

ORIGINAL RESEARCH

PAIN MANAGEMENT

Effect of a single intraoperative dose of dexamethasone on glycemic profile in postoperative patients – an observational study

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ABSTRACT

Background & objective: Dexamethasone is a long-acting corticosteroid with minimal mineralocorticoid activity and is widely used in the perioperative setting owing to its immunomodulatory, anti-inflammatory, and antiemetic effects. However, concern persists regarding its potential to induce postoperative hyperglycemia in non-diabetic patients due to its gluconeogenic properties. We evaluated the alterations in blood glucose levels after a single intraoperative dose of dexamethasone and to determine its impact on the severity and incidence of PONV during the early postoperative period.

Materials and Methods: A prospective observational study was carried out on 100 non-diabetic adult patients (ASA I and II) undergoing elective surgery under general anesthesia (GA) at Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pune. All of the patients were given a single intravenous dose of dexamethasone 8 mg following induction of GA. Fasting blood glucose was measured preoperatively, intraoperatively two hours after administration of dexamethasone, and Fasting Blood Glucose and Post Prandial Blood Glucose on postoperative days (POD) 1, 2, and 3. PONV was evaluated and was graded as none, mild, moderate, or severe. Chi-square tests and paired t-tests were used for the data analysis, with $P < 0.05$ being statistically significant.

Results: There was a statistically significant rise in blood glucose levels two hours after administration of dexamethasone in comparison to preoperative fasting values ($P < 0.05$). Glucose levels returned to baseline over POD 1–3 in a gradual manner without any clinical complications. Dexamethasone was effective in reducing the incidence and severity of PONV, with most patients having no or only mild symptoms.

Conclusion: A single intraoperative dose of dexamethasone is associated with a transient but clinically tolerable rise in blood glucose in non-diabetic patients and is effective in reducing PONV. The benefits of its antiemetic action outweigh its short-term glycemic effects, and with appropriate perioperative monitoring, dexamethasone can be safely used in this patient population.

Keywords: Blood Glucose, Dexamethasone, General Anaesthesia, Non-Diabetic Patients, Postoperative Hyperglycemia.

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1. INTRODUCTION

Dexamethasone is an artificial corticosteroid with broad clinical recognition for its potent and long-acting glucocorticoid activity, with little to no mineralocorticoid activity. It is an indispensable agent in perioperative medicine, where it is widely used for its anti-inflammatory, antiemetic, analgesic, and immunomodulatory effects. Because of its pharmacokinetically favorable profile and broad application, a single intraoperative dose of dexamethasone has become standard care in a wide range of surgeries.^{1,2}

Surgical stress, together with severe illness and trauma, tends to induce profound metabolic alterations in the body, such as glucose intolerance, insulin resistance and hyperglycemia—a condition commonly termed the “diabetes of injury.” Stress-induced hyperglycemia, although a physiologic adaptive response, may complicate postoperative care. The risk-to-benefit ratio, perhaps the most controversial topic concerning the use of corticosteroids in surgical patients, is particularly with respect to transient hyperglycemia and immunosuppression.^{3,4}

Despite such apprehensions, dexamethasone is still universally utilized due to its established benefits. In low doses, it is helpful in reducing postoperative fatigue and, most importantly, inhibiting postoperative nausea and vomiting (PONV). For patients at high risk of PONV, the Society of Ambulatory Anaesthesia recommends administering 4-5 mg. Furthermore, it has been discovered that dexamethasone reduces pain when intravenous propofol is administered during anaesthesia induction, which strengthens its application in standard perioperative treatment.^{5,6}

Dexamethasone's metabolic impact should not be undervalued. It has been discovered that dexamethasone raises blood glucose levels by promoting insulin resistance and hepatic gluconeogenesis. These alterations can cause osmotic diuresis, cell dehydration, and electrolyte disturbances, which present a challenge in postoperative management. In addition, immunosuppression caused by corticosteroids can compromise resistance to infection.

Against this background, this study was conducted with the view to examining the impact of a single intraoperative dose of dexamethasone on the glycemic state of postoperative patients. The particular goals were to track blood glucose levels up to the third day postoperatively and to assess the incidence and severity of PONV. By doing this, the research aims to add another layer of understanding the balance between

perioperative dexamethasone's therapeutic effects and possible metabolic hazards.

2. METHODOLOGY

The Department of Anesthesiology at Dr. D. Y. Patil Medical College, Hospital and Research Centre, Pimpri, Pune, was the site of this proposed observational study. Before the study began, ethical approval was obtained from the Institutional Ethics Committee – IESC/FP/12/2025 and CTRI - CTRI/2025/04/084819. All patients were told about the purpose and methodology of the trial, and each participant provided written informed consent.

The sample size was calculated using a reference study by Peter et al., employing G*Power software version 3.1.9.4.⁷ With the reported means and standard deviations of 139.16 ± 20.59 and 128.95 ± 10.52 , a minimum of 90 participants would be required to achieve a power of 80% at a 95% confidence level with an effect size of 0.6. For this reason, a total of 100 participants were recruited. Since it was an observational study, no extra financial load was placed upon the patients.

The study included one hundred adult patients undergoing elective general anesthesia (GA) for surgery. All patients underwent pre-anesthesia evaluations, which included thorough medical histories, general physical examinations, and the necessary laboratory testing. Non-diabetic persons with ASA physical status I or II who were between the ages of 18 and 70 met the inclusion requirements. The study only included individuals who agreed to provide informed permission and were scheduled for elective operations.

Patients under 18 years old, known diabetics, patients on chronic steroid therapy, or those with diseases that alter glucose metabolism were excluded. Neurologically impaired or psychiatrically ill patients with impaired comprehension, obstetric patients, patients refusing to participate, and patients with ASA physical status III and above were excluded.

Preoperatively, every patient was evaluated with routine investigations. Patients were made nil by mouth for six hours or more prior to surgery.

In the operating theatre, standard monitors, including non-invasive blood pressure (NIBP), electrocardiogram (ECG), and pulse oximetry (SpO₂) were attached, and baseline vitals were recorded. All patients received GA after preoxygenation with 100% oxygen for three minutes. Prior to induction with intravenous propofol (2 mg/kg), premedication consisted of intravenous fentanyl (2 mcg/kg), midazolam (0.02 mg/kg), and glycopyrrolate (0.004 mg/kg). A trained anesthesiologist used sterile single-use endotracheal tubes (males 8–8.5 mm, females

7–7.5 mm) to perform tracheal intubation, which was assisted by succinylcholine (2 mg/kg). Anesthesia was continued with a mixture of oxygen, nitrous oxide, and either isoflurane or sevoflurane, with intermittent intravenous vecuronium as indicated.

As soon as successful intubation was achieved, all patients were administered a single intravenous dose of dexamethasone 8 mg. The blood glucose was assessed two hours after administration by a finger-prick capillary blood sample analyzed with NOCODING ONE PLUS glucometer. Around 30 minutes prior to the conclusion of the surgical procedure, all patients were administered intravenous ondansetron 4 mg for the prevention of PONV.

After surgery, suction of the oropharynx was performed gently, and reversal from neuromuscular blockade was done with intravenous neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg/kg). Extubation was done when the patient had regained adequate spontaneous breathing and consciousness. After extubation, patients were transferred to the postoperative recovery room for additional monitoring and data collection.

The following parameters were measured in the study: fasting blood sugar (FBS) on the day of surgery, two-hour blood glucose level after dexamethasone intake, and FBS and postprandial blood sugar (PPBS) levels at postoperative days (POD) 1, 2, and 3. The incidence and severity of PONV were measured and graded as none, mild, moderate, or severe, depending on the subjective experience of the patient and clinical observation.

2.1. Statistical Analysis

All data collected were gathered and keyed into a formatted database for analysis. Quantitative variables like blood glucose levels were presented in the form of mean \pm standard deviation. As the study was a single-group study with repeated measurements taken at varying time intervals, paired t-tests were employed to compare differences in glucose levels before and after dexamethasone administration as well as between postoperative days. The severity of PONV and other categorical factors were tallied using percentages and frequencies. The Chi-square test or Fisher's exact test, as applicable, was used to examine the association between glycemic fluctuation and PONV severity. A p-value of less than 0.05 was considered statistically significant for all analyses.

3. RESULTS

In our study, 100 patients, consisting of 58 men and 42 women, were analysed. The mean age was 42.6 ± 6.2 years. The ASA physical status classification system

classified 64 patients as ASA I and 36 patients as ASA II. The mean participant weight was 64.7 ± 9.72 kg, while the mean height was 167.4 ± 14.5 cm. The average anaesthesia time was 142.74 ± 21.26 minutes, while the surgery duration averaged 121.57 ± 18.63 minutes. The preoperative HbA1c mean level was 5.36 ± 0.76 , which reflected a reasonable glycemic control before surgery. The findings are summarized in Table 1.

Table 1: Socio-demographic characteristics, duration of anesthesia and surgery, and preoperative HbA1c of study participants

Parameters		Value
Age (year)		42.6 ± 6.2
Gender	Male	58
	Female	42
Age (years)		42.6 ± 6.2
ASA I/II		64/36
Weight (kg)		64.7 ± 9.72
Height (cm)		167.4 ± 14.5
Duration of anesthesia (min)		142.74 ± 21.26
Duration of surgery (min)		121.57 ± 18.63
Preoperative HbA1c		5.36 ± 0.76
<i>Data presented as mean \pm SD or numbers</i>		

Table 2 presents the FBS recorded on the morning of surgery, Capillary Blood Glucose (CBG) after 2 hours of dexamethasone administration, PONV according to severity. Table 3 depicts the glucose values measured across various time points.

In our study, blood glucose two hours after the administration of dexamethasone was 86.45 ± 9.74 mg/dl. The preoperative mean HbA1c was 5.36 ± 0.76 . From the day of surgery until POD 3, FBS and PPBS were recorded. Due to the non-normal distribution of the data, the Wilcoxon signed-rank test was used for comparisons before and after surgery. On the day of the procedure, FBS was 81.48 ± 6.83 mg/dl; on POD 1, it was 87.16 ± 7.54 mg/dl ($P = 0.002$); on POD 2, it was 91.28 ± 10.91 mg/dl ($P = 0.001$); and on POD 3, it was 89.11 ± 9.63 mg/dl ($P = 0.004$). For POD 1 ($P = 0.001$), POD 2 ($P = 0.0005$), and POD 3 ($P = 0.003$), PPBS also rose to 101.68 ± 9.01 mg/dl, 106.94 ± 11.82 mg/dl, and 99.82 ± 8.27 mg/dl, respectively.

Table 2: Blood glucose data

Parameters	Reading
FBS on the morning of surgery	81.48 ± 6.83
Blood glucose 2 hours of dexamethasone administration	86.45 ± 9.74
PONV (none/mild/moderate/severe)	75/22/3/0

Table 3: Blood glucose values

Parameters	FBS	P- value	PPBS	P- value
NT-proBNP (ng/mL) Morning of POD 1	87.16 ± 7.54	0.002	101.68 ± 9.01	0.001
Morning of POD 2	91.28 ± 10.91	0.001	106.94 ± 11.82	0.0005
Morning of POD 3	89.11 ± 9.63	0.004	99.82 ± 8.27	0.003

FBS: Fasting blood sugar; PPBS: postprandial blood sugar; P < 0.05 is significant

In terms of PONV, 75 patients had no nausea or vomiting, 22 had mild, and 3 had moderate symptoms. None had severe PONV. This frequency indicates that dexamethasone was well tolerated in terms of PONV, with most patients having minimal nausea or vomiting during the postoperative course. Given its established antiemetic properties, the low incidence of moderate to severe PONV is clinically noteworthy since it preserves the safety profile of dexamethasone when given perioperatively.

In summary, a single dose of dexamethasone caused statistically significant elevations in FBS and PPBS for as long as 72 hours after surgery. In spite of these elevations, glucose levels were within clinically acceptable ranges. Dexamethasone was accompanied by a low incidence of PONV, further attesting to its safety and efficacy in the perioperative period.

4. DISCUSSION

Because of its anti-inflammatory and antiemetic properties, dexamethasone is a synthetic corticosteroid that is highly active and frequently used in perioperative care. Its use in anesthesia practice has been advocated for the prophylaxis of PONV. Some concern has arisen regarding its metabolic impact, specifically on blood glucose levels. Although these are well-established in diabetic patients, evidence among non-diabetic patients is variable.

Interestingly, a retrospective study by Herbst et al. noted that although dexamethasone does temporarily increase blood glucose levels, it does so without resulting in

clinical disadvantage, indicating its short-term effects could be controlled.⁸⁻¹⁰

This study aimed to evaluate the incidence of PONV and the perioperative glycemic shift following a single intraoperative dose of dexamethasone in non-diabetic patients admitted for elective GA operations.^{11,12}

Our findings showed a statistically significant increase in blood glucose levels two hours following dexamethasone administration, with peak values

commonly recorded on POD 1. These levels steadily declined in the days that followed, returning close to baseline by POD 3 in the majority of patients. Notably, none of the subjects needed insulin intervention, and there were no instances of

hyperglycemic complications.

These results concur with Peter et al., who also observed a significant increase in postoperative blood glucose after one intraoperative dose of dexamethasone in non-diabetic adults. They found hyperglycemia that persisted until POD 3. Despite a statistically significant increase in glucose levels, no adverse clinical result was observed.⁷

Similarly, Deshpande et al. observed that non-diabetic patients undergoing laparoscopic cholecystectomy experienced an abrupt rise in blood sugar following 8 mg intravenous dexamethasone. Their research showed a peak at 2 hours, the values approaching baseline values within 6 hours, which is well in line with the time profile noted in our group.¹³

Notably, Shetty et al. demonstrated a high glycemic rise in both diabetic and non-diabetic groups, reaching its peak at approximately 12 hours after surgery but returning to normal at 24 hours, once more validating the temporary aspect of dexamethasone-induced hyperglycaemia.¹⁴

In contrast, Pang et al.'s meta-analysis showed slightly more protracted elevation in glucose levels in patients with diabetes, particularly within the initial 48 hours after surgery. The rises were within a clinically acceptable range and not linked to enhanced surgical site infections or impaired wound healing.¹⁵

O'Connell et al. investigated diabetic patients presenting for arthroplasty and concluded that dexamethasone administration was strongly correlated with postoperative hyperglycemia. Their results were alert in

diabetic patients but cannot be directly applied to non-diabetic patients.¹⁶

Our study showed the antiemetic effectiveness of dexamethasone. Most patients experienced no PONV or mild symptoms only. This is consistent with the literature supporting the well-established use of dexamethasone in PONV prophylaxis.

Peter et al. observed no significant increase in PONV between patients given dexamethasone, testifying to its effectiveness.⁷ Deshpande et al. also observed better control of PONV with dexamethasone versus saline in their randomized controlled study.¹³ Dexamethasone considerably lowered the incidence of PONV in diabetic and non-diabetic groups in Shetty's study, with no increase in adverse effects, further attesting to its use on a routine basis.¹⁴

Though Joshi et al. emphasized the necessity of clinical judgment in utilising dexamethasone because of its hyperglycemic effect, they ensure it is effective in PONV prevention, particularly when administered as a single intraoperative dose.¹⁷

4.1. Clinical Safety and Monitoring

Our study indicates that in non-diabetic adult patients, administering a single dose of dexamethasone during surgery is considered safe and effective, provided that appropriate monitoring is maintained. Although a transient increase in blood glucose levels was noted, these increases were not linked with adverse consequences or pharmacologic intervention.

This is in concordance with the result of Shetty et al., who concluded that transient hyperglycemia is not a cause for clinical concern among non-diabetic patients.¹⁴ Peter et al. stressed the safety profile of single-dose dexamethasone, although they recommended caution and observation, particularly among borderline glycemic patients.⁷ In addition, O'Connell et al. and Pang et al.'s meta-analysis remind us that dexamethasone is safe in non-diabetics but should be used with caution in diabetics or insulin-resistant groups.^{15,16}

Our study confirms that non-diabetic patients who receive a single intraoperative dose of dexamethasone experience a statistically significant but manageable rise in blood glucose levels after the surgery. Its value in perioperative care is demonstrated by the noticeable reduction in the incidence and intensity of postoperative nausea and vomiting. With proper patient choice and monitoring of blood glucose levels, dexamethasone may be safely given to provide an improvement in postoperative outcomes.

5. CONCLUSION

The results indicate transient postoperative hyperglycemia following a single intraoperative intravenous dose of dexamethasone in non-diabetic adult patients having elective surgery under GA. This hyperglycemic response was within clinically acceptable levels and did not lead to any undesirable outcomes. Notably, dexamethasone was effective against the incidence and severity of PONV and contributed positively towards postoperative recovery and patient comfort. These findings imply that, in appropriately selected non-diabetic patients, a single intraoperative dose of dexamethasone may be used as an adjunct for PONV prophylaxis and perioperative management safely and effectively without posing any significant risk of prolonged glycemic disturbances. Postoperative regular blood glucose monitoring is recommended for early detection and management of any glycemic fluctuation. Additional research with larger numbers and longer follow-ups might add strength to the evidence base and examine outcomes in more vulnerable populations, including diabetics or those with metabolic syndromes.

6. Data availability

Numerical data generated in this study is available with the authors/

7. Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity.

8. Financial support

None.

9. Conflicts of interest

No conflicts of interest.

10. Authors contribution

All authors took equal part in the concept, conduct of the study, data analysis and manuscript writing.

11. REFERENCES

1. Dubashynskaya NV, Bokaty AN, Skorik YA. Dexamethasone Conjugates: Synthetic Approaches and Medical Prospects. *Biomedicines*. 2021;9(4):341. [\[\[PubMed\]\]](#) DOI: 10.3390/biomedicines9040341

2. Bansal T, Singhal S, Taxak S, Bajwa SJS. Dexamethasone in anesthesia practice: A narrative review. *J Anaesthesiol Clin Pharmacol.* 2024;40(1):3–8. [\[\[PubMed\]\]](#) DOI: [10.4103/joacp.joacp_164_22](https://doi.org/10.4103/joacp.joacp_164_22)
3. Vanhorebeek I, Van den Berghe G. Diabetes of injury: novel insights. *Endocrinol Metab Clin North Am.* 2006;35(4):859–72.
4. Davis G, Fayfman M, Reyes-Umpierrez D, Hafeez S, Pasquel FJ, Vellanki P, et al. Stress hyperglycemia in general surgery: Why should we care? *J Diabetes Complications.* 2018;32(3):305–9. [\[PubMed\]](#) DOI: [10.1016/j.jdiacomp.2017.11.010](https://doi.org/10.1016/j.jdiacomp.2017.11.010)
5. El-Daly G, AbdAllah M, Eldorgham L, Refky M. Low-dose dexamethasone versus ondansetron for prevention of postoperative nausea and vomiting after tympanomastoid surgery: a comparative study. *Zagazig Univ Med J.* 2020;28(4):694–700.
6. de Oliveira GS, Castro-Alves LJS, Ahmad S, Kendall MC, McCarthy RJ. Dexamethasone to prevent postoperative nausea and vomiting: an updated meta-analysis of randomised controlled trials. *Anesth Analg.* 2013;116(1):58–74. [\[PubMed\]](#) DOI: [10.1213/ANE.0b013e31826f0a0a](https://doi.org/10.1213/ANE.0b013e31826f0a0a)
7. Peter V, Shenoy U, Rukkiyabeevi B. Effect of a single intraoperative dose of dexamethasone on glycaemic profile in postoperative patients: A double-blind randomised controlled study. *Indian J Anaesth.* 2022;66(11):789–95. [\[PubMed\]](#) DOI: [10.4103/ija.ija_332_22](https://doi.org/10.4103/ija.ija_332_22)
8. Abdelmannan D, Tahboub R, Genuth S, Ismail-Beigi F. Effect of dexamethasone on oral glucose tolerance in healthy adults. *Endocr Pract.* 2010;16(5):770–7. [\[PubMed\]](#) DOI: [10.4158/EP09373.OR](https://doi.org/10.4158/EP09373.OR)
9. Sood A, Ismail-Beigi F. Effect of dexamethasone on insulin secretion: examination of underlying mechanisms. *Endocr Pract.* 2010;16(5):763–9. [\[PubMed\]](#) DOI: [10.4158/EP09372.OR](https://doi.org/10.4158/EP09372.OR)
10. Herbst RA, Telford OT, Hunting J, Bullock WM, Manning E, Hong BD, et al. Effects of perioperative dexamethasone on glycemic control and postoperative outcomes. *Endocr Pract.* 2020;26(2):218–25. [\[PubMed\]](#) DOI: [10.4158/EP-2019-0252](https://doi.org/10.4158/EP-2019-0252)
11. Purushothaman A, Pujari V, Kadirehally N, Bevinaguddaiah Y, Reddy P. A prospective randomized study on the impact of low-dose dexamethasone on perioperative blood glucose concentrations in diabetics and non-diabetics. *Saudi J Anaesth.* 2018;12(2):198–203. [\[PubMed\]](#) DOI: [10.4103/sja.SJA_409_17](https://doi.org/10.4103/sja.SJA_409_17)
12. Ismail EA, Bakri MH, Abd-Elshafy SK. Dexamethasone alone versus in combination with intra-operative super-hydration for postoperative nausea and vomiting prophylaxis in female patients undergoing laparoscopic cholecystectomy: a randomised clinical trial. *Korean J Anesthesiol.* 2017;70(5):535–41. [\[PubMed\]](#) DOI: [10.4097/kjae.2017.70.5.535](https://doi.org/10.4097/kjae.2017.70.5.535)
13. Deshpande K, Abhishek D, Harshitha M, Prem A, Nataraj M, Thejas JA. Effect of single-dose dexamethasone on perioperative blood glucose levels in non-diabetic patients undergoing laparoscopic cholecystectomy. *Res J Med Sci.* 2024;18(8):360–5.
14. Shetty SR, Abdul Rahman A, Aithal R, Bhat S, Akshatha D. Comparison of a single intraoperative dose of dexamethasone on glycemic profile in postoperative diabetic and non-diabetic patients. *Anesthesiol Pain Med.* 2025;15(2):e161467. [\[PubMed\]](#) DOI: [10.5812/aapm-161467](https://doi.org/10.5812/aapm-161467)
15. Pang QY, Wang JY, Liang XL, Jiang Y, Liu HL. Safety of perioperative dexamethasone with antiemetic dosage in surgical patients with diabetes mellitus: a systematic review and meta-analysis. *Perioper Med.* 2023;12(1):4. [\[PubMed\]](#) DOI: [10.1186/s13741-023-00293-4](https://doi.org/10.1186/s13741-023-00293-4)
16. O'Connell RS, Clinger BN, Donahue EE, Celi FS, Golladay GJ. Dexamethasone and postoperative hyperglycemia in diabetics undergoing elective hip or knee arthroplasty: a case-control study. *Patient Saf Surg.* 2018;12(1):30. [\[PubMed\]](#) DOI: [10.1186/s13037-018-0178-9](https://doi.org/10.1186/s13037-018-0178-9)
17. Joshi KN, Chauhan AK, Palaria U. Perioperative hyperglycemic response to single-dose dexamethasone in patients undergoing surgery under spinal anesthesia. *Ain-Shams J Anesthesiol.* 2023;15(1):37.