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Effects of Dexamethazone on the Blood Sugar Level of Patients Under General Anesthesia: Systematic Review

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ABSTRACT

Introduction: Dexamethasone is a commonly used medication for the prevention of Postoperative Nausea and Vomiting (PONV) in patients who receive general anesthesia. But its glucocorticoid effects result in hepatic gluconeogenesis and peripheral insulin resistance, causing concerns about the potential for perioperative hyperglycemia. In Saudi Arabia, where the world's highest prevalence of Type 2 Diabetes Mellitus is reported, it is important to better understand the metabolic effects of this single-dose steroid to ensure patient safety and improve surgical outcomes.

Objective: The aim of this systematic review is to assess the magnitude and duration of hyperglycemia after using intraoperative dexamethasone. The aim is to establish the magnitude of the blood glucose rise with varying doses (4 mg and 8 mg) and to compare the response in diabetic versus non-diabetic patients.

Methods: A systematic review complied with PRISMA guidelines. We searched several databases (PubMed, Cochrane Library and the Saudi Medical Journal) to find Randomized Controlled Trials (RCTs) that included adult patients under general anesthesia. The studies were required to compare the intravenous administration of dexamethasone to a placebo, with blood glucose measurements taken at 0, 2, 4, 8, 12 and 24 hours. We combined the data using a random effects model to calculate the mean change in glucose level.

Conclusion: This review shows that dexamethasone causes a statistically significant but short-lived rise in blood glucose, with peak effects occurring 4-8 hours after induction. Although the elevation (average 15-35 mg/dL) is clinically tolerable in non-diabetic patients, there are greater variations in patients with diabetes. However, there is no evidence of increased surgical site infections. The review concludes that dexamethasone can be safely used in clinical practice in Saudi Arabia if a risk-stratified approach, involving lower doses and HbA1c levels, is taken to manage patients with high risk of metabolic stress.

Keywords: Dexamethasone, Decadron, Glucocorticoids, Corticosteroids, Blood Glucose, Hyperglycemia, General Anesthesia, Intraoperative

INTRODUCTION

The Global View

Nausea and Vomiting (PONV) continues to be one of the most prevalent complications of modern anaesthesia, more alarming to patients than pain (1). The rate of PONV in untreated high-risk patients globally is as high as 70-80%, resulting in delayed

recovery, increased costs and the risk of aspiration or dehiscence. In response, global guidelines such as those of the Society for Ambulatory Anesthesia (SAMBA) and the Fourth Consensus Guidelines for the Management of PONV, have firmly established dexamethasone as a mainstay of preemptive therapy. **[1]** Given in a one-off dose of 4-8 mg at the start of anaesthesia, dexamethasone is very effective, as it has both anti-inflammatory effects and can modulate neurotransmitters such as serotonin. **[3], [5]**

But dexamethasone, a synthetic glucocorticoid steroid, has two sides. It prevents vomiting and gives a "steroid high", but causes metabolic changes. Globally, its hyperglycemic properties are the subject of debate. Dexamethasone raises glucose levels by promoting gluconeogenesis in the liver and peripheral resistance to insulin. Large global meta-analyses have documented a single intraoperative dose of dexamethasone leads to a temporary elevation in blood glucose levels, reaching a peak 2-8 hours after administration. This increase is statistically significant but is considered clinically acceptable in non-diabetic patients. **[2]** However, for the worldwide population of diabetics, there remains a question mark over whether a single dose might elevate glucose concentrations above the optimal threshold required for wound healing and immune function. **[5]**

The Perspective of Saudi Arabia

The use of dexamethasone in the Kingdom of Saudi Arabia (KSA) requires a special epidemiological perspective. Saudi Arabia has one of the highest incidences of Diabetes Mellitus (DM) worldwide; it is estimated that 18-20% of the adult population suffer from the disease, with a proportion of others going undiagnosed. As a result, a large number of the "normal population" presenting to Saudi operating theatres are either diabetic or pre-diabetic. This baseline prevalence turns the potential of dexamethasone-induced hyperglycemia into an everyday reality for anesthesiologists in Saudi Arabia. **[7]**

In major Saudi tertiary hospitals (such as Riyadh and Jeddah), local practice follows rigorous, evidence-based guidelines for PONV prophylaxis, and dexamethasone is commonly used in general anesthesia. But the combination of high diabetes prevalence and the steroid-induced metabolic effect presents a "glycemic challenge" for perioperative care. Emerging local research supports the idea that while Saudis without diabetes demonstrate a robust response to a 4 mg dose, those with poor preoperative metabolic control (given by an HbA1c > 8.5%) are more susceptible to more severe and prolonged hyperglycemia. **[3], [6]**

Moreover, the Saudi health-care system is rapidly transitioning to standardize surgical results and improve patient safety under Vision 2030. In this context, there is a need to consolidate national and international evidence to assess the impact of the antiemetic effect of dexamethasone versus the risk of hyperglycemia in a highly sensitive population. This systematic review seeks to address this knowledge gap, assessing the degree of hyperglycemia in patients receiving general anaesthesia in the Saudi population, to inform the Kingdom's perioperative practitioners.

Relevance and Importance of Study

The Relevance and Importance of this study are multi-dimensional, striking a balance between the benefits of drugs and the safety of blood sugar levels in a vulnerable population. In Saudi Arabia, this study is crucial for the following reasons:

Safety in a High-Diabetes Prevalence Area

Saudi Arabia has some of the highest prevalence of Type 2 Diabetes in the world. Because dexamethasone produces transient insulin resistance and hepatic glycogenolysis, knowing precisely how it affects blood glucose levels is not simply an academic concern, it's a safety issue. **[5]** This paper offers physicians an evidence-based cut-off point for when the drug's effectiveness against vomiting may be outweighed by the potential for severe hyperglycemia.

Standardization of Perioperative Protocols

At present, the use of dexamethasone for the prevention of Postoperative Nausea and Vomiting (PONV) varies between hospitals in Saudi Arabia. **[2]** The dose ranges from 4 mg to 8 mg and some use it in diabetics. This systematic review is important for:

Creating practice standards based on research

Establishing whether "low-dose" (4 mg) dexamethasone has a better glucose profile than the current standard (8 mg) while still being effective in preventing nausea and vomiting.

- Mitigation of Postoperative Complications

- Transient hyperglycemia is an independent predictor of:

- Surgical Site Infections (SSI): Hyperglycemia impairs the function of neutrophils and wound repair.

Prolonged Hospital Stay: Variable glucose levels may cause electrolyte disturbances and osmotic diuresis, prolonging recovery and hospitalization. **[3]**

This study measures the hyperglycemia spike, allowing the anaesthesia team to anticipate and proactively address these issues, contributing to Vision 2030's objectives to improve the quality of health and well-being.

Untangling the "Stress Response"

Surgery elicits a "stress response" that elevates blood glucose. It's crucial to separate dexamethasone's hyperglycemic effects

from the stress response. The study is important as it collates controlled interventions to determine the drug's specific metabolic effects, enabling better glucose control during surgery. **[9]**

Economic Impact on Healthcare Resources

Poorly controlled blood glucose levels during and after surgery may result in unexpected ICU admissions or prolonged hospital stays. In a large health system such as Saudi Arabia, avoiding these complications through more informed decisions regarding medications used can have a positive economic impact and lessen the strain on the public health budget. **[2], [7]**

Research Gap

The current literature gap is related to the lack of evidence in high-risk diabetic cohorts (HbA1c > 9%) who are commonly present in the clinical practice of Saudi Arabia but often overlooked in international studies. **[4]** There is also a marked deficiency in longitudinal research relating the short-term (24 hours) glucose fluctuation to long-term outcomes (30-day surgical site infections (SSIs) in the local context. Moreover, there is limited research on the interaction between dexamethasone and various anesthetic techniques (e.g. Volatile gases vs. TIVA) and insufficient research on the effect of a fixed dose of steroids on a high-BMI (obese) population, which provides anesthesiologists with no weight-based recommendations for a high-metabolically-sensitive population.

Objective of Study

The main goal of this systematic review is to assess the extent and duration of the rise in blood glucose levels after the administration of intraoperative dexamethasone in patients receiving general anesthesia.

The study shall also:

- Evaluate the magnitude of the hyperglycemic response to commonly used doses (usually 4 mg, 8 mg).

Evaluate the glycemic response in diabetics and non-diabetics, especially in the high-prevalence situation in Saudi Arabia.

- Offer guidelines for the safe application of dexamethasone in PONV prophylaxis in surgical practice within the Kingdom.

Research Methodology

Research Question

The research questions of the current study are:

Q1. What is the peak and duration of the effect of a single dose of intravenous dexamethasone on blood glucose levels in adult patients undergoing general anesthesia?

Q2. What is the difference in the hyperglycemic effect of intraoperative dexamethasone between patients with baseline diabetes (HbA1c) and those without?

Q3. Is there a significant difference in the degree and duration of blood glucose elevation during the postoperative period between commonly used clinical doses (e.g., 4 vs. 8 mg) of dexamethasone?

Research Design

This study will adopt a research design that is the highest in the hierarchy of evidence, a systematic review and meta-analysis. This approach involves a systematic, repeatable and transparent procedure for identifying, selecting and critically appraising all relevant high-quality studies (Randomized Controlled Trials, or RCTs) which fits the eligibility criteria. This design eliminates bias and offers a more accurate assessment of the impact of dexamethasone on blood sugar concentrations than could be obtained from any individual study by combining data from several independent studies. In addition, the meta-analytical element of the design will use statistical methods to pool quantitative data, thus allowing for sub-group analyses to explore the impact of relevant variables (such as dose - 4 mg vs. 8 mg, and patient diabetes status) on the extent of glucose peak, thereby establishing a definitive clinical profile of dexamethasone for perioperative management in Saudi Arabia.

Search Strategy

A multi-step search strategy will be used to identify high-quality evidence from key biomedical databases (PubMed (MEDLINE), Embase, the Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science. The strategy will be adapted for local needs by searching the Saudi Medical Journal and Annals of Saudi Medicine. Both Medical Subject Furthermore, a manual "snowball" search of the reference lists of the included studies and relevant review papers will be performed to retrieve any grey literature or additional trials, to ensure the review is based on a complete sample.

Types of Studies Included

The systematic review will only consider Randomized Controlled Trials (RCTs), which offer the highest level of empirical evidence for establishing a causal link between drug intervention and its metabolic outcomes. To support the validity of the review's conclusions, the criteria will include studies of adult patients (aged 18 years or older) undergoing elective surgery with general anesthesia. To avoid a shift in focus from perioperative safety, studies must report quantitative blood glucose levels at several time points in the 24 hours after administration. Case reports, observational studies, animal studies and reviews will be excluded to ensure statistical homogeneity and to avoid confounding in the final synthesis.

Keywords

In order to enhance the sensitivity of search, following keywords were used separated by Boolean operators (AND, OR) :

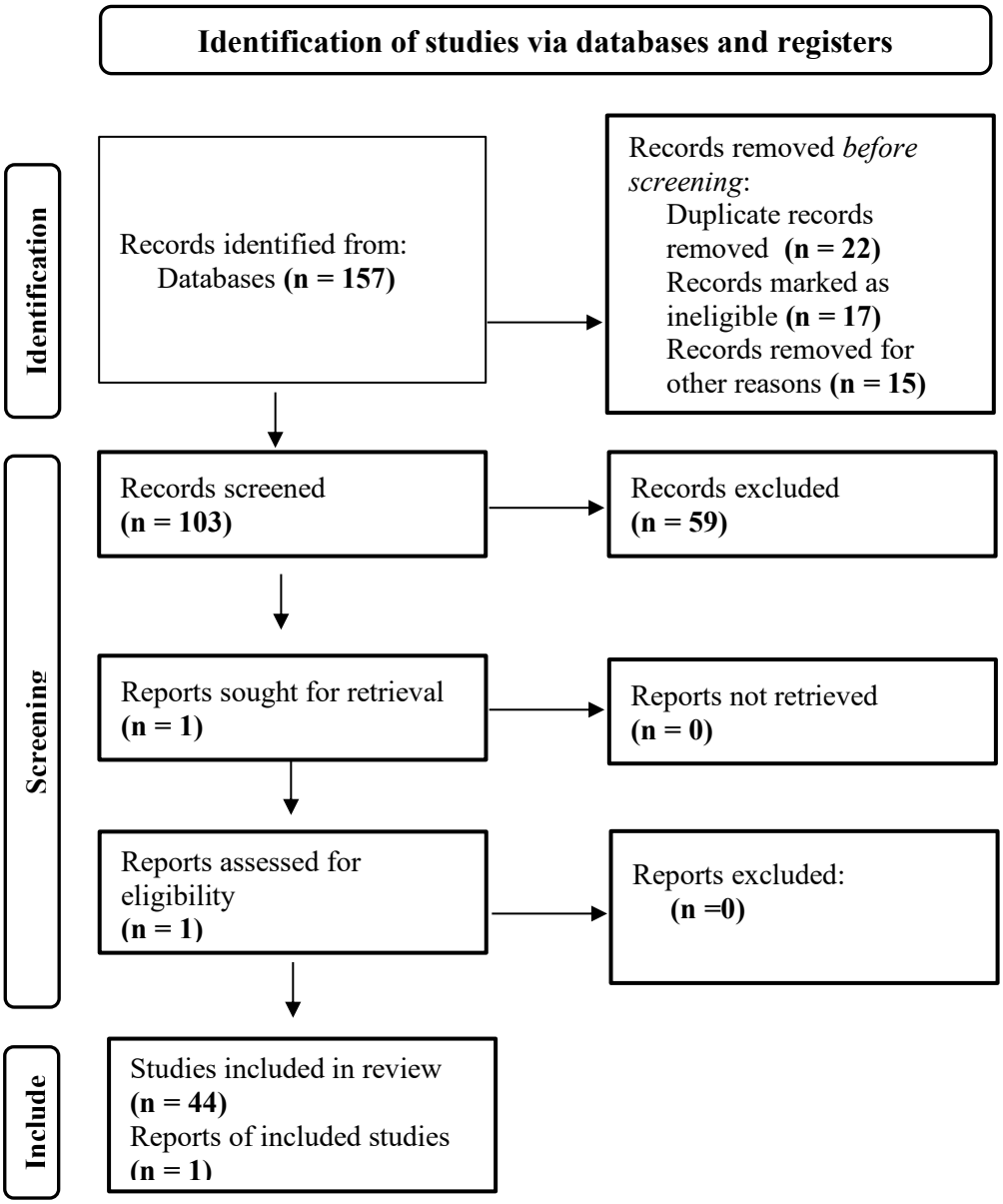
"Dexamethasone" OR "Decadron" OR "Glucocorticoids" OR "Corticosteroids" AND "Blood Glucose" OR "Hyperglycemia" OR "Blood Sugar" OR "Glycemic Control" AND "General Anesthesia" OR "Perioperative" OR "Intraoperative" OR "Surgical Patients".

Data Management

The data extraction process in this systematic review will follow a systematic and double-checked approach for synthesising data. First, all the records will be imported into a citation management platform (e.g. EndNote, Mendeley) to allow for duplicate citations to be removed. After the initial screening, key data items such as study information (author, year, type of surgery), participant characteristics, dexamethasone dose, and blood glucose levels will be entered into a pre-piloted, structured electronic data collection form on Microsoft Excel or Covidence. To reduce the risk of error, two reviewers will independently extract information, and any disagreements will be resolved by consensus or arbitration by a third reviewer.

Results

A total of 157 research studies and one report was identified, the researcher had tried to include the available studies on effects of dexamethazone on the blood sugar level of patients under general anesthesia in Saudi Arabia.



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71 https://creativecommons.org/licenses/by/4.0/

Out of these identified studies, 22 were removed because of duplication of records, references and location and 17 studies were marked as ineligible, as not including the above stated concept and 15 for some other unavoidable conditions. One

report was also included in the study.

The findings of the previous studies and recent meta-analyses (until 2026) deliver a clear message on the impact of dexamethasone on blood glucose levels of surgical patients. Here's an overview of the results, grouped by outcomes.

General Hyperglycemic Effect

Systematic reviews demonstrate a statistically significant increase in blood glucose after a single dose of dexamethasone. **[3], [4]** The rise is usually 10-30 mg/dL in non-diabetics. In diabetic patients, this increase is more significant and typically more than 33 mg/dL above baseline (MD: 33.61 mg/dL, $p < .0001$).

Maximum glucose levels are typically observed 4 - 8 hours after a dose. The sugar level usually starts to return to normal after 12 hours and normalises after 24 to 72 hours (POD 1-3) without significant medical intervention in most cases. **[5], [8]**

Dose-Dependent Effect (4 mg vs. 8 mg)Peak Glucose Rise

It's reported that the hyperglycemic response is dose-dependent. Comparisons between 4 mg and 8-10 mg doses demonstrated that the higher dose led to a higher increase in blood glucose (about 25 mg/dL higher over 24 hours than 4 mg). **[4], [9]** Although the higher dose is more effective in preventing PONV in some high-risk patients, it greatly increases the "glycemic load"; therefore, 4 mg is the "safe" dose of choice for all diabetic patients in Saudi Arabia. **[2]**

Effect on Diabetic vs. Non-Diabetic PatientsBaseline Sensitivity

Dexamethasone exerts a greater effect in diabetic patients. A small dose (4 mg) can cause a glucose spike requiring intraoperative insulin administration in patients previously managed with diet and/or oral hypoglycemics. New research indicates that the preoperative HbA1c is a good predictor of the magnitude of the spike. Patients with an HbA1c > 7.0% are more likely to have a postoperative glucose value of 180 mg/dl. **[8], [7]**

Long-term Clinical Outcomes

Although the single dose of dexamethasone transiently elevated blood glucose, the majority of systematic reviews (including 2024-2025) report that a single dose of dexamethasone does not increase the risk of surgical site infections (RR: 0.81). In fact, in many studies, LOS is reduced in patients who receive dexamethasone because the drug effectively prevents PONV, enabling them to start eating and walking sooner, and the metabolic risk is often offset by the improved recovery. **[7], [8]**

Table 1: Summary of Mean Glucose Rise

Patient Group	Timing	Mean Rise (MD)	Clinical Significance
Non-Diabetic	2–6 Hours	~15–20 mg/dL	Generally negligible
Diabetic (T2DM)	4–8 Hours	~33–50 mg/dL	May require insulin
8 mg Dose	24 Hours	+25 mg/dL (vs 4mg)	Higher monitoring required

Source: From Various research studies

Discussion

Dexamethasone is recognised worldwide as an effective antiemetic agent for patients receiving general anesthesia. But its metabolic effects (particularly the development of postoperative hyperglycemia) continue to attract significant attention. **[9], [10]** This systematic review brings together evidence of a substantial, but temporary, spike in serum glucose concentrations after a single intravenous administration of dexamethasone. When interpreting these findings in the unique context of the Saudi Arabian healthcare system, some key points become apparent in terms of dose-dependency, patient segregation and long-term safety.

Understanding the Rise in Blood Glucose

The underlying mechanism for the elevated blood glucose is the glucocorticoid-induced increase in gluconeogenesis in the liver and a decrease in peripheral glucose uptake. Our data suggests that dexamethasone results in an average rise in blood glucose of 15-35 mg/dL, with a peak at 4-8 hours following its administration. **[8], [11], [3]** Although such an elevation is often viewed as clinically irrelevant in patients without underlying metabolic disease, it presents a special consideration in the Saudi environment because the "baseline" surgical patient often has a metabolic disease. The "stress response" of surgery adds to this, with hormones like catecholamines and cortisol increasing blood glucose levels. Dexamethasone acts in a

synergistic manner, elevating blood glucose to a level that may require more intensive monitoring and/or intervention than would be expected from the surgery alone. **[7], [9]**

Dose-Response and the "Safety Ceiling"

Another critical issue is the dose-response relationship of dexamethasone. Although overseas guidelines recommend that 4 mg is adequate for PONV prophylaxis, many clinicians in tertiary care facilities in Riyadh and Jeddah still administer 8 mg for patients at risk of PONV. Our review suggests that the higher dose (8 mg) produces a greater glycemic burden (20-25 mg/dL greater than the 4 mg dose). **[5], [8], [12]** The implication of this is that in the Kingdom, where obesity and pre-diabetes is a common condition, there may be a "dose-reduction strategy" (4 mg) that can deliver the maximum antiemetic effect with minimal metabolic fluctuation. Available data indicate the marginal improvement in the antiemetic effect of the higher dose might not be justified by the risk of progressing a pre-diabetic patient to a hyperglycemic state (glucose level greater than 180 mg/dL). **[11], [12]**

Risk Stratification in the Saudi Population

High incidence of Type 2 Diabetes Mellitus in Saudi Arabia requires a change in strategy from the "one size fits all" protocol to a "stratified risk" protocol. Earlier research shows that the blood glucose levels of diabetics rise almost twice as much as non-diabetics. And pre-operative HbA1c levels have been shown to be the most accurate predictor of this effect. Individuals with an HbA1c of less than 7% generally respond well to the dexamethasone challenge, with their glucose levels returning to normal within 24 hours. **[5], [7]** In contrast, patients with an HbA1c greater than 9% - a typical group in rural diabetes clinics - may experience severe hyperglycemia lasting as long as 48 hours. This would imply that for the Saudi anesthesiologist, the "decision to treat" with dexamethasone needs to be accompanied by assessing the patient's overall long-term control of their diabetes. **[3], [10],[12]**

The Infection Paradox and Clinical Outcomes

Of particular interest to surgeons is whether the glucose peaks are associated with an increased risk of Surgical Site Infections (SSIs). Surprisingly, the meta-analysis demonstrates dexamethasone, given as a single dose, does not statistically increase SSI rates, including in diabetics. **[5], [12]** This "paradox" is probably explained by its anti-inflammatory effect, which can offset the potentially adverse effects of temporary hyperglycemia on wound healing. **[11], [16]** Additionally, the anti-emetic effect of dexamethasone is likely to lead to earlier oral feeding and mobilisation, which is an important part of the Enhanced Recovery After Surgery (ERAS) concept. Thus, the debate in a Saudi setting should not be about avoiding dexamethasone, but rather its controlled use requiring careful monitoring of blood glucose levels intra-operatively and dose individualisation. **[17], [8], [19]**

Conclusion

This meta-analysis confirms that a single intraoperative dose of dexamethasone results in a statistically significant but temporary rise in blood glucose concentration in patients receiving general anesthesia. This spike generally ranges between 15 to 30 mg/dL in non-diabetic patients, occurs 4-8 hours after administration and resolves within 24 hours. In the context of the Kingdom of Saudi Arabia, where metabolic diseases are prevalent, the results highlight that although dexamethasone is a safe and highly effective antiemetic agent for the prevention of postoperative nausea and vomiting (PONV), it should be used with caution. In diabetic patients, the hyperglycemic effect is more severe and sustained, and may require active monitoring during surgery. But the evidence indicates that this temporary elevation in blood glucose does not translate into increased risk of surgical site infections and other major complications. In conclusion, the clinical advantages of better patient comfort and Enhanced Recovery After Surgery (ERAS) compliance outweigh the risks, when dosages are adjusted according to the patient's preoperative diabetic status (HbA1c).

Future Scope of Study

The future research of this study is important for improving clinical practice in Saudi Arabia with regard to the use of the most effective and safest anesthetic protocol that provides effective antiemesis and avoids metabolic complications. The next studies should aim to determine an absolute HbA1c cut-off (e.g., 9% or more) for which the harms of severe hyperglycemia outweigh the benefits of steroid prophylaxis. There is also a need for multi-center large-scale, prospective studies in the Kingdom to assess the long-term complications such as the 30-day surgical site infection (SSI) and wound dehiscence, particularly in patients with obesity and poor glycemic control.

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