ORIGINAL ARTICLE

Efficacy of Dexamethasone on Perioperative Blood Glucose Concentration and Post-Operative Nausea and Vomiting in Patients Undergoing Laparoscopic Hysterectomy: A Randomised Double Blind Controlled Trial

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ABSTRACT

Context (Background): Dexamethasone is widely used perioperatively for its antiemetic and analgesic properties, but it can elevate blood glucose by stimulating hepatic gluconeogenesis and inducing insulin resistance. However, its glycaemic impact in non-diabetic patients undergoing laparoscopic hysterectomy is not studied in a larger population.
Aims: To evaluate the effect of a single intraoperative dose of dexamethasone on perioperative blood glucose levels and the incidence of postoperative nausea and vomiting (PONV) in non-diabetic patients undergoing laparoscopic hysterectomy.
Settings and Design: A Prospective, randomised, double-blind, placebo-controlled trial conducted at the Department of Anaesthesiology and Critical Care, Pradyumna Bal Medical College and Hospital, KIIT Deemed to be University, Bhubaneswar, Odisha, India. CTRI/2023/07/055255.
Methods and Material: Ninety non-diabetic women (ASA I–II) scheduled for elective laparoscopic hysterectomy were randomised into two equal groups. Group A (n=45) received intravenous dexamethasone 8 mg diluted in normal saline (4 mL) intraoperatively; Group B (n=45) received 4 mL normal saline (placebo). Blood glucose was measured preoperatively, then at 2, 4, and 6 hours intraoperatively, and on postoperative days (POD) 1, 2, and 3 as fasting blood sugar (FBS) and postprandial blood sugar (PPBS). Pain was assessed using the Visual Analogue Scale (VAS). PONV and rescue analgesic requirements were recorded.
Statistical Analysis Used: Shapiro-Wilk test for normality; continuous variables expressed as mean ± SD; categorical variables compared by chi-square or Fisher's exact test; continuous variables by Mann-Whitney U test. $P<0.05$ was considered significant. SPSS version 20.0 was used.
Results: Both groups were demographically comparable. Intraoperative blood glucose (mg/dL) at 2 h (132.5±21.7 vs 106.3±7.1, p=0.02), 4 h (124.3±15.4 vs 103.9±5.2, p=0.01), and 6 h (118.5±16.2 vs 102.3±5.9, p=0.01) were significantly higher in Group A. FBS(mg/dl) on POD-1 (115.4±14.7 vs 99.24±7.2, p=0.02) and PPBS(mg/dl) on POD-1 (131.16±11.9 vs 126.7±6.7, p=0.03) were also significantly elevated. No cases of PONV occurred in Group A versus 8 cases (17.4%) in Group B (p=0.03). Fewer patients in Group A required rescue analgesia (0% vs 15.2%, p=0.03).
Conclusions: A single intraoperative dose of dexamethasone 8 mg significantly elevates perioperative blood glucose in non-diabetic patients undergoing laparoscopic hysterectomy, with the effect persisting into POD-1. Vigilant blood glucose monitoring is warranted. The drug substantially reduces PONV and rescues analgesic requirements, supporting its continued use with appropriate monitoring.

Keywords: Blood glucose, Dexamethasone, Laparoscopic hysterectomy, PONV, Perioperative hyperglycaemia, Randomised controlled trial
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INTRODUCTION

Surgical stress evokes a profound physiological response involving neuroendocrine, immunological, and metabolic systems. Among the most notable changes is an alteration of glucose metabolism resulting in transient hyperglycaemia even in patients without prior diabetes mellitus. This is mediated by a surge in counter-regulatory hormones—cortisol, catecholamines, growth hormone, and glucagon—which increase hepatic glucose output and decrease peripheral insulin sensitivity [1,2,3]. Excess perioperative hyperglycaemia predisposes patients to impaired wound healing, increased susceptibility to infection, and delayed recovery [4].

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Dexamethasone, a synthetic fluorinated glucocorticoid, is frequently employed perioperatively for its potent anti-inflammatory and antiemetic properties. It is particularly valued for reducing PONV, decreasing opioid requirements, and improving patient comfort, and is incorporated into Enhanced Recovery After Surgery (ERAS) protocols across surgical disciplines [5,6,7]. However, dexamethasone exhibits significant metabolic effects—enhancing hepatic gluconeogenesis, reducing peripheral glucose uptake, and inducing insulin resistance—contributing to elevated blood glucose levels [8,9].

Laparoscopic hysterectomy, though minimally invasive, is not devoid of physiological stress. Pneumoperitoneum, patient positioning, and surgical manipulation elicit a neuroendocrine response that elevates blood glucose [10]. The addition of dexamethasone may amplify this response. Despite its common use, there is limited data on its glycaemic impact in non-diabetic women undergoing this procedure [11,12].

Non-diabetic patients may exhibit significant glycaemic excursions in response to stress and steroid administration, potentially contributing to adverse outcomes. The lack of routine perioperative glucose monitoring in this population may lead to underestimation of transient hyperglycaemia [13,14,15]. There is thus a compelling need to assess the extent of hyperglycaemia induced by a single intraoperative dose of dexamethasone and determine whether routine glucose surveillance is warranted [16–19].

This randomised controlled trial was designed to assess the effect of a single intraoperative dose of dexamethasone on perioperative blood glucose levels, PONV, and analgesic requirements in non-diabetic women undergoing elective laparoscopic hysterectomy under general anaesthesia [20,21].

MATERIALS AND METHODS

After getting ethical clearance from the institutional ethical committee, we conducted the study in our tertiary care institute. It was a pprospective, randomised, double-blind, placebo-controlled trial conducted over two years after getting CTRI registration. Helsinki declaration was followed for conduct of this trial. All patients giving consent who were posted for elective laparoscopic hysterectomy under general anaesthesia, of ASA physical status I or II between 18-70 year age groups were included in the study. Patient who refused to give consent, known hypersensitivity to study drugs; pregnancy; renal or hepatic dysfunction; malignancy; known diabetes mellitus; chronic steroid therapy; anticipated anaesthesia duration exceeding 4 hours; history of peptic ulcer disease was excluded from the study.

Sample size was calculated based on the study Peter et al. (2022), using FBS at POD-3 for both groups (96.60±17.40 vs 88.16±8.50) at 5% significance and 80% power. The minimum required sample size was 45 per group thus making total of 90 patients [24]. Ninety patients were randomised using computer-generated randomisation into two groups of 45 each. A double-blind technique ensured that both patients and the primary investigator were unaware of group allocation.

After written informed consent, 100 patients were assessed; 10 were excluded (6 did not meet inclusion criteria, 4 declined).

Group A (Dexamethasone): IV dexamethasone 8 mg diluted with normal saline to a total volume of 4 mL, administered intraoperatively.

Group B (Control/Placebo): IV normal saline 4 mL.

All patients underwent pre-anaesthetic evaluation one day prior to surgery with nil-per-oral instructions for at least 8 hours. Standard monitoring (ECG, NIBP, SpO_2, $EtCO_2$) was applied upon arrival in the operating theatre. Baseline parameters including fasting blood glucose (using glucometer) were recorded. Premedication included glycopyrrolate 0.2 mg IV, nalbuphine 1 mg/kg IV, and midazolam 1 mg IV. The study drug was administered per group allocation. After preoxygenation, induction was with propofol 2 mg/kg IV and succinylcholine 2 mg/kg IV; ondansetron 4 mg IV was given post-induction. Anaesthesia was maintained with isoflurane in oxygen/nitrous oxide mixture and vecuronium for relaxation. IV paracetamol 1 g was given intraoperatively. Reversal was with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg IV, followed by extubation and transfer to the Post Anaesthesia Care Unit (PACU). The allocated anaesthesiologist for that particular operating theatre on that day conducted the anaesthesia service and administered the allocated intervention, thus maintaining blinding and avoiding bias.

Our primary objective was to measure blood glucose levels (FBS and PPBS) at 2 h, 4 h, 6 h intraoperatively, and on POD-1, POD-2, and POD-3.

The secondary objective was to observe Incidence of PONV; postoperative pain (VAS 0–10) and rescue analgesic requirement. (assessed upto POD-1)

IV paracetamol 1 g every 8 hours was given routinely post operatively. Rescue analgesia (IV ketorolac 0.5 mg/kg, maximum 30 mg, in 100 mL normal saline over 10–15 minutes) was administered for VAS score >4. IV Ringer's lactate was used for fluid management.

The Shapiro-Wilk test assessed normality. Continuous variables are expressed as mean ± SD; non-continuous variables as median with interquartile range. Categorical variables were compared using chi-square or Fisher's exact test. Continuous variables were compared using the Mann-Whitney U test. $P<0.05$ was considered statistically significant. Data were analysed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 90 patients completed the study (45 per group). No participants were lost to follow-up.

Demographic Characteristics
Both groups were comparable at baseline with no statistically significant differences in age, weight, height, Body Mass Index (BMI) or duration of anaesthesia

Demographic Variable	Group A (n=45) Mean ± SD	Group B (n=45) Mean ± SD	P value
Age (years)	51.51 ± 4.7	51.38 ± 4.3	0.09
Weight (kg)	56.76 ± 4.2	56.50 ± 4.2	0.71
Height (m)	1.60 ± 0.06	1.60 ± 0.06	0.64
BMI (kg/m²)	21.2 ± 2.3	20.9 ± 2.1	0.28
Duration of anaesthesia (h)	2.1 ± 0.16	2.1 ± 0.11	0.77

[Table/Fig-1]: Demographic Characteristics

Preoperative Fasting Blood Glucose
The mean preoperative FBS was higher in Group A (103 ± 16.2 mg/dL) compared to Group B (91.6 ± 7.8 mg/dL); however, the difference was not statistically significant (p=0.77)

Variable	Group A (n=45)	Group B (n=45)	P value
Preoperative FBS (mg/dL)	103 ± 16.2	91.6 ± 7.8	0.77

[Table/Fig-2]: Preoperative Fasting Blood Sugar (before drug administration)

Intraoperative Blood Glucose (after Drug Administration)
Intraoperative blood glucose (mg/dL) was significantly higher in Group A at all three time points: 2 h (132.5±21.7 vs 106.3±7.1, p=0.02), 4 h (124.3±15.4 vs 103.9±5.2, p=0.01), and 6 h (118.5±16.2 vs 102.3±5.9, p=0.01)

Time Point	Group A Mean ± SD	Group B Mean ± SD	P value
2 hours	132.5 ± 21.7	106.3 ± 7.1	0.02*
4 hours	124.3 ± 15.4	103.9 ± 5.2	0.01*
6 hours	118.5 ± 16.2	102.3 ± 5.9	0.01*

[Table/Fig-3]: Intraoperative Blood Glucose Monitoring. *Statistically significant (p<0.05)

Postoperative Fasting Blood Sugar (FBS)
FBS(mg/dl) on POD-1 was significantly higher in Group A (115.4±14.7 vs 99.24±7.2 mg/dL, p=0.02). Differences on POD-2 and POD-3 were not statistically significant (p=0.09 and p=0.12, respectively)

POD	Group A Mean ± SD	Group B Mean ± SD	P value
Day 1 (FBS)	115.4 ± 14.7	99.24 ± 7.2	0.02*
Day 2 (FBS)	105.5 ± 13.7	100.78 ± 6.9	0.09
Day 3 (FBS)	105.8 ± 14.2	102.83 ± 6.2	0.12

[Table/Fig-4]: Postoperative FBS levels. POD: Postoperative day; *Statistically significant

Postoperative Postprandial Blood Sugar (PPBS)
PPBS(mg/dl)was significantly higher in Group A on POD-1 (131.16±11.9 vs 126.7±6.7 mg/dL, p=0.03). No significant differences were observed on POD-2 (p=0.81) or POD-3 (p=0.37)

POD	Group A Mean ± SD	Group B Mean ± SD	P value
Day 1 (PPBS)	131.16 ± 11.9	126.7 ± 6.7	0.03*
Day 2 (PPBS)	126.2 ± 12.2	125.8 ± 7.8	0.81
Day 3 (PPBS)	126.2 ± 11.4	125.4 ± 5.7	0.37

[Table/Fig-5]: Postoperative PPBS (mg/dl) levels. *Statistically significant

Pain Score (VAS)

Pain grading by VAS showed no significant intergroup difference in mild (p=0.79), moderate (p=0.17), or severe (p=0.34) pain categories [Table/Fig-6].

Pain Category	Group A n (%)	Group B n (%)	P value
Mild (VAS 1–3)	43 (95.6)	42 (93.3)	0.79
Moderate (VAS 4–6)	1 (2.2)	2 (4.3)	0.17
Severe (VAS 7–10)	1 (2.2)	1 (2.2)	0.34

[Table/Fig-6]: Pain Score (Visual Analogue Scale)

Postoperative Nausea and Vomiting (PONV)

No cases of PONV were reported in Group A, whereas 8 participants (17.4%) in Group B experienced PONV. The difference was statistically significant (p=0.03)

PONV	Group A n (%)	Group B n (%)	P value
Yes	0 (0)	8 (17.4)	0.03*
No	45 (100.0)	37 (82.6)	—

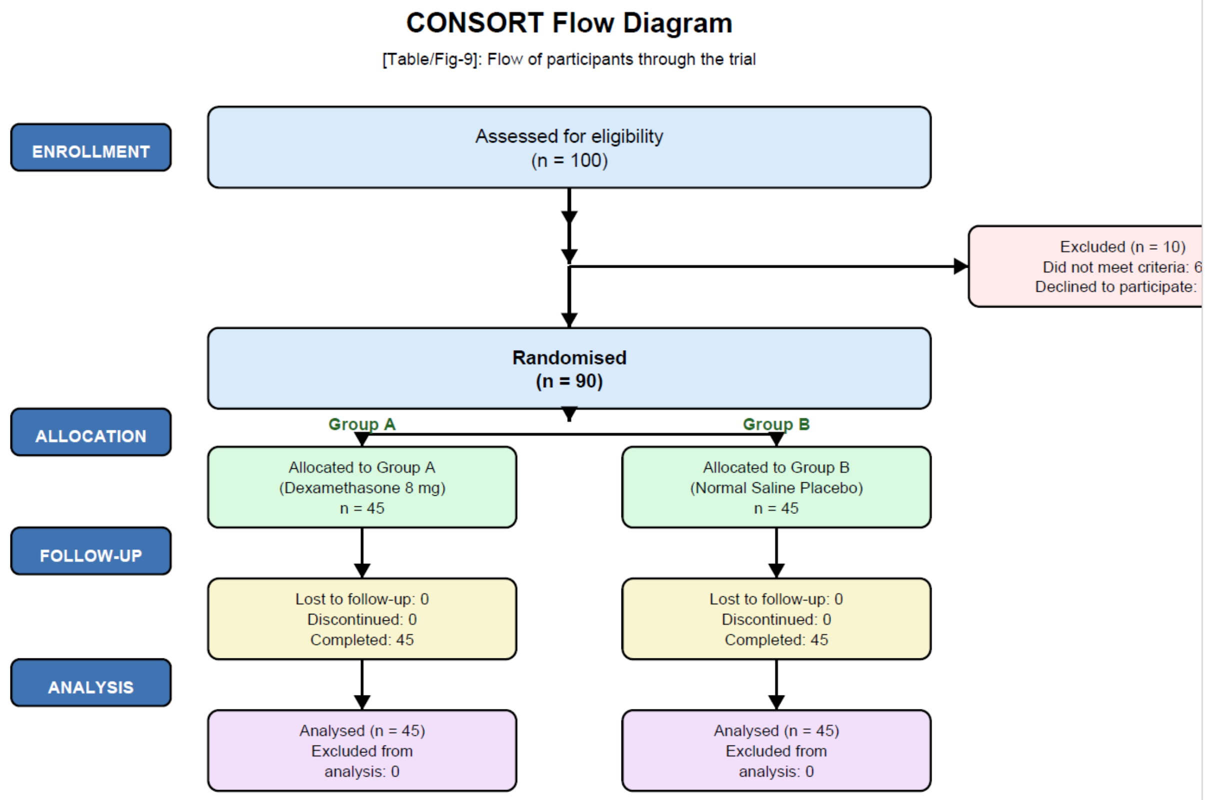
[Table/Fig-7]: PONV incidence. *Statistically significant

Rescue Analgesic Drug Requirement

All patients in Group A (100%) required no rescue analgesia. In Group B, 5 patients (10.9%) required one dose and 2 patients (4.3%) required two doses. The difference was statistically significant (p=0.03) [Table/Fig-8].

Analgesic Requirement	Group A n (%)	Group B n (%)	P value
No drug	45 (100.0)	38 (84.4)	0.03*
One dose	0 (0)	5 (10.9)	—
Two doses	0 (0)	2 (4.3)	—

[Table/Fig-8]: Rescue Analgesic Drug Requirement. *Statistically significant



DISCUSSION

Dexamethasone is extensively used in perioperative care for its analgesic and antiemetic benefits. However, its glucocorticoid activity raises blood glucose by blocking peripheral glucose uptake and promoting hepatic gluconeogenesis. Despite its widespread use, few studies have simultaneously monitored glycaemic trends across multiple time points while also evaluating analgesic and antiemetic effects in non-diabetic patients undergoing laparoscopic hysterectomy. The demographic profiles like age, weight, height, BMI, and anaesthesia duration were comparable between both groups, ensuring a homogeneous study population. The mean anaesthesia duration was 2.1 ± 0.16 h in Group A and 2.1 ± 0.11 h in Group B (p=0.77), consistent with Kang et al. (84.7 vs 90.1 min) and Karacinar et al. (242.9 vs 236.7 min for various dose groups) [28,29].Preoperative FBS(mg/dl) was higher in Group A (103 ± 16.2) than Group B (91.6 ± 7.8), though not statistically different (p=0.77), suggesting a small baseline variation. Purushothaman et al. (2018) reported comparable preoperative levels of 102.6 ± 0.71 in non-diabetic patients [30]. Nonoperative blood glucose was significantly elevated in Group A at all three time points (2 h, 4 h, 6 h), consistent with Ali et al., who documented a peak rise from 95.29 ± 13.69 to 139.97 ± 10.34 mg/dL after dexamethasone 10 mg in patients undergoing intracranial surgery. Pasternak et al. similarly found an increase from 97 ± 15 to 149 ± 23 mg/dL [25,26]. Lukins et al. also reported peak glucose of 11.0 ± 2.0 mmol/L in the dexamethasone arm versus 7.8 ± 2.1 mmol/L in controls, peaking approximately 9 ± 2 hours after induction [31].On POD-1, both FBS (p=0.02) and PPBS (p=0.03) were significantly elevated in Group A, echoing Peter et al. (2022), who reported a 65% rise from baseline in the dexamethasone group versus 52% in controls, with earlier onset and longer duration of hyperglycaemia [25]. In contrast, Corcoran et al. (PADDAG trial) found no significant glucose difference between dexamethasone (4 or 8 mg) and placebo in a multicentre study [33], while Vigil et al. reported similar elevation across both groups [27]. Michael et al. found only 5.6% of patients receiving perioperative dexamethasone had glucose >200 mg/dL [32]. The discrepancies across studies may reflect differences in dose, patient characteristics, surgical type, and glucose monitoring protocols. Regarding PONV, no events occurred in Group A versus 8 events (17.4%) in Group B (p=0.03).

Dexamethasone's antiemetic mechanism is attributed to its anti-inflammatory effects, direct central action at the nucleus tractus solitarius, interaction with NK1/NK2 receptors, and modulation of alpha-adrenergic pathways [35]. A meta-analysis of thyroidectomy patients found doses of 8–10 mg most effective for PONV reduction [34]. In contrast, Peter et al. found no significant association between PONV and dexamethasone [25], and two single-centre trials in intestinal surgery populations did not demonstrate efficacy [33]. Rescue analgesic requirements were significantly lower in Group A (0% vs 15.2%, p=0.03), consistent with the established analgesic adjuvant role of dexamethasone documented by De Oliveira et al. and Waldron et al. [22,23].

Limitations

This was a single-centre study. Blood glucose was measured by glucometer, which may be affected by perfusion, user technique, and device calibration though similar glucometer device is used in the whole hospital (wards, ICUs and OTs). Hormonal and inflammatory markers (insulin, C-peptide, cortisol, IL-6, CRP) were not assessed. Formal quantification of PONV severity was not performed. Longer follow up was not done.

CONCLUSION

A single intraoperative dose of dexamethasone 8 mg significantly elevates perioperative blood glucose in non-diabetic patients undergoing laparoscopic hysterectomy, with the effect persisting into POD-1. Vigilant blood glucose monitoring is therefore advised even in non-diabetic patients receiving perioperative dexamethasone. Dexamethasone also provides clinically significant benefits in reducing PONV and rescue analgesic requirements, reinforcing its role in ERAS protocols when used with appropriate metabolic monitoring.

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