



# Modified Protocol for Management of ICA Injury in Endoscopic Sinus Surgery



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## Background

**Internal carotid artery (ICA) injury during endoscopic sinus surgery (ESS)** is a rare but catastrophic complication. Contemporary series place overall major ESS complication rates at ~0.3–0.9% while reported incidence of ICA injury ranges from 0–0.1%<sup>1</sup>. Injury risk is heightened during sphenoid work where bone overlying the ICA is thin or dehiscence, the ICA often bulges into the sinus<sup>2</sup>, or bony landmarks are obscured by pathology.

Unlike cranial base surgery cases employing two experienced surgeons and a 4-hand technique, often culminating in neurosurgical repair of minor injuries, ESS case literature repeatedly documents first-line field control by packing and rapid coordination with neuro-interventional teams, underscoring the need for an ESS-specific, damage-control algorithm<sup>3,4,5</sup>.

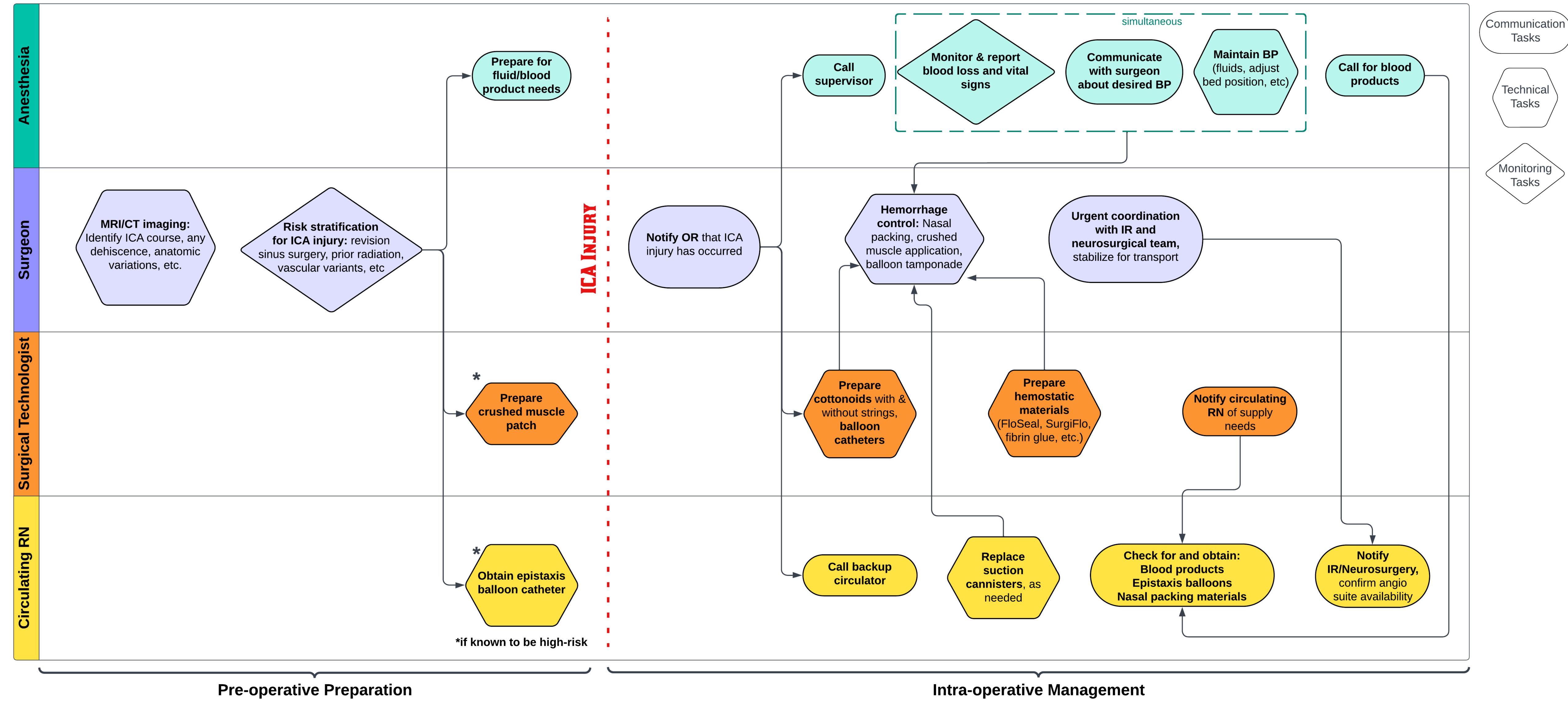
## Objectives

To compare resource availability between skull base and ESS operating rooms and, using peer-reviewed reports of ICA injury in ESS, derive a practical management protocol with educational application

## Methods

We conducted a review of peer-reviewed reports of ICA injury during ESS (1988–2022) using carotid injury, sphenoidotomy, hemorrhage, and endovascular search terms. Eligible studies described ICA injury during ESS with extractable operative details; skull base and non-ICA vascular injuries were excluded. Data on imaging, OR resources, hemostasis, and endovascular management were abstracted and compared with skull base practice. Recurrent steps were mapped onto our institution’s TEAM-ICA framework and refined with multidisciplinary input to develop an ESS-specific management protocol.

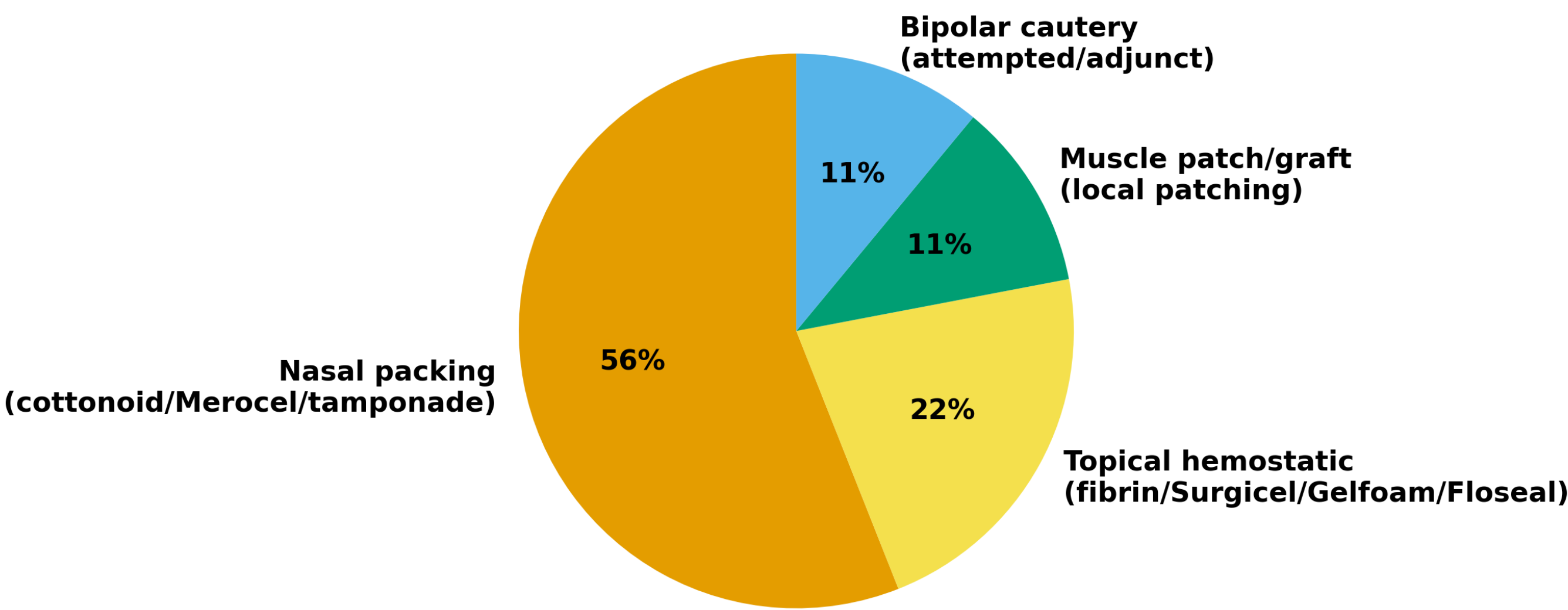
**Figure 2.**  
ICA Injury Management Algorithm during Endoscopic Endonasal Surgery



**Table 1.**

Resource Availability for ICA Injury Management: Cranial Base vs Endoscopic Sinus Surgery		
Supplies/Resources	Cranial Base Surgery	Endoscopic Sinus Surgery
Team surgery	+	-
Specialized OR team	+/-	-
Team simulation training	+/-	-
Image navigation	+	+/-
Neuromonitoring	+	-
Arterial BP monitoring	+	-
Endoscopic bipolar electrocautery	+	+/-
Aneurysm clips	+/-	-
Doppler sonography	+	-
ICG angiography	+/-	-
Hemostatic materials	+	+/-
Adenosine	+/-	-
Interventional Radiology	+	+/-

**Figure 1.**  
Methods of Initial Hemorrhage Management in Reported FESS ICA Injuries



## Results

Comparison of skull base and ESS operating rooms showed major differences in available monitoring, vascular tools, and endovascular access [Table 1]. Literature review of ESS ICA-injury cases demonstrated nasal packing/tamponade and topical hemostatics as the most common field control methods, with bipolar cautery and muscle patch use occasionally cited, and balloon packs seldom cited [Figure 1]; definitive care almost always required catheter angiography with stent-graft or coil/balloon occlusion. Integrating these findings, we modified our protocol into a streamlined ESS-focused algorithm: **Pack → Stabilize → Transfer**. [Figure 2].

## Conclusions

We present a **modified ICA injury management protocol tailored to ESS**, integrating comparative resource availability to inform immediate goals of management. The algorithm codifies pre-operative risk checks, hemostasis/airway/MAP targets, and neurovascular coordination. Future work will implement simulation-based training and formalize Interventional Radiology transfer pathways into institutional protocols.

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