



EFFICACY OF PROPHYLACTIC INTRAVENOUS DEXAMETHASONE FOR PREVENTION OF POST-SPINAL ANAESTHESIA SHIVERING IN PATIENTS UNDERGOING TRANSURETHRAL RESECTION OF THE PROSTATE UNDER SPINAL ANAESTHESIA

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Abstract

Background: Post-spinal anaesthesia shivering (PSAS) is a common complication in elderly patients undergoing transurethral resection of the prostate (TURP) under spinal anaesthesia. Dexamethasone has been proposed as a prophylactic agent due to its anti-inflammatory and thermoregulatory modulatory effects. This study aimed to evaluate the efficacy of intravenous dexamethasone (0.1 mg/kg) in preventing PSAS in this high-risk population.

Methods: A prospective, randomised, double-blind, placebo-controlled trial was conducted at the Sindh Institute of Urology and Transplantation. Sixty patients scheduled for elective TURP under spinal anaesthesia were randomly allocated to receive either dexamethasone 0.1 mg/kg or normal saline (placebo) 30 minutes before spinal anaesthesia. Shivering was assessed using the Wrench scale at predefined intervals. Axillary temperature and postoperative nausea and vomiting (PONV) were also recorded.

Results: Intraoperative shivering occurred in 100% of the dexamethasone group and 96.8% of the placebo group ($P=1.000$). High-grade shivering was comparable between groups (75.8% vs 74.2%). Postoperative shivering rates were similar (27.3% vs 29.0%; $P=1.000$), though resolution time tended to be shorter in the dexamethasone group (16.7 ± 8.0 vs 25.2 ± 11.1 minutes; $P=0.081$). No significant differences were observed in temperature trends or PONV incidence.

Conclusion: Prophylactic dexamethasone (0.1 mg/kg) did not significantly reduce the incidence or severity of intraoperative shivering in elderly TURP patients under spinal anaesthesia.

Introduction

TURP represents one of the most commonly performed urological procedures in elderly men presenting with bladder outlet obstruction secondary to benign prostatic hyperplasia (BPH). As the gold-standard intervention worldwide, TURP offers rapid symptom relief, reduction in urinary retention, and significant improvement in quality of life. In anaesthetic practice, spinal anaesthesia

has emerged as the preferred modality for TURP because it provides superior haemodynamic stability, reduces the risk of deep venous thrombosis, avoids airway manipulation, and facilitates earlier postoperative mobilisation. However, spinal anaesthesia also induces profound thermoregulatory impairment caused by sympathetic blockade, vasodilation, and redistribution hypothermia. These effects, combined with the additional thermal stress imposed by continuous intravesical irrigation using room-temperature fluid, predispose patients to perioperative hypothermia and shivering.

Post-spinal anaesthesia shivering (PSAS) is defined as involuntary, oscillatory muscular activity that may involve isolated muscle groups or the entire body. It is not merely a thermoregulatory event; it also represents a physiological stress response with substantial clinical implications. Shivering increases metabolic rate, oxygen consumption (up to 600%), and carbon dioxide production. This can be dangerous for elderly TURP patients who often have co-existing cardiovascular disease. In addition, shivering elevates intraocular and intracranial pressures, interferes with monitoring modalities such as pulse oximetry and ECG, and significantly worsens patient discomfort.

The pathogenesis of PSAS is multifactorial. The central mechanism involves a downward shift in the hypothalamic thermoregulatory set-point due to spinal sympathetic blockade. Peripheral thermoregulatory mechanisms are also compromised. Redistribution of heat from the core to the periphery leads to an abrupt drop in core temperature within minutes of spinal anaesthesia. This effect is aggravated in TURP because of absorption of cold irrigation fluid, evaporative heat loss from the resection surface, and prolonged exposure in elderly patients with diminished thermogenic reserve.

Dexamethasone is a long-acting synthetic glucocorticoid with potent anti-inflammatory and antiemetic properties. In anaesthesia, dexamethasone is used extensively for prevention of postoperative nausea and vomiting (PONV), reduction in postoperative pain, attenuation of airway oedema, and improvement in quality of recovery. The proposed anti-shivering mechanism includes suppression of pro-inflammatory cytokines, reduction of hypothalamic thermogenic drive, modulation of serotonin pathways, and improved overall recovery physiology. Several clinical studies have reported promising anti-shivering effects with dexamethasone, but findings have been inconsistent due to heterogeneity in dose, timing, surgical procedures, anaesthetic technique, and patient characteristics. Despite several studies on the anti-shivering role of dexamethasone, evidence specifically in elderly TURP patients under spinal anaesthesia is sparse. This population presents a unique physiological challenge with reduced thermogenic capacity, higher prevalence of autonomic dysfunction, and greater susceptibility to perioperative complications. Therefore, evaluating a weight-based dose of dexamethasone (0.1 mg/kg) in this context is clinically relevant. This study aims to determine whether prophylactic dexamethasone can reduce the incidence and severity of shivering and improve perioperative thermal stability

Materials and Methods

Study Design and Ethics

This prospective, randomised, double-blind, placebo-controlled clinical trial was conducted at the Sindh Institute of Urology and Transplantation (SIUT), Karachi, after approval from the institutional Ethical Review Committee (ERC). Written informed consent was obtained from all participants prior to enrolment.

Participants

Male patients aged ≥ 40 years, classified as ASA physical status I–III, scheduled for elective TURP under spinal anaesthesia were included. Exclusion criteria comprised hypersensitivity to corticosteroids, fever or active infection, coagulopathy, infection at the spinal injection site, failed spinal block requiring conversion to general anaesthesia, or requirement for intraoperative blood transfusion.

Randomisation and Blinding

Patients were randomised in a 1:1 ratio using computer-generated random numbers and sealed opaque envelopes. Group Dx received dexamethasone 0.1 mg/kg IV diluted to 10 mL, while Group N received 10 mL normal saline. Study drugs were administered 30 minutes prior to spinal anaesthesia by an anaesthesiologist not involved in outcome assessment. Patients, anaesthesiologists, and outcome assessors were blinded to group allocation.

Anaesthetic Technique

Standardised spinal anaesthesia was performed in all patients using 12.5 mg of 0.5% hyperbaric bupivacaine at the L4–L5 interspace with a 25G Quincke needle. Operating room temperature was maintained at 25–26°C. Patients received 10 mL/kg of pre-warmed crystalloid solution (37.5°C) prior to spinal block.

Outcome Measures

The primary outcome was the incidence of intraoperative shivering. Secondary outcomes included severity of shivering (graded using the Wrench scale), postoperative shivering, time to shivering resolution, axillary temperature trends, and incidence of postoperative nausea and vomiting (PONV).

Shivering and Temperature Assessment

Shivering was assessed at 5, 10, 15, 30, 45, 60, and 90 minutes intraoperatively and in the PACU. Axillary temperature was recorded using a mercury thermometer at corresponding intervals.

Statistical Analysis

Data were analysed using SPSS version 21. Continuous variables were expressed as mean $\pm$ standard deviation and compared using independent sample t-tests. Categorical variables were compared using Chi-square or Fisher's exact test as appropriate. A P-value <0.05 was considered statistically significant.

Results

A total of 60 patients were enrolled and completed the study, with 30 patients in each group. Baseline demographic and clinical characteristics were comparable between the two groups (Table 1).

Intraoperative shivering occurred in 100% of patients in the dexamethasone group and 96.8% of patients in the placebo group ($P=1.000$). The incidence of high-grade shivering (Wrench grade ≥ 3) was similar between groups (75.8% vs 74.2%).

Postoperative shivering was observed in 27.3% of patients in the dexamethasone group and 29.0% in the placebo group ($P=1.000$). Although the overall incidence did not differ significantly, the mean time to complete resolution of shivering was shorter in the dexamethasone group (16.7 ± 8.0 minutes) compared with the placebo group (25.2 ± 11.1 minutes), though this difference did not reach statistical significance ($P=0.081$).

Axillary temperature trends were comparable between groups throughout the intraoperative and postoperative periods (Figure 1). The incidence of PONV did not differ significantly between groups.

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Dexamethasone Group (n=30)	Placebo Group (n=30)
Age (years)	66.8 $\pm$ 6.2	65.9 $\pm$ 5.8
Weight (kg)	82.4 $\pm$ 10.1	80.9 $\pm$ 9.7
Height (cm)	170.3 $\pm$ 6.5	169.1 $\pm$ 6.2

BMI (kg/m ²)	28.7 ± 3.4	27.9 ± 3.1
ASA I/II/III	6 / 15 / 9	7 / 14 / 9

Figure 1. Axillary Temperature Trend

Axillary temperature trend over time by group

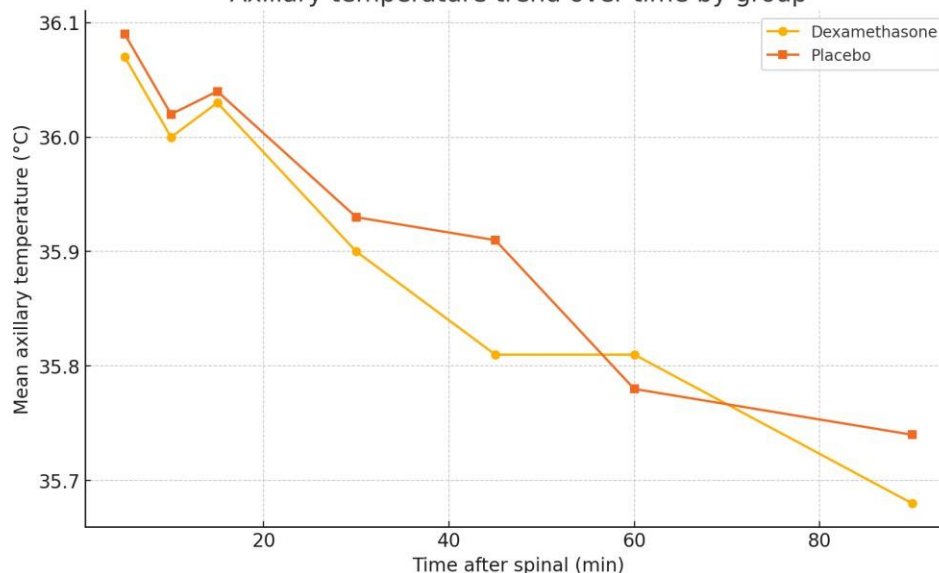
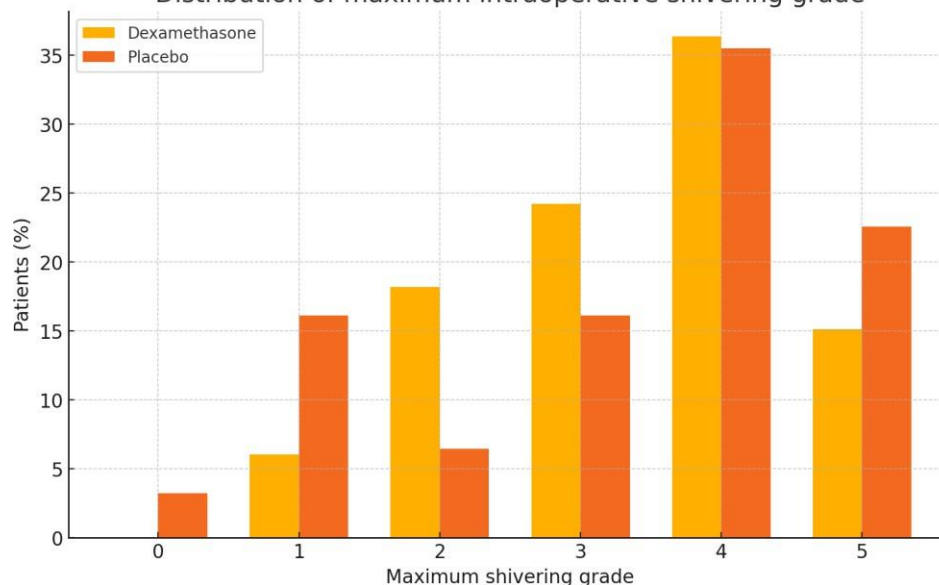


Figure 2. Shivering Severity Distribution

Distribution of maximum intraoperative shivering grade



- **Intraoperative shivering occurred similarly** in both groups (100% in dexamethasone vs 96.8% in placebo; P=1.000), with **no significant difference** in high-grade shivering (75.8% vs 74.2%).
- **Postoperative shivering rates were comparable** (27.3% vs 29.0%; P=1.000), though **dexamethasone showed a trend toward faster resolution** of shivering (16.7 ± 8.0 vs 25.2 ± 11.1 minutes; P=0.081).
- **Temperature trends and PONV incidence were similar** between groups, indicating **no measurable thermoprotective or anti-shivering benefit** at the 0.1 mg/kg dexamethasone dose.

Discussion

The present randomized controlled trial investigated the efficacy of prophylactic intravenous dexamethasone (0.1 mg/kg) for prevention of post-spinal anaesthesia shivering in elderly patients

undergoing TURP. The primary finding was that dexamethasone, at this dose and timing, did not significantly reduce the incidence or severity of intraoperative shivering compared with placebo. Although dexamethasone showed a trend toward faster resolution of postoperative shivering, the overall anti-shivering effect during the intraoperative period appeared limited. These findings highlight several important physiological and methodological considerations.

First, the extremely high incidence of intraoperative shivering observed in both groups (nearly 100%) indicates that TURP under spinal anaesthesia represents a **high-risk thermal environment**, where redistribution hypothermia and cold irrigating fluid create strong thermogenic triggers. Redistribution of core heat into peripheral compartments occurs rapidly after spinal sympathetic blockade, widening the thermoregulatory inter-threshold range and suppressing vasoconstriction. In elderly patients---who have reduced muscle mass, impaired autonomic responses, and diminished brown fat thermogenesis---the ability to compensate for these thermal disturbances is significantly compromised. The absorption of large volumes of room-temperature irrigation fluid during TURP further accelerates the fall in core temperature, likely overpowering the modest thermoregulatory modulation achievable with low-dose dexamethasone.

Second, dexamethasone's anti-shivering effects described in previous studies may be **dose dependent**. Many trials reporting benefits used fixed doses between **4 mg and 8 mg**, administered 30--60 minutes preoperatively. A weight-based dose of 0.1 mg/kg corresponds to approximately 6--8 mg for most patients in this study; however, inter-individual variability, reduced absorption in elderly patients, and potentially slower central neuroimmune modulation may explain the attenuated effect observed. Furthermore, dexamethasone's proposed anti-shivering mechanism involves suppression of pro-inflammatory cytokines (IL-6, TNF- α) and modulation of hypothalamic serotonergic pathways---mechanisms that may require **higher systemic anti-inflammatory thresholds** to meaningfully impact the shivering response.

Third, although dexamethasone failed to prevent intraoperative shivering, the **shorter time to resolution** among patients who developed postoperative shivering in the PACU suggests a secondary benefit. This may reflect dexamethasone's ability to reduce postoperative pain, inflammatory stress, and cytokine-driven thermogenic activity. It may also relate to improved quality of recovery and reduced postoperative fatigue previously reported in dexamethasone literature.

Fourth, the comparable PONV rates between the two groups, with a trend toward reduced vomiting in the dexamethasone arm, is consistent with its well-established antiemetic efficacy. Although PONV was not a primary endpoint, this reinforces the broader peri-operative value of dexamethasone, even when its anti-shivering effect is limited.

It is also important to consider that shivering is a **multifactorial physiological phenomenon**, and single-agent prophylaxis---even with drugs known to modulate thermoregulation---may be insufficient in high-risk surgeries. Agents such as meperidine, tramadol, clonidine, dexmedetomidine, magnesium sulphate, and nefopam have demonstrated strong anti-shivering effects, often through more direct modulation of thermogenic pathways. A multimodal strategy combining **active warming**, warmed irrigation fluids, forced-air warming blankets, higher-dose dexamethasone, or adjunctive pharmacological agents may be more effective than monotherapy.

The study results also highlight the importance of considering **TURP-specific physiological challenges**. Elderly TURP patients commonly present with polypharmacy, autonomic dysfunction, and variable thermoregulatory reserve, all of which may alter drug response. Moreover, the degree of hypothermia can vary with irrigation volume, prostate size, and duration of resection---factors shown in this study to vary slightly between groups.

Several strengths of this trial include strict randomisation, complete blinding, standardised anaesthetic and temperature-recording protocols, and serial shivering assessments using a validated scale. However, limitations must be acknowledged. The sample size, although powered for a moderate effect size, may not detect smaller differences in shivering incidence. The lack of continuous core temperature monitoring (e.g., oesophageal, tympanic, or nasopharyngeal) limits

precision in detecting rapid thermal shifts. Additionally, the fixed OR temperature of 25--26°C, while standardised, may not reflect real-world variability in thermal environments.

Despite these limitations, the present findings contribute meaningfully to the existing evidence base. They indicate that **low-dose dexamethasone alone is insufficient** to prevent shivering during TURP under spinal anaesthesia, a setting characterised by strong thermal stress and rapid hypothermia. Future research should evaluate higher dexamethasone doses, combination regimens, and multimodal warming techniques. Comparative trials with dexmedetomidine, clonidine, or opioids may also clarify the optimal pharmacological strategy for PSAS prevention in elderly TURP populations.

In conclusion, while dexamethasone offers several peri-operative benefits, its role in preventing intraoperative shivering in TURP appears limited at a 0.1 mg/kg dose. A multimodal approach remains essential for effective shivering prevention in elderly patients undergoing spinal anaesthesia.

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