Original Research Paper

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EFFECT OF SINGLE INTRA-OPERATIVE DOSE OF DEXAMETHASONE ON CAPILLARY BLOOD GLUCOSE DURING THE INTRA-OPERATIVE AND POST-OPERATIVE PERIOD IN NON DIABETIC PATIENTS POSTED FOR SURGERY UNDER GENERAL ANAESTHESIA

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ABSTRACT **Introduction:** Dexamethasone is a potent corticosteroid frequently administered during surgery to reduce inflammation, pain, and the incidence of postoperative nausea and vomiting. However, evidence suggests that dexamethasone may impair glucose metabolism and induce hyperglycemia, which can negatively influence postoperative outcomes, including increased infection risk, delayed wound healing, and prolonged hospital stay. Evaluating its impact on glycemic control is therefore essential to optimize perioperative care. **Aim and Objective:** To assess whether a single intraoperative dose of dexamethasone influences glucose metabolism and glycemic control in non-diabetic patients who underwent elective surgery under general anesthesia. **Materials and Methods:** Non-diabetic patients with American Society of Anesthesiologists (ASA) physical status ranging I–II and scheduled for elective surgery under general anesthesia were enrolled. Baseline capillary blood glucose (CBG) levels were recorded. Participants were randomized into Group D who received dexamethasone (8 mg) with ondansetron, and Group P who received placebo with ondansetron. Postoperative CBG was measured at 1- and 3-hours following drug administration. Patients were additionally monitored for postoperative pain, nausea, and vomiting. **Results:** Patients receiving intraoperative dexamethasone demonstrated a statistically significant increase in postoperative CBG levels compared with the placebo group. A single intraoperative dose of dexamethasone (8 mg) significantly elevated CBG levels in non-diabetic patients. These findings suggest that dexamethasone should be used with caution in this population to minimize potential adverse metabolic effects.

KEYWORDS : Dexamethasone, Non diabetics, Hyperglycemia

INTRODUCTION:

Surgical stress initiates a cascade of physiological changes that influence both humoral and immune responses in patients[1]. These include the release of catecholamines, cortisol, and other stress-related hormones, which may impair recovery. Postoperative nausea and vomiting (PONV) are one of the mostdistressing and commonest complications during the first 24 hours after surgery[2]. It has significant implications, ranging from dehydration and electrolyte imbalance to severe consequences such as aspiration pneumonia, delayed recovery, and increased healthcare costs. Multiple factors lead to the occurrence of PONV, such as patient-related variables such as female gender, history of motion sickness, anesthesia-related factors such as use of opioids, volatile anesthetics, and surgery-related determinants.

Dexamethasone which is a synthetic corticosteroid, is widely used in perioperative practice for its anti-inflammatory, antiemetic, analgesic, as well as immunomodulatory properties[3]. Its role in preventing PONV is attributed to its modulation of endogenous prostaglandin and opioid production[4], while its analgesic action is linked to inhibition of phospholipase and interference with the cyclooxygenase and lipoxygenase pathways[5].

Both minimally invasive and open surgical procedures are associated with sympathetic activation, thus resulting in elevated plasma concentrations of catecholamines, growth hormone, vasopressin, cortisol, and glucose. Collectively, these alterations affect glucose metabolism. A widely documented adverse effect of dexamethasone is hyperglycemia, mediated through enhanced hepatic gluconeogenesis, increased insulin resistance, and reduced pancreatic β-cell function[6]. However, its impact and mechanism of action on postoperative glucose metabolism in non-diabetic patients remains underexplored. Therefore, the aim of our study was to evaluate the effect of a single intraoperative dose of dexamethasone on blood glucose levels in non-diabetic patients underwent elective surgery under general anesthesia.

MATERIALAND METHODS:

Study Design and Setting

This study was a prospective, randomized controlledstudy conducted at JSS Hospital, Mysuru after getting approval from the Institutional Ethical Committee.

Study Population

A total of 130 non-diabetic patients, aged 18–80 years, classified as American Society of Anesthesiologists Physical Status (ASA-PS) I–II, and with fasting blood sugar <126 mg/dL, scheduled for elective surgery under general anesthesia with an expected duration of <3 hours, were enrolled.

Exclusion Criteria

Patients were excluded from the study if they had diabetes or impaired glucose tolerance, were pregnant, had a known hypersensitivity to dexamethasone, were on long-term steroid or immunosuppressant therapy, or declined to provide informed consent.

Preoperative Assessment

All patients underwent a thorough pre-anesthetic evaluation 24 to48 hours before surgery, and written informed consent was obtained. On the day of surgery, patients were reviewed 30 minutes before shifting to the operating room, and baseline capillary blood glucose (CBG) was measured.

Sample Size Calculation

Based on a calculated effect size of 0.6888, with 5% alpha error and 95% power, the required sample size was estimated at 62 patients per group. To account for potential dropouts, the final sample size was set at 130 patients (65 per group).

Randomization and Blinding

Patients were randomly allocated intogroups D and P using a computer-generated randomization sequence. Drug preparation and administration were performed by an anesthesiologist who was blinded to group allocation.

- Group D (n=65): Received intravenous (IV) dexamethasone 8 mg + ondansetron 4 mg
- Group P (n=65): Received IV saline placebo (2 mL) + ondansetron 4 mg

Anesthesia Protocol

In the OR, baseline monitoring included electrocardiogram (ECG), systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO_2). After confirming IV access, Ringer's lactate solution was infused. Premedication consisted of intravenous midazolam (0.03 mg/kg), fentanyl (1 µg/kg), and the study drug as per group allocation. Following three minutes of preoxygenation, anesthesia was induced with intravenous xylocard (1 mg/kg), propofol (1–1.5 mg/kg), and succinylcholine (2 mg/kg). The airway was secured with an appropriately sized endotracheal tube, and anesthesia was maintained using intravenous vecuronium (0.2 mg/kg) along with oxygen, nitrous oxide, and isoflurane. At the completion of surgery, neuromuscular blockade was reversed with intravenous neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg). Patients were subsequently extubated and transferred to the postoperative ward for monitoring.

The primary outcome measure was capillary blood glucose (CBG), which was recorded at three time points: baseline (preoperatively), one hour after administration of the study drug (intraoperatively), and three hours after administration of the study drug (postoperatively). Postoperative pain was assessed using the Visual Analogue Scale (VAS), where 0 represented "no pain" and 10 represented the "worst possible pain." Nausea and vomiting were evaluated using a four-point verbal descriptive scale. Intraoperative adverse events, including arrhythmias, hypertension, hypotension, hypoxia, and bronchospasm, were also monitored in accordance with hospital protocols.

Data Collection and Statistical Analysis

Data were recorded using a pretested proforma. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were summarized as frequencies and percentages. Between-group comparisons were performed using the independent sample t-test, and within-group comparisons across different time intervals were analyzed using repeated measures ANOVA. When significant differences were identified, Bonferroni post-hoc analysis was applied to determine specific pairwise differences. A p-value of <0.05 was considered statistically significant.

RESULTS:

Descriptive analysis showed that baseline (0-hour) CBG levels were higher in the ondansetron group (M = 96, SD = 14.75) compared to the dexamethasone group (M = 92.08, SD = 12.5). However, this difference was not statistically significant, $t(128) = 1.64$, $p = 0.104$, 95% CI [-0.83, 8.68]. At 1 hour, CBG values were lower in the ondansetron group (M = 105.11, SD = 21.6) compared to the dexamethasone group (M = 107.63, SD = 21.89), though the difference remained statistically non-significant, $t(128) = –0.66$, $p = 0.509$, 95% CI [–10.09, 5.04]. At 3 hours, the ondansetron group exhibited lower CBG levels (M = 103.91, SD = 25.15) compared to the dexamethasone group (M = 117.25, SD = 24.08), and this difference was statistically significant, $t(128) = –3.09$, $p = 0.002$, 95% CI [–21.9, –4.77].

Within-group analysis using one-way repeated measures ANOVA demonstrated a significant change in CBG levels over time in both groups. In the ondansetron group, changes were significant, $F = 7.08$, $p = 0.001$, with a medium-to-large effect size ($\eta^2 = 0.10$). In the dexamethasone group, changes were more pronounced, $F = 36.27$, $p < 0.001$, with a large effect size ($\eta^2 = 0.36$).

The association between study groups and postoperative pain was assessed using the Chi-square test. However, test assumptions were not met due to low expected cell frequencies, and no statistically significant relationship was observed, $\chi^2(3) = 6.23$, $p = 0.101$. Similarly, the relationship between study groups and PONV was examined, but assumptions were again violated, and no significant association was found, $\chi^2(2) = 4.08$, $p = 0.13$.

DISCUSSION:

Perioperative use of glucocorticoids, such as dexamethasone, has been shown to reduce PONV and pain in various surgeries. However, these drugs can lead to hyperglycemia, which is associated with delayed wound healing, increased risk of surgical site infections (SSI), and prolonged hospital stays. In non-diabetic patients, stress-induced hyperglycemia often results in worse outcomes compared to diabetic patients7. This study aimed to investigate the effects of dexamethasone on blood glucose levels in non-diabetic patients. Previous studies, such as that by Peter V. et al. on middle ear surgeries, demonstrated significant increases in blood glucose levels after dexamethasone administration3. Similarly, Mohammed et al. reported that 8 mg dexamethasone significantly elevated blood glucose levels in non-diabetic patients, while Hans et al. observed higher glucose concentrations in diabetic patients compared to non-diabetics following a 10 mg dose8,9. However, these studies lacked a control group, making it uncertain whether the glucose rise was attributable to dexamethasone or surgical stress. In contrast, our study compared a dexamethasone group with a control group receiving ondansetron and found a statistically significant rise in blood glucose at 3 hours post-surgery (p = <0.01), but no significant change at 1 hour (p = 0.509).

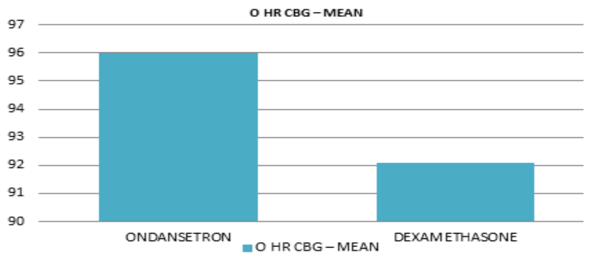
Dexamethasone is also used to reduce opioid consumption by enhancing analgesia10. Several studies have suggested that it reduces postoperative pain and opioid requirements, although findings remain inconsistent11. For example, studies by Shuang Liang et al.and Mitchell C. et al.reported reduced pain scores and delayed need for analgesics with dexamethasone. However, in our study, no statistically significant effect on postoperative pain was observed (p = 0.101)12,13. With respect to PONV, numerous studies, including the DREAMS trial, have confirmed that dexamethasone significantly reduces vomiting and the need for rescue antiemetics14. A pooled analysis of randomized trials further demonstrated that both 4–5 mg and 8–10 mg doses were effective for PONV prevention, while higher doses provided no additional benefit15. Despite this evidence, our study did not demonstrate a significant reduction in PONV with a single 8 mg dose of dexamethasone (p = 0.13), indicating that its role as a standalone antiemetic may be limited in certain surgical settings.

This study has certain limitations. The incidence of PONV in high-risk surgeries, such as middle ear and laparoscopic procedures, was not compared separately with low-risk surgeries, as antiemetics (dexamethasone and ondansetron) were randomly administered across both groups. The study included all procedures performed under general anesthesia irrespective of intraoperative positioning, which itself may influence stress response and blood glucose levels. In addition, other intraoperative stress factors that could contribute to hyperglycemia or PONV were not accounted for. Furthermore, prolonged side effects of dexamethasone were not evaluated in this study; hence, outcomes such as surgical site infections, delayed wound healing, and length of hospital stay were not assessed.

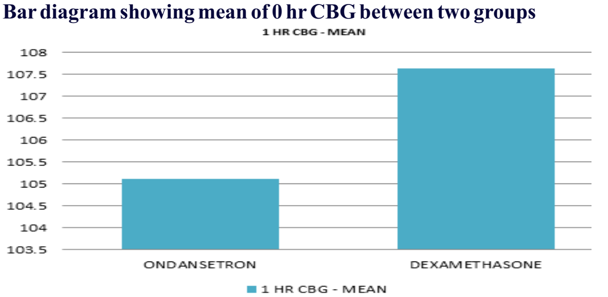
CONCLUSION:

Our study demonstrated a significant increase in capillary blood glucose levels among non-diabetic patients who received 8 mg of intravenous dexamethasone intraoperatively for prophylaxis against PONV. However, dexamethasone did not show a significant effect in reducing postoperative pain, nausea, or vomiting. These findings suggest that perioperative dexamethasone should be administered with caution in non-diabetic patients, and postoperative monitoring of capillary blood glucose levels is warranted. Since our results indicated no benefit of dexamethasone in preventing postoperative pain or PONV, a multimodal approach incorporating alternative analgesics and antiemetics should be considered for effective prophylaxis.

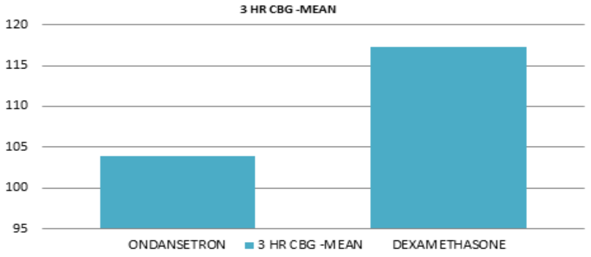
Figures Legends



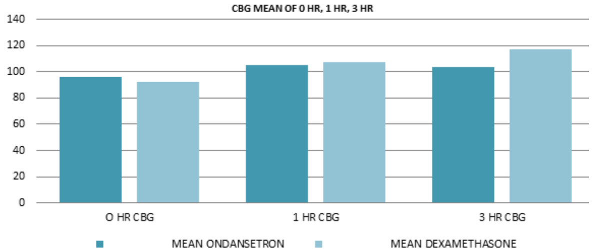
Bar diagram showing mean of 0 hr CBG between two groups



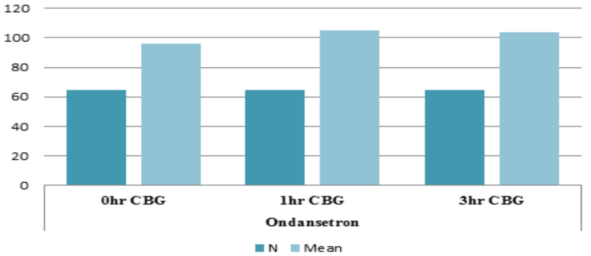
Bar diagram showing mean of 1 hr CBG between two groups



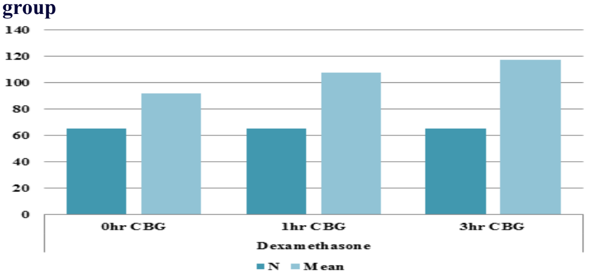
Bar diagram showing mean of 3 hr CBG between two groups



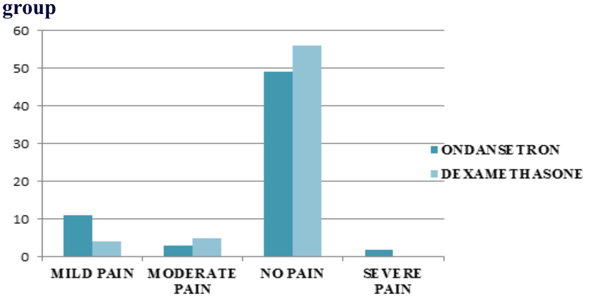
Bar diagram showing mean of 0,1,3 hr CBG between two groups



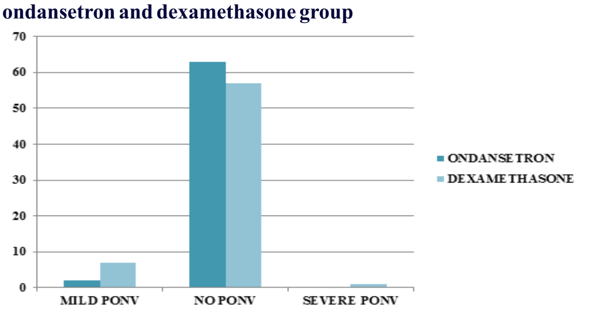
Bar diagram showing comparision of 0,1,3 hr CBG in ondansetron group



Bar diagram showing mean of 0,1,3 hr CBG in dexamethasone group



Bar diagram showing frequency of postoperative pain between ondansetron and dexamethasone group



Bar diagram showing frequency of PONV between ondansetron and dexamethasone group

Table 1: 0 Hour Cbg

GROUPS	N	MEAN	SD	t	p value
ONDANSETRON	65	96	14.75318	1.636	0.104
DEXAMETHASONE	65	92.0769	12.50288		

***Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation**

Table 2 : 1HOUR CBG

GROUPS	N	MEAN	SD	t	p value
ONDASETRON	65	105.1077	21.59798	-0.662	0.509
DEXAMETHASONE	65	107.6308	21.88648		

***Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation**

Table 3 : 3 HR CBG

GROUPS	N	MEAN	SD	t	p value
ONDASETRON	65	103.9077	25.15187	-3.088	0.002*
DEXAMETHASONE	65	117.2462	24.07932		

***Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation**

Table 4: Comparison of Ondansetron at 0hr CBG, 1hr CBG and 3hr CBG

		N	Mean	SD	F	p	η2
Ondansetron	0hr CBG	65	96	14.75	7.08	0.001*	0.1
	1hr CBG	65	105.11	21.6			
	3hr CBG	65	103.91	25.15			

***Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation; η2: Eta Square**

Table 5 : Comparison of dexamethasone at 0hr CBG, 1hr CBG and 3hr CBG

		N	Mean	SD	F	p	η2
Dexamethasone	0hr CBG	65	92.08	12.5	36.27	<.001*	0.36
	1hr CBG	65	107.63	21.89			
	3hr CBG	65	117.25	24.08			

***Statistical significance set at 0.05; N: Number of samples; SD: Standard deviation; η2: Eta Square**

Table 6 : Multiple comparisons of Dexamethasone between 0hr CBG, 1hr CBG and 3hr CBGOndansetron and Dexamethasone

		Mean diff.	Std. Error	t	p	95% CI lower limit	95% CI upper limit
0hr CBG	1hr CBG	-15.55	2.88	-5.401	<.001*	-21.31	-9.8
0hr CBG	3hr CBG	-25.17	3.266	-7. 706	<.001*	-31.7	-18.64
1hr CBG	3hr CBG	-9.62	2.78	-3.459	.003*	-15.17	-4.06

***Statistical significance set at 0.05**

Table 7 : Comparisons of Postoperative Pain between Ondansetron and Dexamethasone groups

		Groups				df	χ2 value	P value
		Ondansetron		Dexamethas				
		N	%	N	%			
post operative Pain	MILD PAIN	11	16.90%	4	6.20%	3	6.233	0.101
	MODERATE PAIN	3	4.60%	5	7.70%			
	NO PAIN	49	75.40%	56	86.20%			
	SEVERE PAIN	2	3.10%	0	0.00%			

***Statistical significance set at 0.05; N: Number of samples; χ2 value: Chi square value; df: Degrees of freedom**

Table 8: Comparisons of PONV between Ondansetron and Dexamethasone groups.

PONV	Groups				df	χ2 value	P value
	Ondansetron		Dexamethasone				
	N	%	N	%			
MILD PONV	2	3.10%	7	10.80%	2	4.078	0.13
NO PONV	63	96.90	57	87.70%			
SEVERE PONV	0	0.00%	1	1.50%			

***Statistical significance set at 0.05; N: Number of samples; χ2 value: Chi square value; df: Degrees of freedom**

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