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ORIGINAL STUDY

Efficacy of Pethidine and Tramadol in the Suppression of Postoperative Shivering: A Comparative Study

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ABSTRACT

Postoperative shivering is a common complication that can affect patient comfort and stability. Pethidine and tramadol are widely used to relieve this symptom, but their relative effectiveness and safety remain under investigation. In this randomized trial, 50 patients (aged 25–35 years) with postoperative shivering were divided into two groups: one group receiving intravenous tramadol (n = 25 patients) and one group receiving pethidine (n = 25 patients). Onset of drug action, vital signs, and side effects were systematically assessed. Pethidine had a significantly faster onset of action than tramadol (12.20 ± 0.35 min vs 7.16 ± 0.28 min, $p < 0.001$). No significant differences were observed between the two groups regarding body temperature, heart rate, oxygen saturation, or blood pressure ($P < 0.05$). Side effects, such as dizziness (16% vs. 8%), nausea and vomiting (20% vs. 8%), and nausea alone (48% vs. 20%), were more common and showed a statistically significant increase in the tramadol group. Both drugs were effective in suppressing postoperative tremor, but pethidine demonstrated superior efficacy, a faster onset of action, and a better safety profile. These results confirm pethidine as the recommended choice at an intravenous dose of 0.5 mg/kg.

Keywords: Postoperative shivering, Pethidine, Tramadol, Opioid therapy, Anesthesia complications

1. Introduction

Shivering is a common physiological response after anesthesia. It is a defense mechanism that increases body temperature through involuntary muscle contractions during hypothermia [1]. Patients who are not adequately warmed during surgery often develop hypothermia, which can exacerbate postoperative complications [2]. Although shivering is usually considered a benign postoperative symptom, it has significant neuropsychological consequences, including patient discomfort, increased metabolic demand, and potential interference with postoperative monitoring [3]. Electromyography has shown that the human shiver frequency is approximately 200 Hz, modulated by a slow rise-fall cycle of 4–8 cycles per minute [4]. Postoperative shivering increases oxygen consumption, induces lactic acidosis, increases carbon dioxide production, and stimulates catecholamine release, leading to increased cardiac output, heart rate, and blood pressure. Furthermore, shivering complicates monitoring procedures, increases intraocular and intracranial pressure, and can be particularly stressful in certain patient populations, such as those in labor [5]. Pharmacotherapy for Stevens-Johnson syndrome (SJS) is widely used to alleviate these side

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Table 1. Questionnaire form.

Descriptive data		
No.	Age	Gender
BMI		
Treatment		
Pethidine	Tramadol	
Clinical data		
Shivering grade	Temperature	Spo_2
HR	BP	
Side effects		
Nausea only	Nausea and vomiting	Dizziness

effects. Pethidine is a unique opioid that exerts its anti-shivering effect primarily by activating μ- and κ-opioid receptors in the central nervous system, lowering the shivering threshold and body temperature. Pethidine is considered the most effective intravenous medication for the prevention and treatment of SJS and has demonstrated superior efficacy to other opioids at similar doses, such as fentanyl, alfentanil, sufentanil, and morphine. However, side effects, such as nausea, vomiting, and respiratory depression, may limit its use [6]. Tramadol, a synthetic, multimodal opioid, acts as a weak μ-opioid receptor agonist, inhibiting the reuptake of norepinephrine and 5-hydroxytryptamine (5-HT), while antagonizing NMDA receptors at clinically relevant concentrations. Comparative studies have demonstrated the efficacy of tramadol in controlling postoperative tremor (PS). Results indicate that a dose of 0.5 mg/kg pethidine is equivalent to a dose of 1 mg/kg tramadol 15 minutes after administration, but tramadol causes fewer side effects [7].

In contrast to previous studies conducted by our team [8–15], this study aimed to evaluate and compare the safety, onset of action, and efficacy of pethidine and tramadol in the treatment of PS. This study was undertaken given the clinical significance of PS and the different pharmacological properties of these two drugs. The findings will help improve treatment and patient outcomes.

2. Methods

2.1. Participants

In this study, 50 samples were collected and divided into two groups. The first group included 25 patients who received tramadol, and the second group included 25 patients who received pethidine to reduce postoperative tremors. Participants' ages ranged from 25 to 35 years. Samples were collected from patients who underwent surgery at Nasiriyah Teaching Hospital in Thi Qar, Iraq. Clinical data were collected regarding vital signs, time of symptom onset, side effects, and descriptive data, as well as age and sex as shown in Table 1.

2.2. Inclusion and exclusion criteria

The study included patients aged 25 to 35 years (ASA I-II) who experienced grade 2 or higher Shivering after undergoing elective surgery under general anesthesia. Patients with drug allergies, chronic opioid analgesic use, severe liver, kidney, or cardiac disease, pregnancy or breastfeeding, or elevated body temperature (less than 34°C or greater than 39°C) were excluded.

2.3. Study design

This study was conducted at Al-Husseini Teaching Hospital, Thi-Qar Governorate, Iraq, and spanned from January 2025 to June 2025. The study consisted of two groups:

- Group 1: 25 patients receiving tramadol for the treatment of postoperative Shivering (PS).
- Group 2: 25 patients receiving pethidine for the treatment of postoperative Shivering (PS).

The following parameters were measured in all study groups:

1. Shivering grade
2. Vital signs (temperature, blood pressure, heart rate, blood oxygen saturation)
3. Time to onset (in minutes)
4. Body mass index (BMI)
5. Side effects (dizziness, nausea, vomiting)
6. Physician satisfaction

2.4. Parameters measurement

Patients with postoperative shivering received 0.5 mg/kg intravenous tramadol in the first group and 0.5 mg/kg intravenous pethidine in the second group. The onset of drug action was recorded, and vital signs such as blood pressure, heart rate, blood oxygen saturation, and body temperature were measured using a Philips IntelliVue MP70 (Philips Healthcare, The Netherlands). Tremor scores were calculated using the Crossley and Mahajan scale, and each patient's body mass index (BMI) was measured [16, 17]. Potential side effects were also recorded and calculated. A questionnaire was administered to measure physician satisfaction with the effectiveness of antitremor treatment.

Table 2. Baseline characteristics and clinical data.

Variables	Tramadol group	Pethidine group	P-value
Age	28.1 (27–35)	30.5 (25–34)	0.211
Gender			
Male. No (%)	13 (52)	14 (56)	0.701
Female. NO (%)	12 (48)	11 (44)	0.676
BMI	27.2 ± 3.17	26.7 ± 3.03	0.191
Shivering grades 1/2/3/4	6/7/10/2	7/8/6/4	0.769

Table 3. Effect of tramadol and pethidine on hemodynamic variables.

Variables	Tramadol group	Pethidine group	P-value
Time to Onset (min)	12.20 ± 0.35	7.16 ± 0.281	<0.001**
Temperature (°C)	36.98 ± 0.098	37.1 ± 0.102	0.736 NS
HR	90.3 ± 9.8	89.6 ± 15.3	0.814 NS
Spo_2	94.24 ± 0.34	96.92 ± 0.37	0.732 NS
Blood pressure			
Systolic	122.0 ± 1.8	126.4 ± 1.67	0.075 NS
diastolic	78.00 ± 1.18	79.68 ± 0.98	0.278

2.5. Statistical analysis

Collected data were evaluated using Microsoft Excel 2019, IBM SPSS (version 28), and GraphPad Prism (version 8). Statistical analysis was performed using the unpaired t-test [18]. The relationships between variables were assessed using Pearson correlation analysis. Statistical significance was defined as ($P < 0.05$) [19].

3. Results

3.1. Baseline characteristics and clinical data

Table 2 summarizes the baseline demographic and clinical data of the study groups. The mean age did not differ significantly between the tramadol and pethidine groups (28.1 years vs. 30.5 years, $p = 0.211$). The gender distribution was similar: 52% were male in the tramadol group, 56% were male in the pethidine group ($p = 0.701$), and 48% were female in the pethidine group ($p = 0.676$). Similarly, body mass index (BMI) and shivering grades did not differ significantly between the two groups ($p = 0.191$ and $p = 0.769$, respectively).

3.2. Effects of tramadol and pethidine on hemodynamic variables

Table 3 shows the onset of action of tramadol (12.20 ± 0.35 min) and pethidine (7.16 ± 0.28 min). A significant difference was observed between the two groups ($p < 0.001$). No significant differences were observed between the two groups regarding body temperature (tramadol: 36.98 ± 0.10°C vs. pethidine: 37.10 ± 0.10°C, $p = 0.736$), blood pressure ($p > 0.05$), or heart rate (tramadol: 90.3 ± 9.8 vs. pethidine: 89.6 ± 15.3, $p = 0.814$). Similarly, as shown in Figs. 1 and 2, no significant difference was observed in oxygen saturation (SpO_2) (tramadol: 94.24 ± 0.34% vs. pethidine: 96.92 ± 0.37%, $p = 0.732$).

3.3. Comparison of post-treatment shivering characteristics in the two groups

Table 4 summarizes the shivering characteristics in the two groups. Dizziness differed significantly between the tramadol group (4 patients, 16%) and the pethidine group (2 patients, 8%) ($P = 0.0005$). Similarly, nausea and vomiting were significantly more frequent in the tramadol group (5 patients, 20%) compared to the pethidine group (2 patients, 8%) ($P = 0.012$). Furthermore, as shown in Fig. 3, a statistically significant difference was observed only in nausea: 12 patients (48%) in the tramadol group and 5 patients (20%) in the pethidine group ($P = 0.0002$).

3.4. Physicians' satisfaction

Fig. 4 shows physicians' satisfaction with the use of tramadol and pethidine for the treatment of postoperative shivering. In a survey of more than 50 physicians, satisfaction with pethidine was 64% compared to 26% for tramadol, a statistically significant difference between the two groups ($p = 0.002$).

3.5. Correlation between time of onset and vital signs

Fig. 5 shows the correlation between time of onset and body temperature, systolic blood pressure,

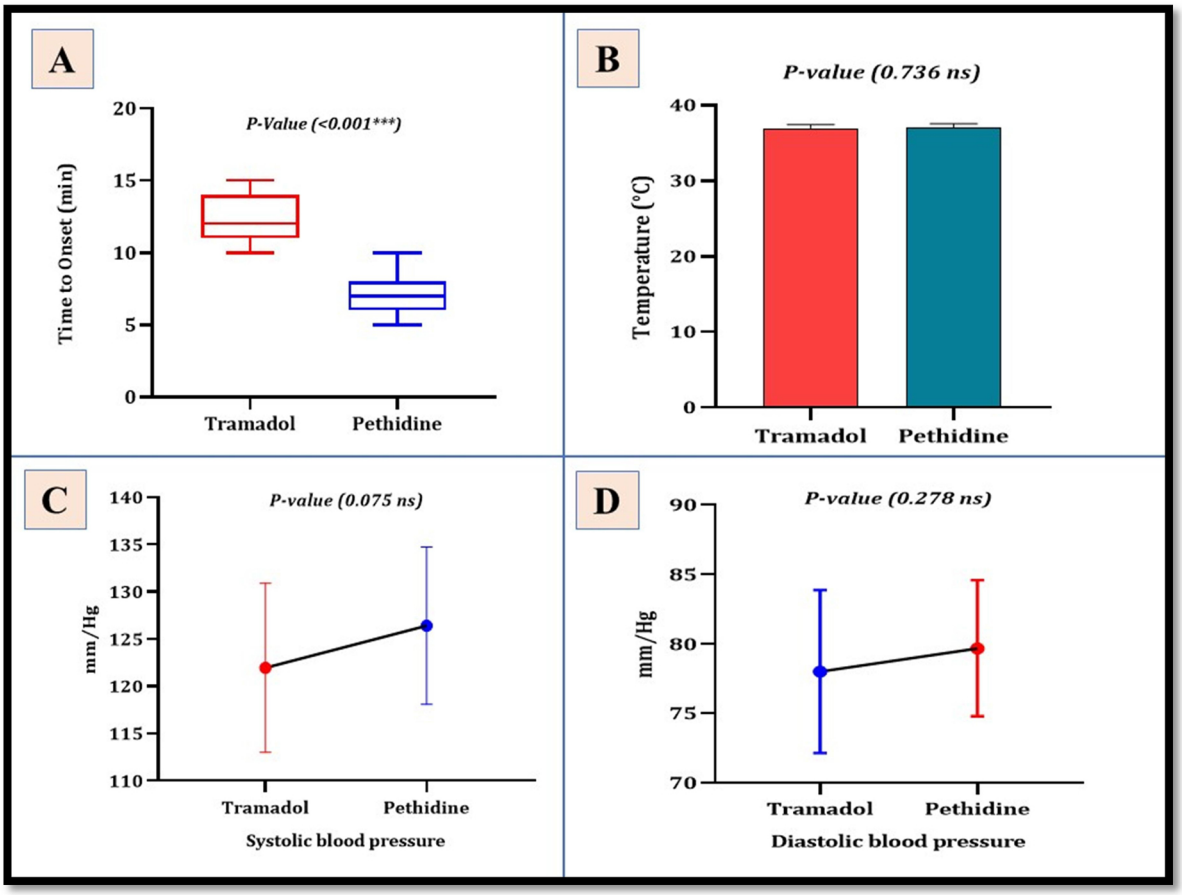

Fig. 1. Comparison of tramadol and pethidine groups: [A] time to onset, [B] temperature, [C] systolic BP, [D] diastolic BP.

diastolic blood pressure, and blood oxygen saturation (SpO_2). Statistical analysis revealed no statistically significant correlation between time of symptom onset and body temperature, systolic blood pressure, or diastolic blood pressure ($R = 0.058$, $P = 0.691$; $R = -0.264$, $P = 0.064$; $R = -0.168$, $P = 0.123$, respectively). However, a positive correlation was found between time of symptom onset and SpO_2 ($R = 0.362$, $P = 0.098$), as shown in Fig. 5[D].

4. Discussion

Postoperative shivering is a common and undesirable complication of general and spinal anesthesia. However, its precise etiology remains unclear, and there are currently no standard recommendations for prevention or treatment [1]. Pharmacological intervention remains the cornerstone of shivering management, with pethidine and tramadol being the most commonly used medications. Tramadol is generally considered less depressant and sedative than pethidine [20].

This study compared the efficacy of intravenous tramadol (0.5 mg/kg) and pethidine (0.5 mg/kg) in patients undergoing elective surgery under spinal anesthesia. Both medications effectively suppressed shivering. The anti-shivering effect of pethidine is primarily mediated by activation of μ- and κ-opioid receptors, which play an important role in thermoregulation [21]. This explains the superiority of pethidine over other μ-opioid agonists such as morphine, fentanyl, and sufentanil [22]. Furthermore, pethidine may act directly on the thermoregulatory center [23]. In contrast, tramadol exhibits weak μ-opioid activity, but its anti-shivering effects are thought to be mediated by the serotonin and norepinephrine pathways. Specifically, the R(+) enantiomer reduces 5-HT_3 reuptake and promotes serotonin release, while the L(–) enantiomer inhibits norepinephrine reuptake, and these two elements together promote the activation of descending inhibitory pathways [23, 24].

Hemodynamic parameters were generally similar in both groups, but the tramadol group had a significantly higher heart rate after treatment, likely reflecting inhibition of adrenaline reuptake [25].

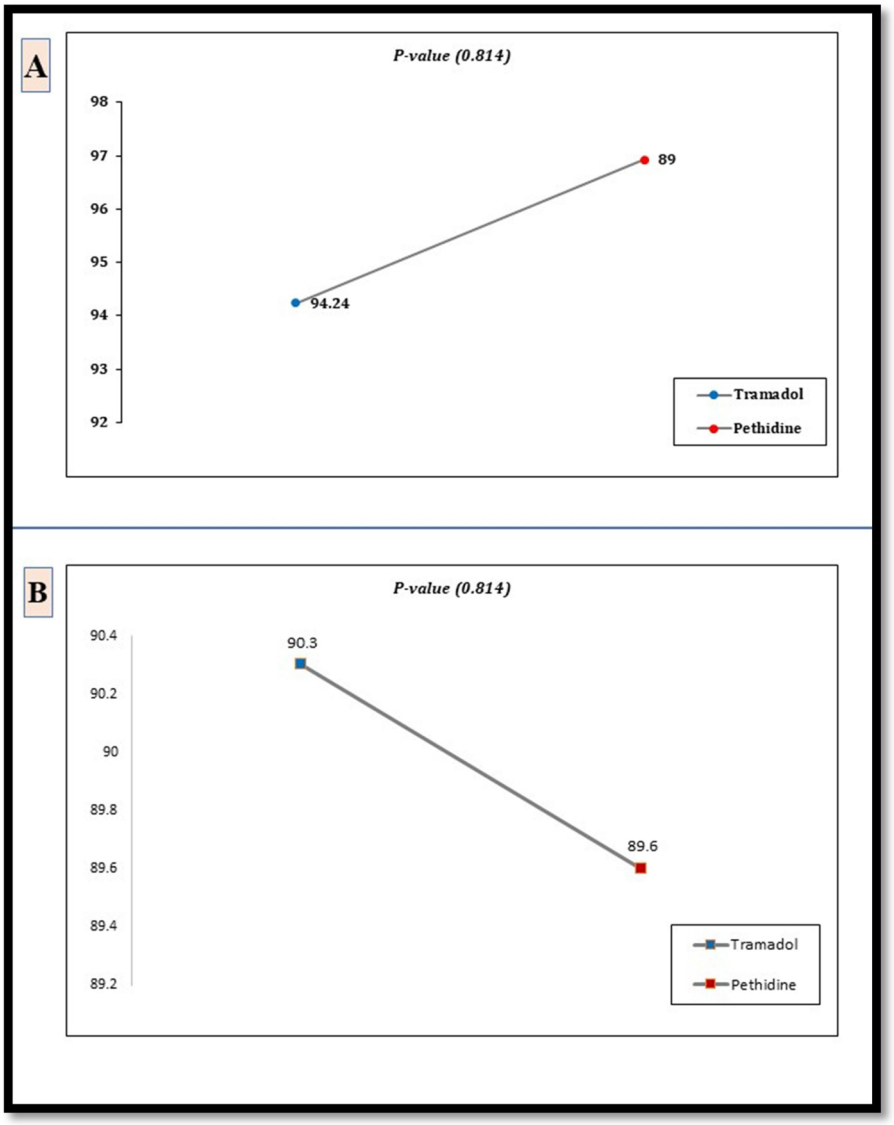

Fig. 2. Comparison of tramadol and pethidine groups: [A] Spo_2, and [B] HR.

Table 4. Comparison of shivering characteristics after treatment between the two groups.

Side effects	Tramadol group	Pethidine group	P-value
Dizziness. No (%)	4 (16)	2 (8)	0.0005**
Nausea and vomiting	5 (20)	2 (8)	0.012*
Nausea only	12 (48)	5 (20)	0.0002**

The mean shivering cessation time was significantly shorter with pethidine (7.16 ± 0.281 min) than with tramadol (12.20 ± 0.35 min) ($p < 0.001$). These results are consistent with previous reports [26–28], including a recent Ethiopian cohort study [23]. In contrast, Wan J-X et al. [29] and Manouchehrian N et al. [30] reported superior efficacy of tramadol compared to pethidine and highlighted potential variability related to methodological differences such as assessment intervals and patient populations.

Regarding side effects, pethidine had a higher incidence of sedation (10%) than tramadol (2.2%), which is consistent with the Ethiopian study [23] but contradicts the results of Wang N et al. [22]. Meanwhile, nausea and vomiting were significantly more frequent with tramadol (20%) than with pethidine (8%) ($p < 0.05$). This may be due to the direct effect of tramadol on the chemoreceptor trigger zone via activation of μ-opioid receptors. However, previous studies have also reported that pethidine can cause similar side effects, such as nausea, vomiting, and respiratory depression [30].

Consistent with Mamo M. et al. [26], no significant correlation was observed between onset of action, body temperature, or blood pressure. However, a positive correlation was observed between onset of action and SpO_2, which may reflect faster tremor suppression in the pethidine group and support the

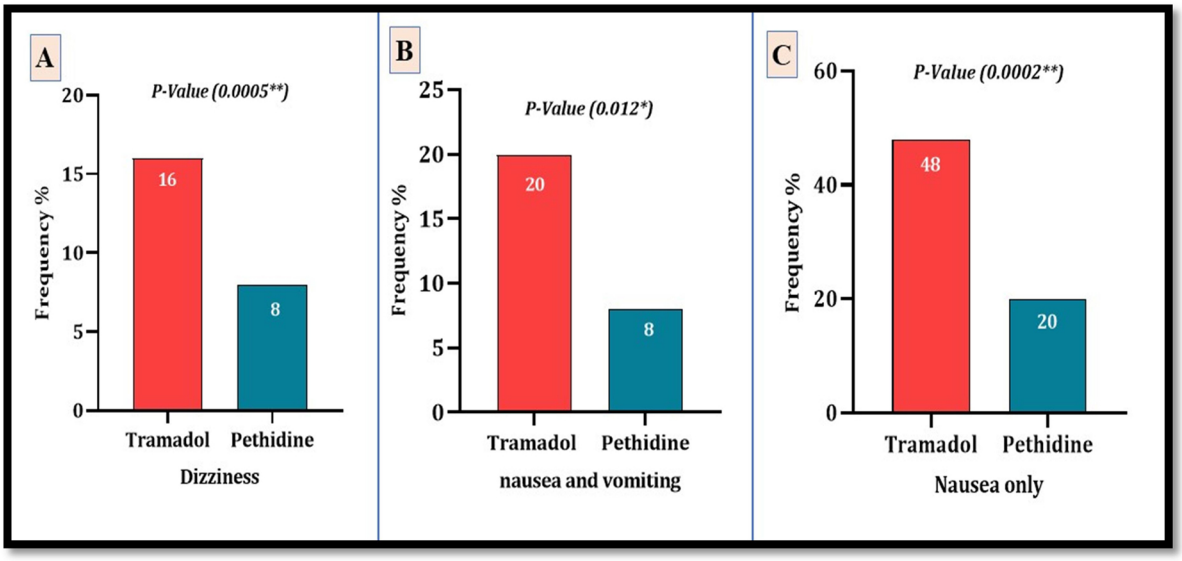

Fig. 3. Comparison of tramadol and pethidine groups regarding to side effects [A] dizziness, [B] nausea and vomiting, and [C] nausea only.

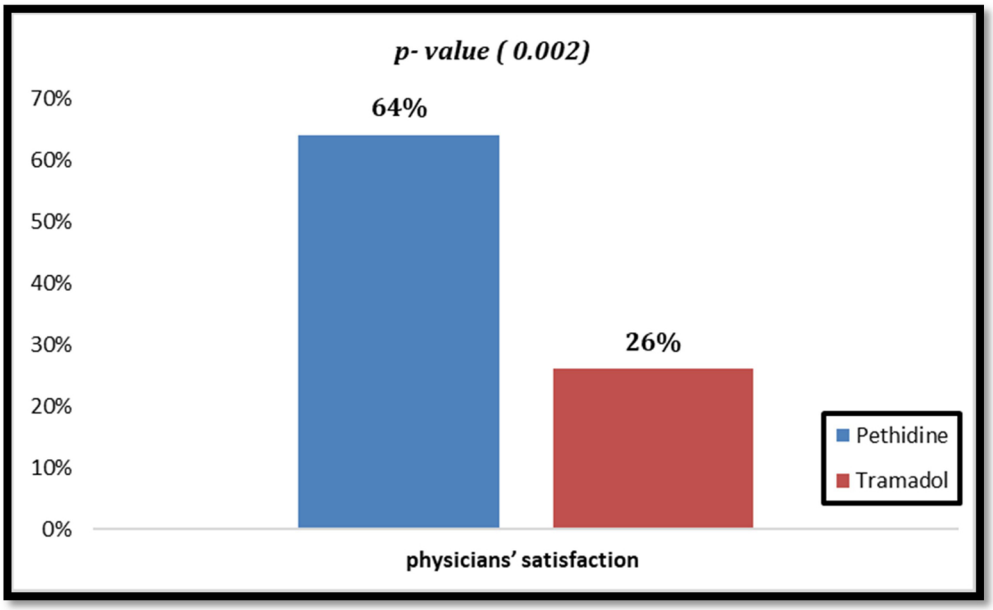

Fig. 4. Physicians' satisfaction with the use of tramadol and pethidine in the treatment of shivering.

hypothesis of Khalil R.Y. et al. [31]. It is important to note that physicians reported greater satisfaction with pethidine than with tramadol, likely due to a faster onset of action. This observation is consistent with Ambika B.A. [32], but should be interpreted with caution, as physician satisfaction is inherently subjective and may be influenced by clinical experience and established efficacy profiles.

Overall, our results confirm the superior antitremor efficacy of pethidine compared to tramadol, but at the cost of greater sedation and a higher incidence of nausea and vomiting with tramadol. These findings highlight the need for personalized drug selection based on the patient's risk profile, expected side effects, and physician preferences.

5. Conclusion

Both tramadol and pethidine were effective in suppressing postoperative shivering, and no significant difference was observed in terms of hemodynamic stability. However, intravenous pethidine (0.5 mg/kg, IV) demonstrated significant clinical advantages over tramadol (0.5 mg/kg, IV), including

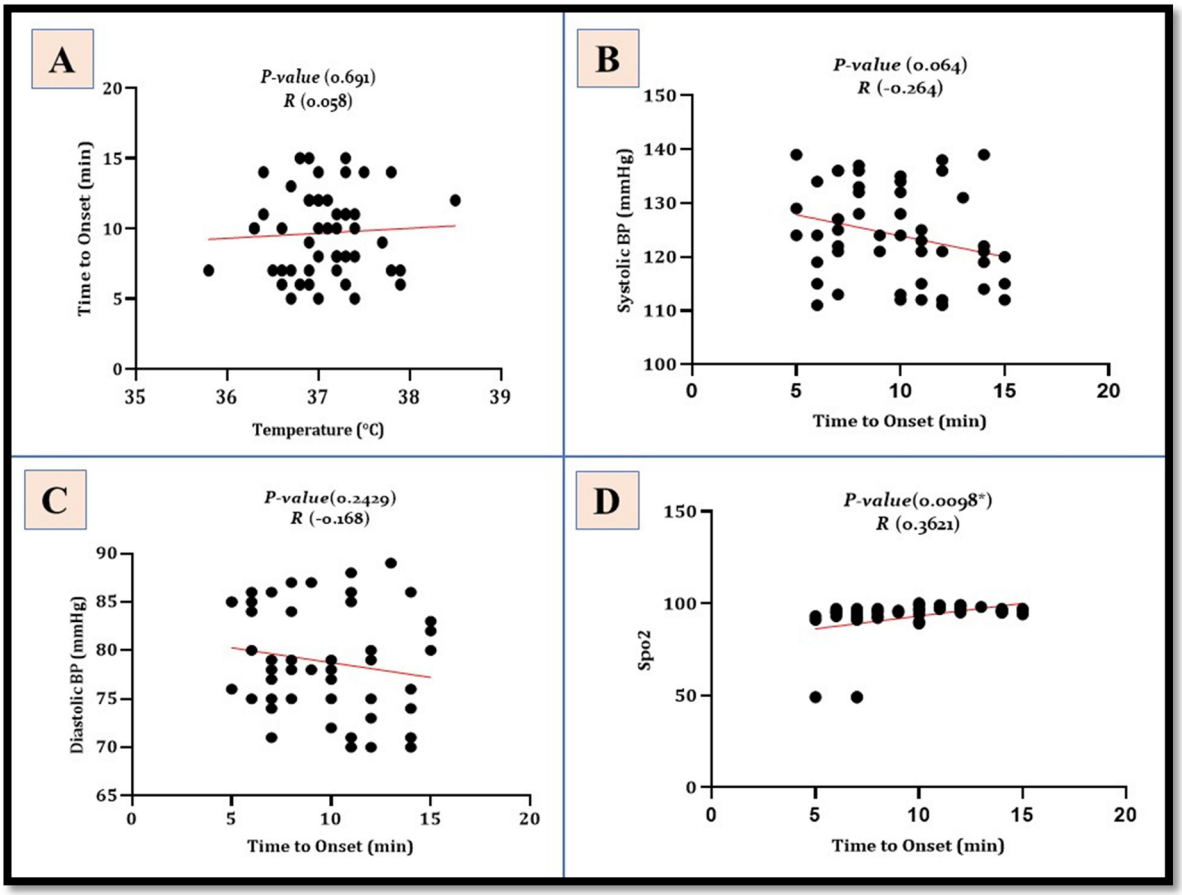

Fig. 5. Correlation between time to onset with [A] temperature, [B] systolic pressure, [C] diastolic pressure, and [D] SpO_2.

a faster onset of action, a lower relapse rate, and fewer sedative side effects. Furthermore, physicians' satisfaction was significantly higher in the pethidine group, highlighting the overall efficacy and clinical benefit of pethidine in the management of postoperative shivering.

6. Recommendations

Pethidine (0.5 mg/kg, IV) is recommended as the drug of choice for postoperative shivering due to its rapid onset of action and reduced side effects. However, in patients with contraindications to pethidine use, tramadol (0.5 mg/kg, IV) may be considered, subject to close monitoring for side effects.

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Al-Ayen Iraqi University (Date: 15 March 2025 / No.: UB-EC-2025-014).

Data availability

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Funding declaration

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Author contribution

Ahmed Jaber Ibrahim conceived and designed the study, performed data interpretation, and drafted the manuscript. Hussien Ibrahim Hayal contributed to patient recruitment, data collection, and laboratory analysis. Ahmed R.Y. Al-Sawad carried out statistical analysis and assisted in data interpretation. Shahab Abdulla contributed to literature review, methodological support, and manuscript revision. Ralela Makline provided critical revision of the manuscript for important intellectual content and supervised the overall project. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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References

1. Lopez MB. Postanaesthetic shivering–from pathophysiology to prevention. *Romanian journal of anaesthesia and intensive care*. 2018;25(1):73.
2. Leslie K, Sessler DI. Reduction in the shivering threshold is proportional to spinal block height. *Anesthesiology*. 1996;84(6):1327–31.
3. Tu Q, Zhou R, Wan Z, Chen S, Yang Q, Que B. Perioperative administration of dexamethasone to prevent postoperative shivering: A systematic review and meta-analysis of randomized controlled trials. *Journal of International Medical Research*. 2023;51(8):03000605231187805.
4. Meigal A, Gerasimova-Meigal L. Cold for gravity, heat for microgravity: A critical analysis of the "Baby Astronaut" concept. *Frontiers in Space Technologies*. 2022;3:981668.
5. Fogel ST. Anesthesia and analgesia in pregnancy. *In Clinical Maternal-Fetal Medicine: CRC Press*; 2021. p. 33.1–.16.
6. Afzal M, Lee A, Asad M, Ali A, Farrukh AM, Semakieh B, *et al.* The effect of intrathecal pethidine on post-spinal anesthesia shivering after cesarean section: A systematic review and meta-analysis. *Annals of Medicine and Surgery*. 2024;86(9):5461–70.
7. Obilo CS, Ewah RL, Ugoji D-PC. Comparison of prophylactic diclofenac sodium suppository with intravenous tramadol in the pre-vention of post-spinal anaesthesia shivering in parturients undergoing caesarean section. *African Journal of Health and Social Sciences*. 2024;1(1):19–28.
8. Althomali RH, Abbood MK, Altalbawy FM, Saleh EAM, Abdullaev SS, Jaber Ibrahim A, *et al.* A novel nanomagnetic palladium(II) complex of bisimidazolium-based N-heterocyclic carbene: an efficient heterogeneous catalyst for A3 coupling reactions. *J Mol Struct*. 2023;1290:135911.
9. Ibrahim AJ. Adsorption behavior of crystal violet dye in aqueous solution using Co + 2 hectorite composite as adsorbent surface. *Anal Methods Environ Chem J*. 2023;6(1):5–16.
10. Ibrahim AJ, Dwesh HAW, Al-Sawad AR. Adsorption of methylene blue dye onto bentonite clay: Characterization, adsorption isotherms, and thermodynamics study by using UV-Vis technique. *Anal Methods Environ Chem J*. 2023;6(3):5–18.
11. Sayed BT, Al-Sakhnini MM, Alzubaidi AA, Alawadi AH, Ibrahim AJ, Askar S. Assessment of nano-imprinting process in CuZr amorphous films through combination of machine learning and molecular dynamics. *J Electron Mater*. 2023;52(10):6943–58.
12. Al-Hawary SIS, Saleh EAM, Mamajanov NA, Gilmanova NS, Alsaab HO, Alghamdi A, *et al.* Breast cancer vaccines: A comprehensive and updated review. *Pathol Res Pract*. 2023;249:154735.
13. Al-Hawary SIS, Tayyib NA, Ramaiah P, Parra RMR, Jaber Ibrahim A, Mustafa YF, *et al.* Functions of LncRNAs, exosomes derived MSCs and immune regulatory molecules in preeclampsia disease. *Pathol Res Pract*. 2023;250:154795.
14. Amirinejad N, Shekarchizadeh A, Mousavi M, Behzadi MA, Hassanshahian M, Ataie SA, *et al.* Structural characterization of biosurfactant produced by marine bacterium Pseudomonas fragi strain F1 (isolated from Persian Gulf) and evaluation of antimicrobial and antibiofilm activity. *Preprint*. 2023.
15. Jaber Ibrahim A, Naser J, Taiyh E, Hassan Z, Mohammed J. Removal and determination of Malachite Green dye using nanofiber membranes and UV-Vis spectrophotometer. *Anal Methods Environ Chem J*. 2025;8(2):26–43.
16. Margiana R, Gupta R, Al-Jewari WM, Hjazi A, Alsaab HO, Mustafa YF, *et al.* Evaluation of telomere length, reactive oxygen species, and apoptosis in spermatozoa of patients with oligospermia. *Cell Biochem Funct*. 2024;42(2): e3935.
17. Ibrahim AJ. The determination and evaluation of trace elements in the blood of radiography workers using graphite furnace atomic absorption spectrometry. *Anal Methods Environ Chem J*. 2024;7(1):76–85.
18. Arwa HAS. Evaluation of some heart enzymes and iron levels in β-thalassemia patients in Thi-Qar City, Iraq. *Baghdad Sci J*. 2024;21:2007–16.
19. Al-Saeed AH. Evaluation of oxidative status, potassium, magnesium, and lipid profile in serum of patients with β-thalassemia major, Thi-Qar, Iraq. *Maaen J Med Sci*. 2023;2(3):108–15.
20. Siddique SS, Arif A, Farooq U, Iffat S, Moin S, Siddique R, *et al.* Comparison of efficacy of intravenous tramadol and intravenous dexmedetomidine on post-spinal anesthesia shivering in caesarean section: Efficacy of tramadol vs dexmedetomidine in post-spinal shivering. *Journal of Health and Rehabilitation Research*. 2024;4(3):1–4.
21. KamailPour H, AvestiMehr S. A comparative study on the effect of tramadol and pethidine on postoperative shivering. *Anaesthesia, Pain & Intensive Care*. 2019.
22. Wang N, Wang R, Chen Y, Zhang W, Wang J. Pethidine versus tramadol for shivering treatment after spinal anaesthesia: a meta-analysis of randomized controlled trials. *Indian Journal of Surgery*. 2021:1–6.
23. Tilahun A, Seifu A, Aregawi A, Abera B, Demsie D. Effectiveness of meperidine versus tramadol on post spinal anesthesia shivering in elective cesarean section: A prospective observational cohort study. International Journal of Surgery Open. 2021;28:22–6.
24. Munday J, Delaforce A, Heidke P, Rademakers S, Sturgess D, Williams J, *et al.* Perioperative temperature monitoring for patient safety: A period prevalence study of five hospitals. *International Journal of Nursing Studies*. 2023;143:104508.

25. Amsalu H, Zemedkun A, Regasa T, Adamu Y. Evidence-based guideline on prevention and management of shivering after spinal anesthesia in resource-limited settings. *International Journal of General Medicine*. 2022;15:6985.
26. Mamo M, Zema Z, Abera W, Tila M, Darma B, Suileman M, *et al.* Effect of intravenous tramadol versus pethidine on postspinal shivering control among mothers during cesarean section at Wolaita Sodo University comprehensive specialized hospital, Southern Ethiopia: a prospective observational cohort study. *Annals of Medicine and Surgery*. 2023;85(6):2324–9.
27. Thomas S, Pradhan A, Chauhan D. A randomised clinical trial to compare the efficacy of tramadol and nalbuphine for treatment of shivering after spinal anaesthesia in patients posted for lower limb orthopaedic surgery. *Journal of Clinical & Diagnostic Research*. 2021;15(5).
28. Al Maruf A, Islam MS, Hoq N. Effect of tramadol and pethidine on shivering during cesarean section under spinal anaesthesia. *Journal of Armed Forces Medical College, Bangladesh*. 2014;10(2):27–32.
29. Wan J-X, Li X-C, Zeng S-S, Li Y-Q, Wang F-J. Comparison of intravenous butorphanol vs. Tramadol for post-spinal anesthesia shivering: a meta-analysis and systematic review. *Frontiers in Medicine*. 2023;10:1271664.
30. Manouchehrian N, Mohammadian A, Jahromi MSS, Sanatkar M. A comparison of the therapeutic effect of tramadol and meperidine for treatment of shivering after spinal anesthesia in elective caesarean section. *Archives of Anesthesiology and Critical Care*. 2015;1(2):50–4.
31. Khalil RY, Faraj GK. A comparison of tramadol and pethidine analgesia on the duration of labour. *Disease and Diagnosis*. 2021;10(1):1–6.
32. Ambika B. A Comparative Study to Assess the Efficacy and Safety of Tramadol, Pentazocine and their Combination with Piroxicam in Post Cesarean Pain Man: Rajiv Gandhi University of Health Sciences (India); 2017.