Original Research Article

COMPARISON OF THE EFFICACY OF DEXMEDETOMIDINE AND PROPOFOL INFUSION ON BLOOD GLUCOSE LEVELS IN PATIENTS WITH SINONASAL MUCORMYCOSIS POSTED FOR FUNCTIONAL ENDOSCOPIC SINUS SURGERY

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ABSTRACT

Background: Perioperative hyperglycemia is a potentially reversible factor contributing to adverse surgical outcomes. This study compares the effectiveness of dexmedetomidine and propofol infusions in maintaining perioperative blood glucose levels and hemodynamic stability in patients with post-COVID sinonasal mucormycosis undergoing functional endoscopic sinus surgery (FESS).
Materials and Methods: A randomized clinical study was conducted on 42 patients diagnosed with diabetes mellitus and sinonasal mucormycosis following COVID-19 infection. Patients were randomly assigned to two equal groups: Group A received a dexmedetomidine infusion, and Group B received a propofol infusion. Blood glucose levels and intraoperative hemodynamic parameters (HR, MAP) were recorded. The Mann-Whitney U test was applied for statistical analysis.
Results: Mean blood glucose levels at baseline, 1 hour intraoperatively, and 1 and 6 hours postoperatively were similar between Group A (171.38 ± 16.71, 188.52 ± 18.39, 172 ± 18.37, 183 ± 34) and Group B (169.09 ± 20.8, 189.38 ± 23.32, 179 ± 26.34, 190.54 ± 29.34), with no statistically significant differences (p = 0.696, 0.89, 0.772, 0.3). However, Group A demonstrated significantly better control of mean arterial pressure [MAP] and heart rate [HR] intraoperatively ($p < 0.05$).
Conclusion: Dexmedetomidine infusion was more effective than propofol in blunting the hemodynamic stress response (HR, MAP). Both agents had a comparable effect on perioperative blood glucose levels, suggesting similar efficacy in mitigating metabolic stress responses.
Keywords: Blood glucose levels, dexmedetomidine, propofol, post-COVID, sinonasal mucormycosis, FESS, hemodynamic stability.

INTRODUCTION

SARS-CoV-2 has affected millions of people worldwide. It mainly presents as a respiratory illness, with symptoms ranging from mild, similar to the common cold, to more severe conditions such as pneumonia. The limited evidence in the literature has challenged clinicians, as patients often show diverse clinical features. COVID-19 patients—especially those who are severely ill or immunocompromised—face a higher risk of developing invasive fungal infections.[1] Mucormycosis is a serious fungal infection that primarily impacts individuals with weakened immune systems. Neutropenic patients and those with compromised immunity, such as COVID-19-positive individuals, are particularly vulnerable to mucormycosis.[2] The widespread use of

corticosteroids in COVID-19 treatment has further worsened hyperglycemia, increasing the risk of invasive fungal infections.[3] Emerging evidence indicates that COVID-19 was more prevalent and often more severe in patients with conditions like diabetes mellitus, hypertension, and cardiovascular disease (CVD).[4] People with diabetes are generally more susceptible to infections due to various factors, including: a) increased angiotensin-converting enzyme 2 (ACE-2) expression,
b) higher levels of furin, c) impaired T-cell function, and d) elevated levels of interleukin-6 (IL-6).[5]
In patients with diabetes, glucose homeostasis can be disrupted by a complex interplay of perioperative factors. Nutritional deprivation and changes in routine diabetes management often complicate glycemic control.[6] Additionally, surgical stress induces the excessive release of proinflammatory cytokines and triggers sympathetic activation, resulting in elevated levels of catecholamines, cortisol, glucagon, and growth hormone.[7] These counter-regulatory hormones increase blood glucose levels by promoting endogenous glucose production and hepatic insulin resistance, while also decreasing glucose uptake in skeletal muscle.[8] Since perioperative hyperglycemia is a potentially reversible factor contributing to poor surgical outcomes, anesthesiologists should prioritise optimal blood glucose management to enhance perioperative care in these patients.[9] Although some case reports have described the anaesthetic management of sinus mucormycosis surgeries, no studies to date have evaluated the effects of dexmedetomidine versus propofol on blood glucose levels during the perioperative period or on postoperative outcomes in diabetic patients undergoing functional endoscopic sinus surgery (FESS) for sinonasal mucormycosis.[10]

MATERIALS AND METHODS

The prospective, randomised clinical trial included 70 patients undergoing functional endoscopic sinus surgery (FESS) under general anaesthesia between August 2021 and December 2021. The study was initiated after ethical clearance and patient consent were obtained. Inclusion Criteria included those diagnosed with Type 2 diabetes mellitus and sinonasal mucormycosis, who provided written informed consent, and were classified as ASA physical status II or III. Patients with severe systemic illnesses were excluded. This included those with diabetic ketoacidosis, end-stage renal disease, acute coronary syndrome, heart blocks, bleeding diathesis, and those on medications affecting surgical hemostasis. Additional exclusions included patients with anaemia (haemoglobin < 10 g/dL), convulsions, uncontrolled systemic hypertension, cerebrovascular accidents (CVA), coronary artery disease, arrhythmias, hepatic or renal dysfunction, metabolic or electrolyte disorders, chronic obstructive pulmonary disease (COPD), severe asthma, and pregnancy. Patients were randomised using computer-generated numbers into two equal groups:

- Group A (n = 35): Received dexmedetomidine infusion under general anaesthesia.
- Group B (n = 35): Received propofol infusion under general anaesthesia.

The primary objective of the study was to compare the efficacy of continuous intraoperative infusion of dexmedetomidine and propofol on perioperative blood glucose levels as a marker of the surgical stress response. The secondary objectives included assessing the impact of these infusions on intraoperative and postoperative hemodynamic stability. All patients were counselled regarding the surgical procedure and the Visual Analogue Scale (VAS) for pain assessment (Annexure 3). Written informed consent was obtained. Patients received alprazolam 0.5 mg orally the night before surgery. On the day of surgery, patients were transferred to the preoperative area. Baseline parameters were recorded after connecting standard monitors (pulse oximeter, non-invasive blood pressure, and ECG). An 18-G intravenous cannula was inserted, and an infusion of 500 mL of normal saline was initiated. General anaesthesia was induced with intravenous midazolam 1 mg and fentanyl 2 µg/kg. Patients were preoxygenated with 100% oxygen at 6 L/min for 3 minutes. Propofol 2 mg/kg was administered for induction, followed by vecuronium 0.1 mg/kg for muscle relaxation. Endotracheal intubation was performed using an appropriately sized cuffed tube, and saline-soaked throat packs were placed. Group A (Dexmedetomidine): Received a loading dose of dexmedetomidine 1 µg/kg diluted to 20 mL with normal saline over 10 minutes. Anaesthesia was maintained with oxygen, air, and isoflurane. Initial gas flows were set at 4 L/min until equilibrium was achieved between inspired and end-tidal isoflurane. Flows were then reduced to 2 L/min. A maintenance infusion of dexmedetomidine at 0.5 µg/kg/hr (diluted in 20 mL normal saline) was continued. In Group B (Propofol), after induction, a propofol infusion was started at 12 mg/kg/hr for the first 10 minutes, followed by 10 mg/kg/hr for the next 10 minutes, and maintained at 8 mg/kg/hr. Isoflurane concentrations were adjusted based on clinical signs of inadequate anaesthesia, such as tachycardia (HR > 100 bpm) and hypertension (20% increase from baseline). In both groups, any mean arterial pressure (MAP) < 60 mmHg was managed with intravenous mephentermine 6 mg. The target MAP was maintained between 60–70 mmHg. Intravenous paracetamol 1 g was administered intraoperatively for analgesia. Towards the end of surgery and before nasal packing, study drug infusions were stopped. Isoflurane was discontinued after surgery. Neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01

mg/kg. Patients were extubated and transferred to the recovery room, where hemodynamic parameters, blood glucose levels, VAS scores for pain, and Ramsay Sedation Scores (RSS) were recorded at 1 hour, 2 hours, and 6 hours postoperatively. Rescue analgesia with intravenous tramadol 0.25 mg/kg was administered if VAS $\geq$ 3, and the time to first analgesic requirement was noted. Perioperative hyperglycemia was defined as two successive blood glucose readings >180 mg/dL (10.0 mmol/L) and was managed with regular intravenous insulin. Patients on oral hypoglycemic agents (OHA) continued their usual medications postoperatively or received insulin if glucose remained uncontrolled. Hypoglycemia was defined as blood glucose < 80 mg/dL (4.4 mmol/L) and managed with IV 20% dextrose or oral glucose-containing fluids as needed. The totality of paracetamol and opioid consumption during the first 24 hours postoperatively was recorded. Adverse effects, including nausea, vomiting, hematoma, or vascular puncture, were documented and treated accordingly. Blood glucose levels were measured at baseline, 1 and 2 hours after induction, and at 1 and 6 hours postoperatively. Hemodynamic parameters (heart rate, systolic/diastolic/mean blood pressure, SpO_2) were recorded at baseline, before and after induction, immediately post-intubation, and at 15, 30, 60, 90, 120, and 150 minutes intraoperatively, as well as 30 minutes postoperatively. Intraoperative opioid and isoflurane consumption were calculated. Postoperative VAS and RSS scores were assessed along with any adverse events.

Based on prior studies by Hyuckgoo Kim et al,[1] and S. S. Harsoor et al,[2] using blood glucose level 1 hour after induction as the primary parameter:

The sample size calculation is $n=2(Z_\alpha+Z_{1-\beta})^2 \sigma^2/d^2$

Where Z_α=standard table value for 95% CI=1.96

$Z_{1-\beta}$=standard table value for 80% power=0.95

Σ=standard deviation=16.35

Σ=standard deviation=36.1

D=effect size=1

n = 35 in each Group

Hence, **n = 35** patients per group.

Statistical Analysis: Data were entered in Microsoft Excel and analysed using SPSS version 23.0. Descriptive statistics such as mean, standard deviation, and percentages were used. The Chi-square test was used to compare categorical variables between groups. The student's *t*-test was applied to assess significant differences between groups. A *p*-value < 0.05 was considered statistically significant.

RESULTS

The demographic parameters, including age, gender distribution, BMI, and duration of surgery, were comparable between the two groups (Group A: Dexmedetomidine and Group B: Propofol), with no statistically significant differences observed (p > 0.05) [Table 1]. Baseline blood glucose levels were also comparable between the groups (p = 0.696). Although blood glucose levels increased perioperatively in both groups, no significant differences were found at 1 hour, 2 hours, or postoperatively at 1 and 6 hours (p > 0.05) [Table 2, Bar Diagram 1]. These findings suggest that neither dexmedetomidine nor propofol had a significant impact on perioperative glycemic control.

At baseline, mean arterial pressure (MAP) and heart rate (HR) were similar in both groups (p > 0.05). However, significant differences in HR and MAP were observed at several intraoperative time points. Group A (Dexmedetomidine) demonstrated more stable hemodynamic parameters compared to Group B (Propofol), with statistically significant differences at 60, 90, 120, and 150 minutes intraoperatively (p = 0.001). By the end of surgery, both MAP and HR remained more controlled in the dexmedetomidine group (p = 0.001), indicating a relatively better hemodynamic profile [Bar Diagrams 2 and 3].

Postoperative pain scores (VAS) and Ramsay Sedation Scores (RSS) were recorded at 1, 2, and 6 hours. The requirement for rescue analgesia was lower in Group A (Dexmedetomidine), suggesting superior postoperative pain management. Adverse effects such as nausea and vomiting were minimal and comparable between the groups.

Table 1: Demographic Data

DATA	GROUP A	GROUP B
AGE (YEARS)	43.85±10.04	41.77±10.10
Gender distribution	MALE (09) FEMALE (12)	MALE (10) FEMALE (21)
BMI	25.4+6.8	26.2+6.1
Duration of Surgery (MIN.)	180+18.69	178+19.50
Type of surgery	Post covid sinunasal mucormycosis	Post covid sinunasal mucormycosis

Table 2: Blood Glucose Levels in Both the Groups

BLOOD GLUCOSE	GROUP A	GROUP B	P VALUE
BASELINE	171+16	169+20	0.696
1 HR	188+18	189+23	0.89
2 HR	181+20	201+26	0.473
END	198+20	201+28	0.473
1 HR PO	201+22	200+3.9	0.772
6HR PO	203+21	205+20	0.3

HR-hour, END-end of the surgery, PO- postoperative
p > 0.05

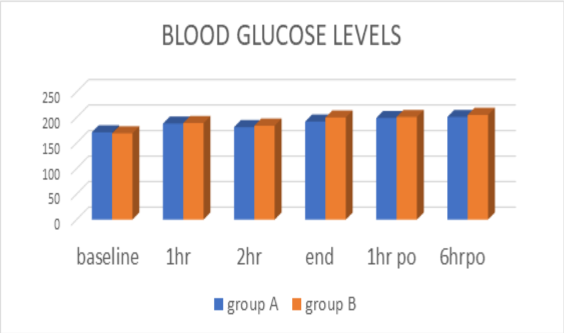

Figure 1: Comparison of blood glucose levels among the study subjects

hr-hour, END-end of the surgery, PO-postoperative

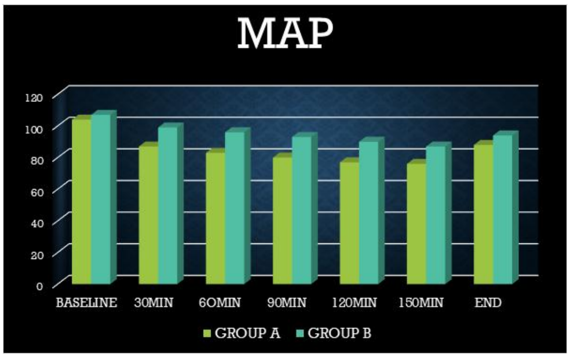

Figure 2: Comparison of mean arterial pressure [MAP]among the study subject

MIN -minutes
p ≤ 0.05 *clinically significant

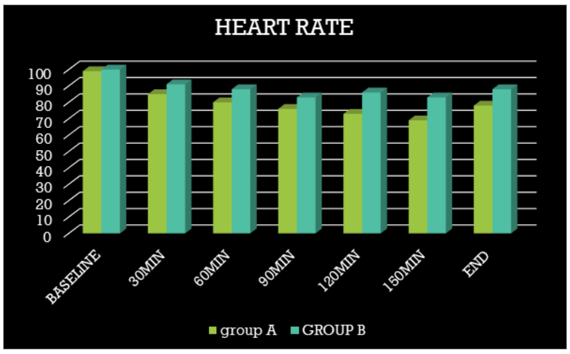

Figure 3: Comparison of Heart Rate among the study subjects

MIN -minutes
p ≤ 0.05 *clinically significant

DISCUSSION

This study aimed to evaluate the effects of intraoperative infusions of dexmedetomidine and propofol on perioperative blood glucose levels, hemodynamic stability, and postoperative outcomes in diabetic patients undergoing surgery for sinonasal mucormycosis. Dexmedetomidine showed superior hemodynamic stability, as evidenced by lower intraoperative heart rates and more consistent MAP values. These findings align with previous studies that highlight dexmedetomidine's sympatholytic effects, which help reduce the systemic response to surgery and maintain hemodynamic stability.[11,12]
In contrast, propofol is known to cause greater hemodynamic fluctuations due to its vasodilatory properties.[13]
In terms of glycemic control, neither drug showed a significant advantage. Both groups exhibited perioperative hyperglycemia, likely due to the stress response associated with surgery, characterised by elevated catecholamine and cortisol levels.[14] Despite its sympatholytic properties, dexmedetomidine did not significantly attenuate this hyperglycemic response compared to propofol, aligning with existing literature that suggests its impact on glucose metabolism may be limited.[15]
Dexmedetomidine also provided better postoperative analgesia and sedation, leading to reduced opioid requirements in the immediate postoperative period.[16] This is consistent with its known α2-adrenergic receptor agonist properties, which enhance analgesia and reduce pain scores.[17]
Clinically, dexmedetomidine may be more favourable in patients where circulatory stability and post-surgery comfort are priorities.[18] Although propofol displayed greater variability in hemodynamic parameters, it remained an effective anaesthetic agent without significantly affecting blood glucose levels.[19] Therefore, the choice between dexmedetomidine and propofol should be individualised, particularly in diabetic patients who are more vulnerable to perioperative complications.[20] Our results showed no significant difference in perioperative blood glucose levels between dexmedetomidine and propofol groups. This is consistent with recent evidence in diabetic surgical patients, where dexmedetomidine was shown to maintain stable perioperative glycemic trends without increasing hyperglycemia.[21] Future studies with larger sample sizes are warranted to explore subtle differences in glycemic control and investigate long-term outcomes associated with dexmedetomidine use in diabetic surgical populations.[22]

CONCLUSION

Dexmedetomidine provides hemodynamic stability by attenuating the stress response compared with propofol. However, both agents show similar effects on perioperative glucose levels, indicating that their influence on the metabolic stress response is comparable.

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