




Hypotensive Anaesthesia in Functional Endoscopic Sinus Surgeries: A Systematic Review

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Article History	Abstract 
<p>Received on: 07 Jan 2024 Revised on: 16 Feb 2024 Accepted on: 19 Feb 2024</p>	<p>This systematic review comprehensively analyzes the literature on hypotensive anesthesia in Functional Endoscopic Sinus Surgeries (FESS), crucial for treating sinonasal disorders. The anesthesia technique choice significantly influences FESS outcomes. Hypotensive anesthesia, involving controlled blood pressure reduction during surgery, garners attention for potential benefits. A database search identified relevant studies examining its efficacy, safety, and impact on intraoperative visibility, surgical time, blood loss, and postoperative outcomes. Various drugs, including inhalational agents, hypocapnia, hypercapnia, local adrenaline, fentanyl, remifentanyl, esmolol, dexmedetomidine, and nitroglycerine, have been employed to minimize bleeding and enhance operative conditions. Sevoflurane is a common inhalation agent. Dexmedetomidine, with lower bolus doses, proves advantageous for visibility and achieving a MAP of 60 mm Hg swiftly. Opioids have a lower hypotensive potential, nitroglycerine lacks analgesic effects, and beta-blockers provide favorable conditions. Dexmedetomidine's prolonged analgesia correlates with improved postoperative outcomes. Limited studies explore combined drugs' efficacy or side effects. Cognitive dysfunction is a concern, with hypotension approved up to a MAP of 60 mm Hg. The technique's application extends to children, but careful patient selection is crucial, considering contraindications and comorbidities.</p>
<p><i>Keywords</i></p> <p>Nasal surgeries, Endoscopic, Anaesthesia, Hypotension, Bloodless</p>	

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INTRODUCTION

1.1 Background

Endoscopic sinus surgery (FESS) is a widely employed procedure for managing chronic rhinosinusitis, nasal polyposis, and other sinonasal disorders. The anesthesia chosen significantly influences surgical success, with hypotensive anesthesia emerging as a potential strategy for optimizing intraoperative conditions. Various

anesthetic techniques have proven beneficial for FESS [1][2]. Hypotensive anesthesia, specifically used in FESS, aims to reduce intraoperative bleeding and enhance visibility. Pharmacological agents such as nitroglycerin, sodium nitroprusside, and esmolol, among others, are utilized, and controlled hypotension is induced through inhalational agents or intentional hypovolemia via fluid restriction. Normovolemic hemodilution involves replacing the patient's blood with a balanced crystalloid or colloid solution. Selective arterial clamping is employed for localized hypotension, targeting specific vessels. These strategies collectively seek to improve surgical conditions during FESS, facilitating more precise and efficient treatments with reduced blood loss [3][4].

1.2 Objectives of the Review

This systematic review aims to:

- Evaluate the efficacy of hypotensive anesthesia in enhancing intraoperative visibility during endoscopic sinus surgeries.
- Assess the impact of hypotensive anesthesia on surgical time and blood loss.
- Analyze the safety profile of hypotensive anesthesia in the context of endoscopic sinus surgeries.
- Investigate postoperative outcomes associated with the use of hypotensive anesthesia in FESS.

METHODS

2.1 Search Strategy

A comprehensive search of electronic databases, including PubMed, Scopus, and the Cochrane Library, was conducted to identify relevant studies published up to the present date. Search terms included variations of "deliberate hypotension," "hypotensive anesthesia," "endoscopic sinus surgery," and related keywords such as field visibility and blood loss.

2.2 Inclusion and Exclusion Criteria

Studies meeting the following criteria were included: Original research articles. Studies investigating the use of hypotensive anesthesia in endoscopic sinus surgeries, including unbiased RCTs or systematic reviews. Publications in English. Studies were excluded if they were

reviews, case reports, or did not report relevant outcomes.

2.3 Data Extraction and Analysis

Data extraction encompassed study characteristics, patient demographics, anesthesia protocols, intraoperative outcomes, and postoperative follow-up. The methodological quality of included studies was assessed using established criteria.

RESULTS

3.1 Study Selection

The initial search yielded a total of 1156 studies (Figure 1). Following the application of inclusion and exclusion criteria, 20 studies were included for detailed analysis.

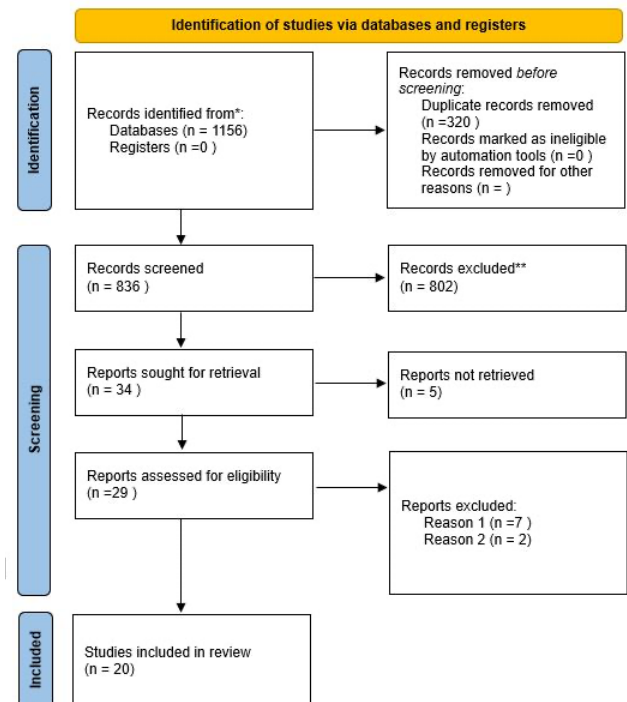


Figure 1 Flow diagram of study flow

3.2 Intraoperative Visibility

The majority of studies consistently report enhanced intraoperative visibility with the use of hypotensive anesthesia. The controlled reduction of blood pressure contributes to improved visualization of sinonasal structures, facilitating precise surgical maneuvers. Various drugs, including dexmedetomidine, esmolol, and nitroglycerin, have been utilized, with dexmedetomidine often considered the ideal choice for Functional Endoscopic Sinus Surgery (FESS) [5][6][7]. Its unique properties, such as

sedation without respiratory depression and minimal impact on airway reflexes, create a controlled and calm intraoperative environment. Dexmedetomidine, by maintaining stable hemodynamics and reducing bleeding, enhances surgical precision and visibility, ultimately ensuring the safety and success of FESS procedures.

3.3 Surgical Time and Blood Loss

Deliberate hypotension, maintaining mean arterial pressure (MAP) between 50 and 65 mmHg and systolic blood pressure (SBP) between 80 and 90 mmHg, is recognized as a blood conservation approach [8][9].

Studies suggest that hypotensive anesthesia protocols permit effective hemostasis management with significantly reduced operative time. Monitoring MAP and blood pressure ranges, along with timely intervention using vasoactive medications, is crucial for successful outcomes. While several studies indicate a trend toward reduced surgical time and blood loss with hypotensive anesthesia, variations in study designs and patient populations limit definitive conclusions.

In the context of FESS, propofol and remifentanyl target-controlled infusion in combination with dexmedetomidine have shown promise in reducing intraoperative hemorrhage and improving surgical field quality. Additionally, dexmedetomidine has demonstrated benefits in mitigating the rise in MAP and heart rate during intubation and extubation, enhancing postoperative analgesia.

3.4 Safety Profile

The safety profile of hypotensive anesthesia in FESS is well-established. Lowering blood pressure during FESS does not significantly increase the risk of adverse outcomes, such as cardiovascular problems or organ dysfunction. Studies consistently show that managed hypotension in FESS does not compromise patient safety and may even lead to faster recovery. However, individual patient considerations, including pre-existing medical conditions, should guide adjustments to ensure optimal safety [10][11][12][13]. The safety of hypotensive anesthesia has also been confirmed in pediatric cases.

3.5 Postoperative Outcomes

Research examining postoperative outcomes after hypotensive anesthesia in FESS reveals positive results. Reduced intraoperative bleeding due to controlled hypotension leads to improved vision, shorter surgical periods, less postoperative pain, and faster recovery compared to conventional anesthesia. The approach is associated with fewer complications, lower morbidity, and a decreased need for blood transfusions, suggesting potential economic benefits and improved patient satisfaction [14][15][16][17]. Limited long-term follow-up data are available, with some contrasting opinions.

3.6. The literature survey

It includes various studies investigating the efficacy and safety of hypotensive anesthesia in Functional Endoscopic Sinus Surgery (FESS). In a study by Usha Bafna *et al.*, involving 70 adult patients, Dexmedetomidine (Dexmed) demonstrated superior efficacy compared to Clonidine, with no significant side effects and better postoperative outcomes. Abu-sinna *et al.*'s research on 40 adults found Propofol to be more effective than Nitro-glycerine (NTG), with an increased incidence of tachycardia observed with NTG. Shams T *et al.*'s study on 40 adults favored Dexmed over Esmolol, noting reduced analgesia with Esmolol and improved postoperative outcomes with Dexmed.

Chhabra, Alka *et al.*'s investigation with 68 adults comparing Dexmed and Magnesium sulfate (Magsulf) highlighted Dexmed's superiority, despite concerns about the slow onset of Magsulf and doubts regarding neuromuscular recovery. Srivatsava.U *et al.*'s study with 52 adults indicated that Esmolol was more effective than NTG, showing better visibility with Esmolol. Deng-Feng Ding *et al.*'s research involving 62 adults revealed that Dexmed, compared to Saline TCI, provided better analgesia and sedation, emphasizing the unique aspects of Total Intravenous Anesthesia (TCI). Chaaban *et al.*'s study with 33 adults found similar outcomes between Propofol and Sevoflurane, with differences in administration routes (intravenous vs inhalational).

Akkaya *et al.*'s study with 60 adults favored Dexmed over Magsulf, noting improved analgesia and longer surgical duration with Magsulf. Milonsky *et al.*'s investigation with 90 adults suggested Total Intravenous Anesthesia (TIVA) as

superior to Sevoflurane, with slower recovery in the Sevoflurane group. Mostafa I A's study on 60 children indicated Dexmed's superiority over Esmolol, with slower recovery observed with Dexmed. Amico D, in a meta-analysis of 10 RCTs involving 9359 patients, reported decreased hospital stay and atrial fibrillation with Mean Arterial Pressure (MAP) maintained at 60 mm, prompting exploration of further MAP reductions. Nalan Celebi et al's research with 40 adults found Esmolol and Remifentanyl to be equally effective, with similar cognitive dysfunction and good visibility provided by both.

Erdem A F et al's study with 50 adults, using Propofol and Remifentanyl, reported satisfactory effectiveness with a 20% decline in cerebral oxygen saturation, emphasizing patient selection for controlled hypotension. Khosla et al's investigation with 1148 adults suggested less blood loss when adrenaline was added to Total Intravenous Anesthesia (TIVA), and preoperative steroids were effective, underlining the importance of patient selection. Ahn H J's study with 40 adults reported better visibility and less bleeding with Propofol and Remifentanyl compared to Sevoflurane. Sahu P et al's research with 60 adults indicated Dexmed's superiority over Propofol, with increased sedation observed with Propofol and better analgesia with Dexmed. Bajwa et al's study with 150 adults favored Dexmed and Esmolol over NTG, with NTG showing limited effectiveness and Esmolol lacking analgesic or sedative properties.

Giriyapur P's study with 68 adults suggested 2 mic/kg of Fentanyl as superior for analgesia with no significant side effects. Hilal A's research with 80 adults favored Dexmed over saline, indicating improved sedation and analgesia with Dexmed. Motlagh et al's study with 81 adults found 0.8 mic/kg bolus of Dexmed to have similar effects with less sedation, emphasizing comparable analgesia. Overall, these studies collectively contribute to understanding the varied outcomes and considerations associated with hypotensive anesthesia in FESS.

DISCUSSION

4.1 Mechanisms of Improved Visibility

A crucial aspect associated with hypotensive anesthesia is controlled vasodilation, involving the

dilation of blood vessels. This optimizes blood flow and reduces overall pressure within the vascular system. The regulated vasodilation contributes to maintaining a bloodless field, enhancing visibility of the surgical site. Moreover, it reduces stress on delicate tissues, enabling a more accurate and meticulous surgical approach. The establishment of a comfortable and regulated atmosphere by hypotensive anesthesia enhances access to surgical sites. Reduced blood pressure and controlled vasodilation synergize to improve the surgeon's ability to navigate anatomical structures, [18][19][20] particularly in the confined spaces encountered during Functional Endoscopic Sinus Surgery (FESS).

4.2 Variability in Study Designs

The heterogeneity in study designs, patient populations, and anesthesia protocols across the reviewed studies highlights the need for standardized approaches to assess the impact of hypotensive anesthesia. Future research should strive to establish consensus guidelines for the application of hypotensive anesthesia in FESS [21][22].

4.3 Limitations of the Evidence

The limitations of the available evidence include the lack of large-scale randomized controlled trials, variations in outcome reporting, and potential publication bias. Addressing these limitations will enhance the reliability and generalizability of findings [23][24].

Recommendations for Future Research

Based on the findings of this systematic review, the following recommendations for future research are proposed:

- Conduct large-scale randomized controlled trials comparing hypotensive anesthesia with standard anesthesia in FESS.
- Standardize outcome measures and reporting to facilitate comparison across studies.
- Investigate the long-term postoperative outcomes and patient satisfaction associated with hypotensive anesthesia in FESS.

Standardizing protocols and outcome measures will lead to a better understanding of the impact of

hypotensive anesthesia on improving endoscopic sinus surgery outcomes.

CONCLUSION

Even at lower than established dosages, hypotensive anesthesia with dexmedetomidine offers prospective benefits in terms of increased intraoperative visibility, reduced surgical time, and blood loss in endoscopic sinus procedures. Hypotensive anesthesia demonstrates a favorable safety profile, with few recorded side effects. The heterogeneity in study designs, especially in combined techniques, and the scarcity of long-term follow-up data underscore the need for more research to establish standardized protocols and analyze the long-term effects associated with hypotensive anesthesia in FESS.

Author Contribution

Dr AG – design and concept, Dr NSS and GS - literature search, Dr SPS- write up and communication.

Ethical Clearance

Not applicable: This study does not require ethical clearance as it does not involve human subjects, sensitive data, or any procedures that fall within the scope of ethical review.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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