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Original Research Article

EVALUATION OF THE EFFICACY OF PREEMPTIVE DEXAMETHASONE FOR POSTOPERATIVE ANALGESIA IN PATIENTS UNDERGOING TOTAL ABDOMINAL HYSTERECTOMY UNDER SPINAL ANAESTHESIA: A PROSPECTIVE RANDOMISED CONTROLLED STUDY

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ABSTRACT

Background: Total abdominal hysterectomy is associated with moderate to severe postoperative pain. Preemptive analgesia aims to reduce pain by acting before the noxious surgical stimulus. This study evaluated the efficacy of intravenous dexamethasone as a preemptive analgesic in patients undergoing total abdominal hysterectomy under spinal anaesthesia.

Materials and Methods: Sixty ASA I–II patients aged 18–60 years scheduled for total abdominal hysterectomy under spinal anaesthesia with 0.5% hyperbaric bupivacaine were enrolled in this prospective randomised controlled study. Patients were randomised into two equal groups of 30: Group D received intravenous dexamethasone 8 mg in 100 mL normal saline before spinal anaesthesia; Group C received 100 mL normal saline only. Outcomes included duration of sensory and motor block, VAS pain scores at 2, 4, 6, 12, and 24 hours, time to first analgesic request, total analgesic consumption in the first 24 hours, and incidence of side effects.

Results: Group D had a significantly longer duration of sensory block (212.4 ± 26.8 min vs 178.6 ± 24.2 min; $p < 0.001$) and motor block (178.8 ± 22.4 min vs 152.4 ± 19.6 min; $p < 0.001$). VAS scores were significantly lower in Group D at all time points ($p < 0.001$). Time to first analgesic request was significantly longer in Group D (7.8 ± 1.6 h vs 4.2 ± 1.2 h; $p < 0.001$), and total tramadol consumption was lower (108.3 ± 28.6 mg vs 186.7 ± 34.4 mg; $p < 0.001$). The incidence of nausea was significantly lower in Group D ($p = 0.048$).

Conclusion: Preemptive intravenous dexamethasone 8 mg significantly prolonged sensory and motor block duration, improved postoperative analgesia, reduced analgesic consumption, and lowered the incidence of nausea in patients undergoing total abdominal hysterectomy under spinal anaesthesia.

Keywords: Preemptive analgesia; dexamethasone; total abdominal hysterectomy; spinal anaesthesia; postoperative pain; VAS score.

INTRODUCTION

Total abdominal hysterectomy (TAH) is one of the most frequently performed major gynaecological surgeries worldwide. It is associated with moderate to severe postoperative pain that, if poorly managed, leads to increased morbidity, delayed mobilisation, and prolonged hospital stay. Effective pain control is therefore a central goal in the perioperative management of patients undergoing this procedure.[1] Spinal anaesthesia with 0.5% hyperbaric bupivacaine is widely used for TAH. It offers reliable sensory and motor blockade, avoids the risks associated with general anaesthesia, reduces intraoperative blood loss, and allows earlier mobilisation compared with general anaesthesia.[2] Several strategies — including intrathecal adjuvants and regional analgesic

techniques — have been explored to extend postoperative analgesia beyond the finite duration of the spinal block.[3]

Multimodal analgesia, which combines agents from different analgesic classes to achieve better pain control with fewer side effects, is now the accepted standard of care after major abdominal surgery. Studies have demonstrated that a structured multimodal approach shortens hospital stay and reduces analgesic-related complications.[4] Within this framework, preemptive analgesia — an analgesic intervention administered before surgery to blunt sensitisation of the nociceptive pathway — has attracted interest as a means of reducing postoperative pain intensity and opioid requirements. Dexamethasone is a synthetic glucocorticoid having potent anti-inflammatory as well as antiemetic properties. Its analgesic mechanism involves inhibition of phospholipase A2, suppression of pro-inflammatory prostaglandins, reduction of bradykinin levels at peripheral nociceptors, and limitation of neuropeptide release from sensory nerve endings. These actions raise the pain threshold and attenuate the inflammatory response that amplifies postoperative pain. Systematic reviews and meta-analyses have confirmed that perioperative dexamethasone reduces postoperative pain scores, prolongs the duration of regional anaesthesia, and decreases analgesic consumption across a range of surgical settings.[5]

Despite this evidence, studies specifically examining the effect of preemptive intravenous dexamethasone 8 mg in patients undergoing TAH under spinal anaesthesia remain limited. This prospective randomised controlled study was therefore designed to evaluate the efficacy of preemptive intravenous dexamethasone on the duration of sensory and motor block, VAS pain scores, time to first analgesic request, total analgesic consumption in the first 24 hours, and the incidence of side effects in patients undergoing TAH under spinal anaesthesia with 0.5% hyperbaric bupivacaine.

MATERIALS AND METHODS

This prospective randomised controlled double-blind study was conducted over 18 months. Sixty patients scheduled for elective TAH under spinal anaesthesia were enrolled after written informed consent was obtained.

Patients were randomised into two groups of 30 using a computer-generated random number table with sealed opaque envelopes. Group D (dexamethasone group) received intravenous dexamethasone 8 mg in 100 mL normal saline infused over 15 minutes before spinal anaesthesia. Group C (control group) received 100 mL normal saline infused over 15 minutes. Drug preparation was performed by an anaesthesiologist not involved in outcome assessment. The observer recording outcomes was blinded to group allocation.

Patients were positioned in the right lateral decubitus position. Under aseptic precautions, spinal anaesthesia was administered at the L3–L4 or L2–L3 interspace using a 25-gauge Quincke spinal needle. Intrathecal injection of 3 mL (15 mg) of 0.5% hyperbaric bupivacaine was performed over 20 seconds. The patient was immediately repositioned supine. Sensory block level was assessed by pin-prick every two minutes until the block was established. Surgery commenced when the sensory level was at or above T6.

The primary outcomes were: (1) total duration of sensory block, defined as the time from intrathecal injection to regression of sensory block by two dermatomes from the maximum level; (2) total duration of motor block, assessed using the Bromage scale (0 = no motor block; 3 = complete inability to move legs); (3) VAS pain scores (0 = no pain; 10 = worst imaginable pain) at 2, 4, 6, 12, and 24 hours postoperatively; (4) time to first analgesic request; and (5) total analgesic consumption in the first 24 hours. Tramadol 50 mg intramuscularly was administered as rescue analgesia when VAS ≥ 4. Side effects — including nausea, vomiting, hypotension (systolic blood pressure < 90 mmHg or a fall > 20% from baseline), bradycardia (heart rate < 50 bpm), pruritus, and post-dural puncture headache — were recorded.

Data were analysed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables are expressed as mean ± standard deviation. The independent samples t-test was used to compare continuous data between the two groups. Categorical data are expressed as frequency and percentage, and were compared using the chi-square test or Fisher's exact test as appropriate. A p-value < 0.05 was considered statistically significant.

Inclusion Criteria

- Patients aged between 18 and 60 years were eligible for enrolment.
- Only patients belonging to ASA physical status I or II were included.
- Patients scheduled for elective total abdominal hysterectomy (TAH) under spinal anaesthesia were considered eligible.
- Only patients who provided written informed consent were enrolled in the study.

Exclusion Criteria

- Patients with a known allergy to dexamethasone or bupivacaine were excluded from the study.
- Patients with coagulopathy or infection at the lumbar puncture site were not enrolled.
- Patients with diabetes mellitus requiring medication were excluded.
- Patients with severe systemic disease (ASA physical status III or IV) were not considered eligible.
- Patients who declined to provide consent were excluded from participation.

RESULTS

All 60 patients completed the study. No patient was excluded after randomisation. The two groups were comparable in all baseline and demographic parameters.

All patients were female. The majority of patients in both groups were aged between 41 and 50 years. The mean age was 44.6 ± 7.2 years in Group D and 43.8 ± 6.9 years in Group C, with no significant difference between the groups (p = 0.63). [Table 1]

Table 1: Age and gender distribution of the study population (n = 60). All patients were female. Data presented as n (%) or mean ± SD

Age group (years)	Group D (n = 30)	Group C (n = 30)	p-value
18–30	4 (13.3%)	3 (10.0%)	0.63
31–40	4 (13.3%)	5 (16.7%)	
41–50	14 (46.7%)	13 (43.3%)	
51–60	8 (26.7%)	9 (30.0%)	
Mean ± SD (years)	44.6 ± 7.2	43.8 ± 6.9	

The two groups were similar in weight, height, body mass index (BMI), ASA physical status, and duration of surgery. No statistically significant difference was observed for any parameter (p > 0.05 for all). [Table 2]

Table 2: Demographic and clinical characteristics of the study population (n = 60). Data presented as mean ± SD or n (%)

Parameter	Group D (n = 30)	Group C (n = 30)	p-value
Weight (kg)	62.4 ± 7.8	63.1 ± 8.2	0.71
Height (cm)	158.2 ± 5.4	157.6 ± 5.1	0.64
BMI (kg/m²)	24.9 ± 2.8	25.4 ± 3.0	0.47
ASA I, n (%)	18 (60.0%)	17 (56.7%)	0.79
ASA II, n (%)	12 (40.0%)	13 (43.3%)	—
Duration of surgery (min)	78.4 ± 12.6	76.9 ± 11.8	0.61

Group D showed a significantly longer duration of sensory block compared to Group C (212.4 ± 26.8 min vs 178.6 ± 24.2 min; p < 0.001) (Table 3). The time to maximum sensory level and the maximum dermatome level reached were comparable between the groups (p > 0.05).

Table 3: Sensory block parameters in both groups (n = 60). Data presented as mean ± SD or median (range)

Parameter	Group D (n = 30)	Group C (n = 30)	p-value
Time to maximum sensory level (min)	8.4 ± 2.1	8.2 ± 1.9	0.68
Maximum sensory level (dermatome)	T5 (T4–T6)	T5 (T4–T6)	>0.05
Duration of sensory block (min)	212.4 ± 26.8	178.6 ± 24.2	<0.001

The mean duration of motor block was significantly longer in Group D (178.8 ± 22.4 min) than in Group C (152.4 ± 19.6 min) (p < 0.001) (Table 4). The time taken to achieve complete motor block (Bromage grade 3) was similar in both groups.

Table 4: Motor block parameters in both groups (n = 60). Motor block assessed using the Bromage scale (0 = no block; 3 = complete motor block). Data presented as mean ± SD.

Parameter	Group D (n = 30)	Group C (n = 30)	p-value
Time to Bromage grade 3 (min)	12.6 ± 2.4	12.2 ± 2.2	0.47
Duration of motor block (min)	178.8 ± 22.4	152.4 ± 19.6	<0.001

Group D had significantly lower VAS pain scores at all recorded time points compared to Group C (p < 0.001 at each time point) (Table 5). The largest difference between the groups was observed at 6 hours postoperatively (3.4 ± 1.0 vs 5.2 ± 1.2).

Table 5: VAS pain scores at 2, 4, 6, 12, and 24 hours postoperatively (n = 60). VAS: visual analogue scale (0 = no pain; 10 = worst imaginable pain). Data presented as mean ± SD.

Time point	Group D (n = 30)	Group C (n = 30)	p-value
2 hours	2.2 ± 0.8	3.8 ± 1.0	<0.001
4 hours	2.8 ± 0.9	4.4 ± 1.1	<0.001
6 hours	3.4 ± 1.0	5.2 ± 1.2	<0.001
12 hours	2.6 ± 0.8	4.6 ± 1.0	<0.001
24 hours	1.8 ± 0.6	2.8 ± 0.8	<0.001

The mean time to first analgesic request was significantly longer in Group D (7.8 ± 1.6 h) than in Group C (4.2 ± 1.2 h) ($p < 0.001$) (Table 6). More than one-third of patients in Group D (36.7%) did not request analgesia until after 8 hours, compared with only one patient (3.3%) in Group C.

Table 6: Time to first analgesic request in both groups (n = 60). Data presented as mean ± SD or n (%).

Parameter	Group D (n = 30)	Group C (n = 30)	p-value
Mean time to first request (h)	7.8 ± 1.6	4.2 ± 1.2	<0.001
< 4 hours, n (%)	2 (6.7%)	12 (40.0%)	<0.001
4–6 hours, n (%)	5 (16.7%)	10 (33.3%)	
6–8 hours, n (%)	12 (40.0%)	7 (23.3%)	
> 8 hours, n (%)	11 (36.7%)	1 (3.3%)	

Total tramadol consumption in the first 24 hours was significantly lower in Group D (108.3 ± 28.6 mg) compared with Group C (186.7 ± 34.4 mg) ($p < 0.001$) (Table 7). A greater proportion of Group D patients required two or fewer rescue doses.

Table 7: Total analgesic consumption in the first 24 hours (n = 60). Rescue analgesia: tramadol 50 mg IM administered when VAS ≥ 4. Data presented as mean ± SD or n (%).

Parameter	Group D (n = 30)	Group C (n = 30)	p-value
Total tramadol in 24 h (mg)	108.3 ± 28.6	186.7 ± 34.4	<0.001
0 rescue doses, n (%)	2 (6.7%)	0 (0.0%)	
1 rescue dose, n (%)	8 (26.7%)	3 (10.0%)	
2 rescue doses, n (%)	12 (40.0%)	9 (30.0%)	
3 rescue doses, n (%)	6 (20.0%)	13 (43.3%)	
4 rescue doses, n (%)	2 (6.7%)	5 (16.7%)	

The incidence of nausea was significantly lower in Group D (13.3% vs 33.3%; $p = 0.048$). No significant difference was found between the groups in the incidence of vomiting, hypotension, bradycardia, pruritus, or headache (Table 8). The proportion of patients experiencing any side effect was significantly higher in Group C (83.3% vs 43.3%; $p = 0.001$).

Table 8: Incidence of postoperative side effects (n = 60). Data presented as n (%).

Side effect	Group D (n = 30)	Group C (n = 30)	p-value
Nausea	4 (13.3%)	10 (33.3%)	0.048
Vomiting	2 (6.7%)	6 (20.0%)	0.136
Hypotension	3 (10.0%)	4 (13.3%)	0.691
Bradycardia	2 (6.7%)	3 (10.0%)	0.640
Pruritus	1 (3.3%)	0 (0.0%)	1.000
Headache	1 (3.3%)	2 (6.7%)	0.614
Any side effect	13 (43.3%)	25 (83.3%)	0.001

DISCUSSION

This prospective randomised controlled trial demonstrates that a single preemptive intravenous dose of dexamethasone 8 mg significantly prolonged the duration of spinal anaesthesia, improved postoperative pain scores at all time points, delayed the time to first analgesic request, reduced total analgesic consumption, and lowered the incidence of nausea compared with saline in patients undergoing TAH under spinal anaesthesia with 0.5% hyperbaric bupivacaine.

The prolongation of sensory block in our study (212.4 ± 26.8 min vs 178.6 ± 24.2 min; $p < 0.001$) is consistent with findings reported by Abdel-Wahab et al,[6] who conducted a randomised controlled trial in patients undergoing lower abdominal surgery under hyperbaric bupivacaine spinal anaesthesia and found that intravenous dexamethasone significantly extended sensory block duration. They attributed this effect to the membrane-stabilising and anti-inflammatory properties of dexamethasone, which attenuate c-fibre nociceptor activity and slow block regression.

Manohar et al,[7] evaluated intravenous dexamethasone on spinal anaesthesia duration in parturients undergoing lower segment caesarean section and similarly found a significant increase in sensory block duration in the dexamethasone group compared with control. Our findings in the TAH population mirror these results and extend the evidence to a non-obstetric abdominal surgical setting.

The reduction in VAS pain scores at all time points in our study aligns with data from Mehdiratta et al,[8] who showed in a randomised controlled trial that intravenous dexamethasone administered before skin incision for caesarean delivery produced significantly lower postoperative pain scores across all time points up to 24 hours. The mechanism involves glucocorticoid-mediated suppression of prostaglandin synthesis and limitation of inflammatory mediator release at the surgical site.

Vasan et al,[9] compared two doses of intravenous dexamethasone (4 mg vs 8 mg) in patients

undergoing caesarean section under spinal anaesthesia and reported significantly lower VAS scores in the 8 mg group at all time points. This dose-response relationship provides indirect support for the 8 mg dose used in the present study. Jamwal et al,[10] specifically examined dexamethasone as a preemptive analgesic in patients undergoing TAH under spinal anaesthesia in a prospective observational study and reported comparable findings in terms of prolonged block duration and reduced analgesic requirements. Our randomised design with a matched control group strengthens the causal inference that an observational study cannot provide.

The significant prolongation of time to first analgesic request in Group D (7.8 ± 1.6 h vs 4.2 ± 1.2 h; $p < 0.001$) is clinically meaningful. Ravishankar et al,[11] reported a similar delay in parturients undergoing caesarean section under spinal anaesthesia and attributed the extended analgesia to the sustained peripheral anti-nociceptive action of dexamethasone at the nociceptor level.

The reduction in total tramadol consumption in Group D (108.3 mg vs 186.7 mg; $p < 0.001$) carries direct clinical relevance. Lower analgesic use is known to reduce the risk of opioid-related adverse effects thereby facilitating faster postoperative recovery. A systematic review by Abebe et al,[12] pooling data from multiple randomised controlled trials confirmed that intravenous dexamethasone significantly reduces requirements of rescue analgesic after spinal anaesthesia in both obstetric as well as non-obstetric populations.

The lower incidence of nausea in Group D (13.3% vs 33.3%; $p = 0.048$) reflects the well-established antiemetic property of dexamethasone. This dual benefit of analgesia and antiemesis is especially valuable in gynecological surgery where postoperative nausea and vomiting are common. Sinha et al,[13] reported reduced nausea and improved analgesic outcomes with dexamethasone as part of a multimodal regimen for TAH patients. Zhang et al,[14] similarly demonstrated, in a systematic review of abdominal surgery trials, that dexamethasone reduces nausea rates and postoperative pain when used as an adjuvant.

No serious adverse effects attributable to dexamethasone were observed in this study. The rates of hypotension, bradycardia, pruritus, and headache were similar between the two groups. This is consistent with the recognised safety profile of a single perioperative dose. De Oliveira et al,[15] confirmed the safety of perioperative dexamethasone in a large meta-analysis of randomised controlled trials, reporting no increase in wound infection, glycemic disturbance, or other adverse events with single-dose administration.

Limitations of this study include its single-centre design, the use of a fixed bupivacaine dose without dose titration, and the absence of long-term follow-up. Multicentre trials with larger sample sizes and dose-comparison arms would further define the optimal preemptive dexamethasone strategy for this surgical population.

CONCLUSION

A single preemptive intravenous dose of dexamethasone 8 mg significantly prolonged the duration of sensory and motor block, reduced postoperative pain scores at all time points, delayed the time to first analgesic request, and reduced total analgesic consumption in patients undergoing total abdominal hysterectomy under spinal anaesthesia. It also reduced the incidence of postoperative nausea without increasing adverse effects. Dexamethasone is a safe, effective, and cost-efficient addition to the perioperative analgesic regimen for this patient population.

Declarations

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Consent: Obtained

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