surgery is common and has an incidence of ICA rupture rate of approximately 1.1%. Ciric and colleagues[2] used a postal questionnaire survey, involving more than 900 neurosurgeons, inquiring about their complication profile. Surgeons who had performed in excess of 500 transsphenoidal pituitary approaches had a 50% chance of being in the situation where they had to manage the carotid artery catastrophe. This finding implies that the increased subspecialization of endonasal skull base surgery is associated with a greater chance of experiencing a carotid artery injury (ie, subspecialty surgeons need to be geared up to manage an ICA injury). More advanced surgical resections center on the management of the ICA and, hence, have a greater chance of ICA injury. Endoscopic resections of craniopharyngiomas, clival chordomas, and chondrosarcomas have an ICA rupture rate of between 5% and 9%.[3–5] The increasing use of endoscopic approaches to the skull base increases the risk of encountering potential vascular injuries; it is essential that the specialist endoscopic skull base surgeon has appropriate training, not only in endonasal skull base anatomy and the avoidance of complications but also in managing a carotid artery catastrophe.

SIMULATION TRAINING

What is surgical simulation?

- Definition
- Goals of simulation
- Types of simulation (bench models, cadavers, virtual reality simulators, and live animals)

A simulator is defined as a device or model that is used to train people by imitating the situations that they will need to deal with. It allows users to gain experience and to