

# Hemorrhagic Complications of Endoscopic Sinus Surgery



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## KEYWORDS

- Epistaxis • Endoscopic sinus surgery • Internal carotid artery
- Anterior ethmoid artery • Posterior ethmoid artery • Sphenopalatine artery

## KEY POINTS

- Vascular anatomy of the nose and paranasal sinuses is well defined and avoiding certain pitfalls during endoscopic sinus surgery can prevent intraoperative and postoperative hemorrhage and associated complications.
- Internal carotid artery injury can be prevented by a thorough understanding of the surgical anatomy. Having a plan of action in place before such injuries can save valuable time and improve outcomes.
- Preoperative steps, including thorough history and physical, review of medications/vitamins, and preoperative steroid courses can decrease the risk of bleeding.
- Intraoperatively, total intravenous anesthesia, controlled hypotension, and positioning of the patient can reduce blood loss and improve visibility.
- Postoperatively, any patient with epistaxis should be evaluated with nasal endoscopy. Special attention should be directed to the most common sites of postoperative bleeding.

## INTRODUCTION

Major complications during endoscopic sinus surgery (ESS) are rare, occurring in 0.36% to 3.1% of patients, and include severe bleeding, orbital injury, cerebral spinal fluid leak, and intracranial damage.<sup>1-5</sup> Of this subset of patients, postoperative hemorrhage accounts for 23% to 39% of those complications.<sup>1,5</sup> Major hemorrhage with the need for transfusion occurs rarely and occurred in only 0.76% of patients in one large review.<sup>3</sup> Although rare, major hemorrhage can be serious for the patient, resulting in increased morbidity and mortality if appropriate action is not taken immediately.

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This article focuses on those hemorrhagic complications during and following ESS, with attention to relevant surgical anatomy, common pitfalls leading to bleeding from major intranasal vessels, preventative measures, and management of certain catastrophic hemorrhagic complications for which preparedness can mean the difference between life and death.

## VASCULAR ANATOMY OF THE NOSE AND SINUSES

The nose and paranasal sinuses have a robust vascular supply. Much of this blood supply is derived from the external carotid system via the sphenopalatine artery (SPA). This artery exits through the sphenopalatine foramen (SPF) within the lateral nasal wall and lies within the superior meatus between the basal lamella of both the middle and superior turbinates.<sup>6</sup> The SPF sits at a distance of 6 cm from the nasal sill in most patients.<sup>6</sup> The artery often divides into multiple branches and can enter the nasal cavity through multiple accessory foramina.<sup>7,8</sup> The posterior septal branch, a branch of the SPA, is most notable for its cause of post-ESS hemorrhage and is discussed in greater detail later.

Several commonly used techniques in ESS (middle turbinate resection and the creation of wide maxillary anrostomies) place the SPA and its branches at risk of injury. When performing these techniques it is best to leave a stump of the resected middle turbinate attached to the lateral nasal wall and use cautery to seal any exposed vessels. In addition, clinicians should avoid enlarging the maxillary anrostomy too far posteriorly, because the SPA exits in close proximity to the posterior maxillary sinus wall.

Endoscopic control of the SPA for epistaxis management includes performing SPA ligation/cautery, a procedure first described by Budrovich and Saetti.<sup>9</sup> An incision is made in the mucosa of the lateral nasal wall roughly 1 cm anterior to the lateral insertion point of the middle turbinate. This area may also be easily accessed after creating a maxillary anrostomy. A mucoperiosteal flap is then elevated posteriorly toward the SPF with a freer elevator. One anatomic landmark that has been shown to have a fairly consistent relationship with the SPF is the crista ethmoidalis. Locating this bony eminence in the perpendicular plate of the palatine bone is helpful in aiding the surgeon locate the SPF, which lies posterior to the crista ethmoidalis in 95% of cases.<sup>7</sup> In addition, Bolger and colleagues<sup>10</sup> performed 22 cadaver dissections and found that the SPA exited the SPF posterior to the crista ethmoidalis in 21 of 22 cadavers. Once identified, the SPA is then clipped or cauterized with bipolar cautery. As previously stated, the anatomy of the SPA can vary and it is important to inspect the area for additional branches of the SPA exiting the lateral nasal wall via alternative foramina. Failure to find additional accessory foramina, if present, could result in inadequate control of bleeding from the region of the SPA.

The posterior septal artery is a branch of the SPA that supplies blood to the posterior nasal septum and nasal cavity. It is also the vascular pedicle on which the nasoseptal flap used for skull base reconstruction is based. The posterior septal artery runs along the inferior face of the sphenoid sinus and may be injured while creating a sphenoidotomy or when providing exposure for pituitary hypophysectomy. Bleeding from the posterior septal branch can be brisk, but is easily controlled with monopolar or bipolar cautery. Note that, with increasing performance of endoscopic skull base surgery and use of the nasoseptal flap for reconstruction, the incidence of significant epistaxis requiring intervention in the operating room is around 1.3% to 1.5% following transnasal transsphenoidal pituitary surgery.<sup>11,12</sup>

The internal carotid artery (ICA) is intimately associated with the lateral portion of the sphenoid sinus. It is divided into the following segments: parapharyngeal, petrous,

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