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A Comparison between Propofol, Dexmeditomedine and Nitroglycerin as Hypotensive Agents and their Effect on Blood Loss in Functional Endoscopic Sinus Surgery (FESS)

Thesis

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List of Abbreviations

Abb.	Full term
µg	Microgram
ACE	Angiotensin converting enzyme
ANH	Acute Normovolemic Hemodilution
ASA	American Society of Anesthesiologists
BBB	Blood–brain barrier
bpm	Beat per minute
CHF	Congestive heart failure
CO_2	Carbon dioxide
CYP 2A6	Cytochrome P-450
ECG	Electrocardiography
EEG	Electroencephalogram
FDA	Food and Drug Administration
FESS	Functional endoscopic sinus surgery
GA	General anesthesia
GABA	γ-aminobutyric acid
GTN	Glyceryl trinitrate
GTP	Guanosine triphosphate
HR	Heart rate
hr	Hour
ICP	Intracranial pressure
ICU	Intensive care unit
IV	Intravenous
IVRA	Intravenous regional anesthesia
MAP	Mean arterial pressure
NO	Nitric oxide
NTG	Nitroglycerin

List of Abbreviations Cont...

Abb.	Full term
PACU	Postanesthesia care unit
PD	Pharmacodynamic
PK	Pharmacokinetic
PONV	Postoperative nausea and vomiting
PRIS	Propofol infusion syndrome
SNP	Sodium nitroprusside
α2-AR	α2-adrenergic receptor

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ABSTRACT

Background: Functional endoscopic sinus surgery (FESS) has been proposed as selected treatment used in patients with chronic sinusitis that have not responded to medical therapy. Due to the nature location of endoscopic sinus surgery; even a small amount of bleeding can reduce the operative visibility**.** The aim of the work was to compare between propofol, Dexmeditomedin and nitroglycerin as regards their effects as hypotensive agents and their effects on blood loss in FESS

Patients and methods: Sixty adult patients of ASA physical status I and II, admitted to Ain Shams University hospital, scheduled for FESS and were randomly assigned into three groups, (**D group)** for dexmedetomidine (n=20), **(P group)** for propofol (n=20) and **(N group)** for nitroglycerine (n=20). **In Group (D)** patients received dexmeditomedin loading dose of 1 mcg/kg over 10 (on 100ml normal saline) before induction followed by a maintenance infusion of 0.5mcg/kg/hr. **In Group (P)** patients received propofol infusion 8mg/Kg/hr IV. **In group (N):** patients received nitroglycerin infusion 2µg/kg/min. MAP and HR were measured continuously and recorded every 15 minutes, bleeding score for assessment of intraoperative surgical field and duration of surgery was measured.

Results: Targeted mean arterial pressure (MAP) of (55-65 mmHg) and improved surgical field quality were achieved in group D and group P. Also dexmeditomedine was faster in achieving target blood pressure than propofol heart rate (HR) was significantly lower in the D group. Duration of surgery was shorter in group D and group P.

Conclusion: Dexmedetomidine and propofol are more effective in achieving controlled hypotention than nitroglycerine. Both drugs were associated with less bleeding and shorter duration of surgery in patients undergoing FESS. Dexmeditomedine was more effective in controlling heart rate than propofol and nitroglycerine. Also dexmeditomedine was faster in achieving target blood pressure than propofol.

Keywords: Propofol, Dexmedetomidine, Nitroglycerine, Controlled hypotension, Sinusitis.

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is becoming a widely performed operation. FESS is indicated for the surgical management of acute and chronic sinus pathologies when conservative management has failed. Objective of functional endoscopic sinus surgery (FESS) is to restore drainage and aeration of Paranasal sinuses and seeks to preserve the normal anatomical structures and function ***(Cho et al., 2012).***

With the advantage of enhanced illumination and visualization, it has dramatically improved surgical dissection. Impaired visibility due to excessive bleeding is a major hurdle that has been reported for FESS under general anesthesia (GA) ***(Sieskiewicz et al., 2014).***

Major complications have been reported for FESS under general anesthesia resulting from impaired visibility due to excessive bleeding ***(Yoo et al., 2010).***

There are several important advantages of using the intentional hypotensive anesthetic technique during the FESS like reduction in blood loss, hence, reduction in blood transfusion rate, improvement in the surgical field, and reduction of the duration of surgery ***(Elsharnouby and Elsharnouby, 2006)***.

In hypotensive anesthesia, the patient's baseline mean arterial pressure (MAP) is reduced by 30% or MAP is kept at 60-70 mm Hg. Consequently, the systolic blood pressure values are about 80–90 mm Hg ***(Guney et al., 2012)***.

Several pharmaceuticals have been used successfully to produce controlled hypotension during general anesthesia, for example: propofol, dexmeditomedine and nitroglycerine ***(Gerlach and Dasta, 2007)***.

Dexmedetomidine is highly selective, specific, and potent α_2 -adrenergic agonist having analgesic, sedative, antihypertensive, and anesthetic sparing effects when used in the systemic route. Prior administration of dexmedetomidine can also provide a hypotensive anesthesia, a better surgical field, and finally an abbreviated operative duration ***(Nasreen et al., 2009).***

Propofol is one of the most common drugs used in general anesthesia, which reduces systemic blood pressure by dilating blood vessels. In the maintenance of anesthesia, propofol infusion reduces pressure by 20%–30% compared to before that ***(Reves and Glass, 2010).***

Organic nitrate esters have a direct relaxant effect on vascular smooth muscles ***(Srivastava et al., 2013).***

AIM OF THE WORK

This study aims to compare the effect of propofol, Dexmeditomedine and Nitroglycerin as hypontensive agents in FESS and their effect on decreasing blood loss during surgery.

Chapter 1

HYPOTENSIVE ANESTHESIA

Blood pressure is one of the essential vital signs that are monitored by health care professionals in modern medicine. In general, a normal blood pressure is an indicator of preserved cardiac output and good organ perfusion, and management of the patient often focuses on maintaining a normal blood pressure. Therefore, maintaining a patient's stable blood pressure within normal limits during surgery (normotensive anesthesia) is one of the indices of skillful anesthesia, and normotensive anesthesia is usually considered to be the gold standard for anesthesia ***(Tobias, 2002).***

The strategy of lowering the patient's blood pressure or controlled hypotension during anesthesia (hypotensive anesthesia) has been practiced for decades. The physiological principle which underlies hypotensive anesthesia is a natural survival mechanism. When profuse bleeding occurs, the blood pressure drops. This drop leads to a reduction or cessation of the bleeding, blood pressure stabilization, and recovery. Accordingly, reducing the patient's blood pressure during surgery can potentially reduce overall bleeding ***(Hassan et al., 2011).***

The indications for hypotensive anesthesia are the surgical site, the course and extent of the surgery, and the patient's general condition. Hypotensive anesthesia is

considered to be a suitable anesthetic technique for those patients who will be undergoing spinal surgery, hip or knee arthroplasty, craniosynostosis, hepatic resections, robotic surgery, and major maxillofacial operations. However, the use of hypotensive anesthesia is associated with the risk of reduced perfusion to important organs and tissues, mainly the brain, heart, and kidneys. Thus, the hypotensive technique is potentially unsafe in some patients and is not suitable for all ***(Banerjee et al., 2013).***

In hypotensive anesthesia, the patient's baseline mean arterial pressure (MAP) is reduced by 30%. Consequently, the systolic blood pressure values are about 80–90 mm Hg and the MAP is reduced to 50–65 mm Hg ***(Degoute, 2007).***

A prospective randomized clinical trial in which patients, who underwent orthognathic surgery, were randomly allocated to undergo these surgeries under normotensive or hypotensive anesthesia. They reported that the extent of intraoperative blood loss in those operations that were done under hypotensive anesthesia was substantially less than that in those operations that were done under normotensive anesthesia ***(Piñeiro-Aguilar et al., 2011).***

Since intraoperative blood loss is reduced under hypotensive anesthesia, the need for allogeneic blood transfusion and its risks, namely, postoperative infection, acute lung injury, postoperative cardiac failure, tumor recurrence,

perioperative myocardial infarction, and increased mortality, is also reduced ***(Ashworth et al., 2010).***

Evaluation of the surgical field conditions is subjective and difficult to measure because the appraisal relies solely on the surgeon's assessment of the conditions. The duration of the surgery may be used as an objective indicator for surgical field conditions because the duration of an operation which is conducted under poor surgical field conditions may be longer than the one which is conducted under good surgical field conditions. The results of trials whose aim was to study the difference in surgical field conditions in major maxillofacial operations in hypotensive and normotensive anesthesia found that the surgical field conditions are better under hypotensive anesthesia than those under normotensive anesthesia ***(Carlos et al., 2014).***

Protocols for Hypotensive Anesthesia

Through the years, a multitude of drug combinations and protocols for hypotensive anesthesia have been suggested and compared. The two main strategies for achieving hypotensive anesthesia are (a) deep anesthesia and heavy analgesia and (b) standard anesthesia and administration of hypotensive drugs. By deepening the anesthetic plane and using high doses of analgesics, such as opioids, the recovery time may be prolonged. On the other hand, administering a hypotensive agent to a patient who is anesthetized using a standard