

## Effectiveness of Total Intravenous Anesthesia in Endoscopic Sinus Surgery

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### Abstract

A 58-year-old female presented for functional endoscopic sinus surgery (FESS) to treat chronic rhinosinusitis. FESS has been mainstay treatment for chronic rhinosinusitis, with or without nasal polyps. Goals for FESS included optimal visualization of anatomical structures with minimal bleeding in the surgical field.<sup>1</sup> The anesthetic technique chosen, either total intravenous anesthesia (TIVA) or inhalational anesthesia (IA), has shown to affect visibility of the sinonasal mucosa, dictating outcome of intraoperative blood loss. Differences between anesthetic agents focused on vasodilation, particularly in the nasal mucosa.<sup>2,7,8</sup> Current evidence supported TIVA as the superior anesthetic technique in FESS, as it has shown to successfully reduce intraoperative blood loss with superior surgical visibility.

**About the Author:** Anna Busalacchi is a registered intensive care unit nurse, currently enrolled in Texas Christian University Nurse Anesthesia program.



### Introduction

- Endoscopic sinus surgery (ESS) is the mainstay treatment currently for chronic rhinosinusitis, with or without nasal polyps.
- Goals for successful ESS: optimal visualization of anatomical structures and landmarks with minimal blood loss/bleeding in surgical field.<sup>1</sup>
- ESS is generally conducted under general anesthesia for patient comfort utilizing total intravenous anesthesia (TIVA) for optimal surgical field visualization, yet inhalational anesthesia (IA) is still being used in these cases.<sup>3</sup>
- The research promoting the use of TIVA stems from the pharmacodynamics of propofol versus inhalational agents such as sevoflurane and isoflurane.<sup>1,3,6</sup>
- The difference between these agents are how they produce vasodilation in the body and particularly the nasal mucosa.
- Anesthetic technique has shown to affect visibility of the sinonasal mucosa and dictate the outcomes of blood loss and operative time.
- Highlighting the difference between TIVA and IA shines a light on the influence that anesthesia can have on these patients' surgical course.

### Case Description

#### Pre-Anesthetic Evaluation:

- A 58-year-old female, 67 inches, 107.4 kilograms, ASA II presented for Endoscopic Sinus Surgery (ESS) to treat chronic rhinosinusitis
- Medical history: sinusitis, hyperlipidemia, obesity
- Preoperative vital signs: HR 80, BP 151/89 mmHg, RR 16, SpO2 97%
- Preoperative Medications: clindamycin 900 mg IV, midazolam 2 mg IV, both given in the preoperative area

#### Intraoperative Management:

- General anesthesia induced with lidocaine 60 mg IV, propofol 180 mg IV, and succinylcholine 120 mg IV
- Following induction: rocuronium 40 mg IV, dexamethasone 10 mg IV, propofol infusion started at 100 mcg/kg/min
- Maintenance: propofol infusion remained on throughout procedure, rocuronium 10 mg given one hour into case
- At time of closure: propofol infusion turned off, ondansetron 4 mg IV, ketorolac 30 mg IV, acetaminophen 1 g IV
- No vital sign abnormalities throughout case noted
- Estimated blood loss of case: 50 mL, calculated by amount in canister with irrigation subtracted

#### Postoperative Course:

- Reversed with sugammadex 200 mg IV, extubated and transferred to PACU with oral airway in place and dressing under nose placed and secured by surgeon
- PACU vital signs: HR 74, BP 133/70 mmHg, RR 18, SpO2 95%

#### Follow Up:

- Patient dressing under nose observed with no bloody drainage, discharged to home within 2 hours of procedure ending
- No nausea or pain noted by patient before discharge

### Propofol Vasodilation Mechanism:

- concentration-dependent vasodilatory effect<sup>7</sup>
  - depresses central sympathetic tone<sup>3,7</sup>
    - avoids peripheral vasodilation<sup>1</sup>
- depresses cerebral blood flow= decreased arterial supply to the ethmoid bed<sup>2</sup>

### Inhalational Agent Vasodilation Mechanism:

- concentration-dependent vasodilatory effect<sup>7</sup>
  - directly acts on smooth muscle of blood vessels<sup>7,8</sup>
  - leads to vasodilation of peripheral and cerebral blood vessels<sup>7,8</sup>
- relaxes pre-capillary sphincters in the mucosa= increases blood flow to the paranasal sinuses<sup>7,8</sup>

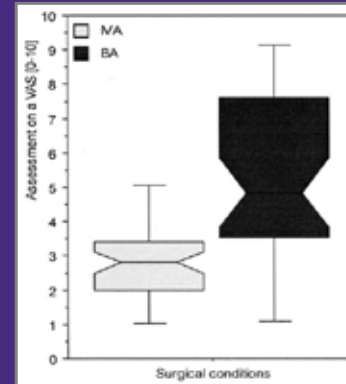


Figure 1: Comparison of TIVA versus "balanced anesthesia," meaning the use of inhalational agents, via a visual analog scale used by surgeons to grade the surgical field visibility.<sup>6</sup>

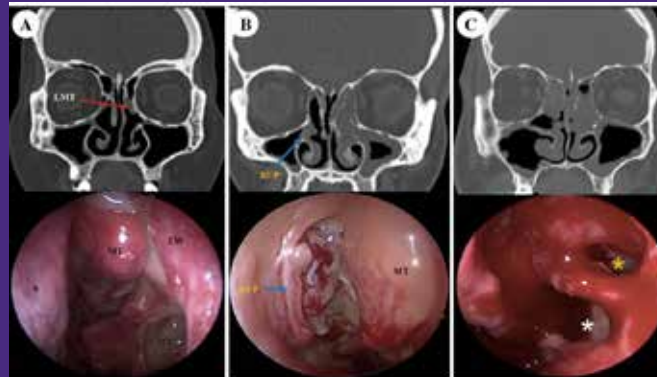


Figure 2: Radiological and endoscopic images demonstrating the progression of increased bleeding and decreased surgical visibility in a revision ESS.<sup>9</sup>

### Discussion

#### Case Key Points:

- TIVA requested by surgeon as anesthetic technique
- Very minimal blood loss
- No hemodynamic abnormalities throughout entire case

#### Case Critiques:

- Emergence was delayed by ten minutes, due to propofol lingering; propofol infusion should have been turned off sooner
- Estimated blood loss was calculated by amount in suction canister with amount of irrigation subtracted; many researchers are now recommending looking at hemoglobin values before and after the case

#### Clinical Rationale:

- Surgeon must be able to identify anatomic landmarks within confined surgical space to complete ESS.
- By decreasing arterial blood supply to the ethmoid bed, propofol leads to better visibility for the surgeon and better patient outcomes.<sup>2</sup>
- Those with more severe chronic rhinosinusitis have shown to benefit even greater with TIVA in surgical outcomes.<sup>7</sup>

### Conclusion

- The nasal mucosa is a highly vascularized area. When operated on, bleeding can lead to a great deal of blood loss and challenging visibility for the surgeon.<sup>1</sup>
- The use of TIVA over IA has proven to lead to decreased blood loss and a cleared surgical field, graded using the Wormald visibility scale in a large pool of randomized controlled trials and prospective studies.<sup>1</sup>
- TIVA versus IA has also proven to have no major difference in the hemodynamic profile of these researched patients in the noted studies, proving its safety.<sup>1</sup>

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### Literature Review

- The overwhelmingly present theme across many studies supporting TIVA highlight the benefits of using propofol as the main anesthetic drug and how it interacts in the body.<sup>1,2,3,7</sup>
- Many studies used conducted research in similar manners of blindly assigning patients to receive TIVA or IA and measuring outcomes of blood loss and surgical visibility.
- Patients with varying degrees of chronic rhinosinusitis were studied.
- Hemodynamic profiles were monitored and compared between anesthetic techniques.<sup>1,4</sup>

### Key Findings from Literature

- TIVA has proven to be the superior anesthetic technique because it has shown to successfully reduce intraoperative blood loss with superior surgical visibility.<sup>7</sup>
- Propofol, with the use of a short-acting opioid, such as remifentanyl, is currently the leading anesthetic technique in ESS.<sup>6</sup>
- Gaps in research have become evident including the need for standardized surgical visibility scoring, how more extensive chronic rhinosinusitis affects surgical outcomes regardless of anesthetic technique, and the quality of life of these patients following their surgery and anesthesia.<sup>2,5,6</sup>