e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(8); 763-768

Original Research Article

Beyond Antiemesis: Intravenous Ondansetron as a Haemodynamic Stabilizer During Spinal Anaesthesia — A Randomized Double-Blinded Study

Adepu Srinivas[1], M. Shankar[2], Saranya Devi Datla[3]

[1]Assistant Professor, department of Anaesthesiology, Government Medical College, Jagtial, Telangana, India

[2]Assistant Professor, department of Anaesthesiology, Government Medical College, Wanaparthy, Telangana, India

[3]Associate Professor, department of Anesthesia, Konaseema Institute of Medical Sciences and Research Foundation, Amalapuram, Andhra Pradesh, India

Received: 07-06-2026 / Revised: 08-07-2026 / Accepted: 10-08-2026

Corresponding Author: Dr. Saranya Devi Datla

Conflict of interest: Nil

Abstract:

Background: Spinal anaesthesia (SA) is commonly associated with hypotension and bradycardia due to sympathetic blockade, reduced venous return and activation of cardioinhibitory reflexes. Ondansetron, a 5-HT3 receptor antagonist, may attenuate these haemodynamic changes.

Aim: To evaluate the effect of prophylactic intravenous ondansetron on SA-induced hypotension and bradycardia.

Methods: This prospective randomized double-blinded study was conducted at KIMS, Amalapuram, from November 2025 to May 2026. A total of 100 patients undergoing elective surgery under SA were enrolled and divided into two groups of 50 each. Group O received intravenous ondansetron before SA, while Group C received normal saline placebo. Haemodynamic parameters, incidence of hypotension and bradycardia, vasopressor requirement, atropine requirement and adverse events were recorded and compared.

Results: Both groups were comparable in baseline characteristics. Hypotension was significantly lower in the ondansetron group compared with placebo, 26% versus 54%. Bradycardia was also lower in the ondansetron group, 10% versus 28%. Ondansetron significantly reduced vasopressor requirement, atropine requirement and nausea/vomiting. Mean arterial pressure was better maintained after SA in the ondansetron group.

Conclusion: Prophylactic intravenous ondansetron improved haemodynamic stability and reduced hypotension and bradycardia following SA.

Keywords: Ondansetron; Spinal anaesthesia; Hypotension; Bradycardia; Vasopressor.

DOI: 10.25258/ijcpr.18.8.117

Introduction

Spinal anaesthesia (SA) is widely used for lower abdominal, pelvic, obstetric and lower limb surgeries because it provides rapid, reliable anaesthesia with good postoperative analgesia. However, SA-induced hypotension and bradycardia remain important perioperative concerns due to sympathetic blockade, reduced venous return and activation of the Bezold–Jarisch reflex [1]. These haemodynamic changes may lead to nausea, vomiting, dizziness, reduced organ perfusion, increased vasopressor requirement and, in obstetric patients, possible uteroplacental perfusion compromise [2]. Ondansetron, a selective 5-hydroxytryptamine-3 receptor antagonist, is commonly used as an antiemetic, but it may also attenuate SA-induced hypotension and bradycardia by inhibiting serotonin-mediated cardiac vagal reflexes [3, 4]. Recent randomized trials and meta-analyses have reported mixed but clinically relevant findings: some studies showed improved haemodynamic stability and reduced vasopressor requirement, whereas others found no significant preventive effect, indicating the need for further well-designed randomized double-blinded studies [4]. The present study was therefore planned to evaluate the effect of prophylactic intravenous ondansetron on the incidence and severity of SA-induced hypotension and bradycardia. The aim of this study was to compare haemodynamic outcomes, vasopressor requirement and adverse effects between patients receiving intravenous ondansetron and those receiving placebo before SA.

Methods

The present study was conducted as a prospective, randomized, double-blinded study in the Department of Anaesthesiology, KIMS, Amalapuram, from November 2025 to May 2026. Patients posted for elective surgeries under SA were screened for eligibility after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrolment. Adult patients of either-gender belonging to ASA physical status I and II, who were scheduled to undergo lower abdominal, lower limb or pelvic surgeries under subarachnoid block were included in the study. Patients with refusal for SA, known allergy to ondansetron or local anaesthetic drugs, significant cardiovascular disease, baseline hypotension or bradycardia, conduction abnormalities, severe hepatic or renal disease, pregnancy unless specifically included, coagulopathy, local infection at the puncture site, chronic use of beta blockers or antiarrhythmic drugs, and those requiring conversion to general anaesthesia were excluded from the study.

Eligible patients were randomly allocated into two groups using a computer-generated randomization sequence. Group O received intravenous ondansetron before administration of SA, while Group C received an equal volume of normal saline as placebo. The study drug was prepared by an anaesthesiologist who was not involved in patient management or outcome assessment. The patient, attending anaesthesiologist, data collector and statistician were blinded to the group allocation. On arrival in the operating room, standard monitoring was applied, including non-invasive blood pressure, electrocardiography and pulse oximetry. Baseline heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure, mean arterial pressure (MAP) and oxygen saturation were recorded. An intravenous line was secured, and patients received preloading or coloading with crystalloid solution as per institutional protocol. The study drug was administered intravenously approximately five minutes before SA. Subarachnoid block was performed under strict aseptic precautions in the sitting or lateral position at the L3–L4 or L4–L5 interspace using a spinal needle. Hyperbaric bupivacaine was injected after free flow of cerebrospinal fluid was confirmed. Patients were then positioned supine, and the sensory level of block was assessed.

Haemodynamic parameters were recorded at baseline, immediately after SA and at regular intervals intraoperatively until completion of surgery. The primary outcome was the incidence of SA-induced hypotension. Hypotension was defined as a fall in SBP of more than 20% from baseline or SBP less than 90 mmHg. Bradycardia was defined as HR less than 60 beats per minute or a fall of more than 20% from baseline. Hypotension was treated with intravenous fluids and vasopressors such as mephentermine or phenylephrine according to institutional practice. Bradycardia was treated with intravenous atropine when clinically indicated. Secondary outcomes included number of hypotensive episodes, incidence of bradycardia, total vasopressor requirement, atropine requirement, nausea, vomiting, shivering and other adverse events. Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and percentage. Intergroup comparison was performed using independent t-test or Mann–Whitney U test for continuous variables and Chi-square test or Fisher's exact test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

The present randomized double-blinded study included 100 patients undergoing surgery under SA, with 50 patients each in the ondansetron and placebo groups. Both groups were comparable with respect to age, gender distribution, body weight, ASA physical status, duration of surgery, baseline HR and baseline MAP, with no statistically significant difference between the groups (Table 1). The incidence of SA-induced hypotension was significantly lower in the ondansetron group compared with the placebo group, 26% versus 54%, respectively (Table 2). Bradycardia was also less frequent among patients who received ondansetron, occurring in 10% compared with 28% in the placebo group (Table 2). The need for atropine was significantly reduced in the ondansetron group (Table 2). Intraoperative haemodynamic monitoring showed that MAP was better maintained in the ondansetron group at 5, 10, 15 and 30 minutes after SA (Table 3). The placebo group showed a greater fall in MAP during the early post-spinal period (Table 3). Vasopressor requirement was significantly lower in the ondansetron group, with fewer patients requiring rescue vasopressor therapy (Table 4). The mean number of hypotensive episodes and total mephentermine dose were also significantly reduced in the ondansetron group (Table 4). Nausea and vomiting were less common among patients receiving ondansetron, while the incidence of shivering was comparable between the groups (Table 2). Overall, prophylactic intravenous ondansetron was associated with better haemodynamic stability, reduced hypotension, reduced bradycardia and lower vasopressor requirement following SA.

Table 1: Demographic and baseline characteristics among the study members			
Variable	**Group O**	**Group C**	**p-value**
Age (years)*	42.6 ± 11.8	43.9 ± 12.4	0.59
Male/Female	28/22	26/24	0.69
Weight (kg)*	64.8 ± 8.9	65.5 ± 9.4	0.7
ASA I/II	32/18	30/20	0.67
Duration of surgery (min)*	72.4 ± 18.6	75.1 ± 19.2	0.47
Baseline HR**	78.6 ± 9.4	79.8 ± 10.1	0.54
Baseline MAP (mmHg)*	92.8 ± 8.6	93.5 ± 9.1	0.69
*Mean ± SD; **beats/min, Mean ± SD			

Table 2: Incidence of hypotension and bradycardia			
Parameter	**Group O**	**Group C**	**p-value**
Hypotension	13 (26%)	27 (54%)	0.004
Bradycardia	5 (10%)	14 (28%)	0.022
Nausea/Vomiting	4 (8%)	13 (26%)	0.016
Shivering	6 (12%)	8 (16%)	0.56
Atropine requirement	4 (8%)	12 (24%)	0.029

Table 3: Intraoperative haemodynamic changes; MAP in Mean ± SD			
Time interval	**Group O**	**Group C**	**p-value**
Baseline	92.8 ± 8.6	93.5 ± 9.1	0.69
5 min after spinal	86.4 ± 7.8	79.2 ± 8.5	<0.001
10 min after spinal	84.8 ± 8.2	76.6 ± 9.3	<0.001
15 min after spinal	86.1 ± 7.9	78.8 ± 8.7	<0.001
30 min after spinal	88.5 ± 8.1	83.2 ± 8.4	0.002

Table 4: Vasopressor requirement and treatment outcomes			
Variable	**Group O**	**Group C**	**p-value**
Patients requiring vasopressor	12 (24%)	26 (52%)	0.004
Hypotensive episodes*	0.5 ± 0.8	1.4 ± 1.1	<0.001
Total mephentermine dose (mg)*	3.2 ± 4.6	8.6 ± 6.8	<0.001
Total IV fluid used (mL)*	782 ± 146	864 ± 172	0.011
Recovery uneventful	49 (98%)	47 (94%)	0.31
*Mean ± SD			

Discussion

SA is a reliable and widely used technique for lower abdominal, lower limb, pelvic and obstetric procedures, but hypotension and bradycardia remain common clinically important adverse events. In the present randomized double-blinded study, prophylactic intravenous ondansetron was associated with a significantly lower incidence of SA-induced hypotension compared with placebo. Hypotension occurred in 26% of patients receiving ondansetron and 54% of patients receiving placebo, indicating a clinically meaningful reduction in haemodynamic instability. This finding is consistent with the proposed role of ondansetron as a 5-hydroxytryptamine-3 receptor antagonist capable of attenuating serotonin-mediated cardioinhibitory reflexes after SA. Spinal blockade produces sympathetic denervation, venous pooling, reduced preload and decreased systemic vascular resistance. In susceptible patients, reduced ventricular filling may activate the Bezold–Jarisch reflex, producing paradoxical bradycardia, vasodilatation and hypotension. Recent reviews have emphasized that SA-induced hypotension is multifactorial and remains particularly relevant in elderly, obstetric and high-risk surgical populations [5, 6]. Therefore, an intervention that reduces both hypotension and bradycardia without major adverse effects has practical anaesthetic relevance. The present findings support the concept that ondansetron may be useful not only as an antiemetic but also as an adjunct for maintaining haemodynamic stability after SA.

The reduction in hypotension observed in the ondansetron group was comparable to findings reported by Mendonça et al., who studied non-obstetric surgical patients and found that 8 mg intravenous ondansetron significantly reduced SA-induced hypotension compared with placebo. In that randomized double-blind trial, hypotension occurred in 27.8% of patients in the ondansetron group compared with 50% in the placebo group, which closely resembles the pattern observed in the present study [4]. Similarly, Hou et al. reported in a systematic review and meta-analysis that

ondansetron significantly reduced the incidence of hypotension, bradycardia and vasopressor requirement after SA, although they also noted moderate evidence quality and heterogeneity among studies [3]. Tubog et al. also observed a beneficial effect of prophylactic ondansetron in non-caesarean SA populations, suggesting that its haemodynamic effect may not be restricted only to obstetric anaesthesia [7]. These findings strengthen the external validity of the present study because our population included patients undergoing surgeries under SA in a general clinical setting. However, variation in dose, timing of administration, local anaesthetic dose, block height, fluid strategy and vasopressor protocol may influence the magnitude of benefit. Thus, while the present study supports the beneficial role of ondansetron, it should be interpreted as part of a broader multimodal haemodynamic strategy rather than as a stand-alone substitute for vigilant monitoring and prompt vasopressor therapy.

In the present study, bradycardia was significantly lower in the ondansetron group, occurring in 10% of patients compared with 28% in the placebo group. This finding is important because bradycardia after SA may represent more than a simple fall in HR; it may be an early sign of profound vagal activation, reduced venous return and impending cardiovascular collapse in vulnerable patients. The lower atropine requirement in the ondansetron group further supports a clinically relevant cardio-stabilizing effect. The mechanism is biologically plausible because serotonin acting on cardiac 5-HT3 receptors has been implicated in activation of vagal afferent pathways involved in the Bezold–Jarisch reflex. By blocking these receptors, ondansetron may reduce reflex-mediated bradycardia and hypotension. Heesen et al. previously reported that prophylactic 5-HT3 receptor antagonists reduced the risk of hypotension after SA, supporting this mechanistic rationale [8]. Gao et al. also concluded that prophylactic ondansetron reduced hypotension, vasopressor consumption, bradycardia, nausea and vomiting in obstetric and non-obstetric patients [9]. Nevertheless, not all studies have demonstrated a consistent HR benefit. Mendonça et al. found a reduction in hypotension and ephedrine requirement but did not observe a significant difference in HR variations [4]. This suggests that ondansetron's principal effect may be stronger on vascular tone and vasopressor requirement than on HR in some settings, depending on patient age, baseline autonomic tone and level of sympathetic block.

The present study also demonstrated better preservation of MAP in the ondansetron group at 5, 10, 15 and 30 minutes after SA. The early post-spinal period is critical because the most prominent fall in blood pressure usually occurs soon after sympathetic blockade becomes established. Better maintenance of MAP in the ondansetron group indicates that ondansetron may blunt the depth of early haemodynamic decline. The significantly lower vasopressor requirement and fewer hypotensive episodes in the ondansetron group further support this interpretation. Similar findings were reported by Xiao et al., who observed that ondansetron reduced the effective dose requirement of phenylephrine infusion for preventing hypotension during caesarean delivery [10]. Sheng et al. further quantified this interaction and showed that ondansetron reduced norepinephrine infusion dose requirements during SA for caesarean section [11]. These studies indicate that ondansetron may have a vasopressor-sparing effect when used as part of prophylactic haemodynamic management. In the present study, total mephentermine requirement was significantly lower among patients receiving ondansetron, which is consistent with this vasopressor-sparing concept. This is clinically useful because repeated vasopressor boluses may produce fluctuations in blood pressure and HR. Reducing vasopressor requirement may provide smoother intraoperative haemodynamics, although vasopressors remain the standard treatment once clinically significant hypotension occurs.

The beneficial effect of ondansetron on nausea and vomiting in the present study was expected but still clinically relevant. Nausea and vomiting after SA may occur due to hypotension, vagal stimulation, visceral traction, opioid use or patient-related factors. Since ondansetron is already widely used for prevention of perioperative nausea and vomiting, its additional haemodynamic benefit may make it a practical pre-spinal adjunct. In the present study, nausea and vomiting occurred less frequently in the ondansetron group than in the placebo group, while shivering was comparable. Some earlier studies have suggested that ondansetron may reduce post-spinal shivering, but this effect has been inconsistent. Zheng et al. reported that ondansetron was effective in preventing shivering during caesarean section under neuraxial anaesthesia [12], while other studies have not uniformly confirmed a strong anti-shivering effect. Recent obstetric studies also show mixed results regarding haemodynamic outcomes. Zhang et al. found that ondansetron helped prevent supine hypotensive syndrome during SA for caesarean section [2], and Qin et al. reported that prophylactic 4 mg or 8 mg ondansetron improved haemodynamic stability, with 8 mg showing a stronger effect on post-spinal hypotension [1]. In contrast, Karachanidi et al. found no significant preventive effect of two doses of ondansetron on maternal hypotension after SA with ropivacaine [13]. This disagreement highlights that ondansetron's effect may depend on patient population, intrathecal drug used, dose, timing, preload or coload practice and the definition of hypotension.

The present study adds to the growing evidence that intravenous ondansetron given before SA may reduce hypotension, bradycardia and vasopressor requirement, while also reducing nausea and vomiting. Its advantages include easy availability, familiar dosing, low cost and routine perioperative use. However, the findings should be interpreted with caution. The study was conducted at a single centre, and the sample size was moderate. The results may not be directly generalizable to high-risk cardiac patients, severe hypovolaemia, emergency surgery, obstetric patients or elderly patients with major autonomic dysfunction unless these groups are specifically studied. The study also used institutional protocols for fluid administration and vasopressor treatment, which may differ from other centres. Current evidence suggests that ondansetron should be considered an adjunct, not a replacement, for established preventive measures such as appropriate fluid coloading, left uterine displacement in obstetric patients, careful block height assessment and early vasopressor administration. Recent reviews on post-spinal hypotension emphasize that multimodal prevention is more effective than reliance on any single drug [14, 15]. Overall, the present findings are clinically meaningful and support the prophylactic use of intravenous ondansetron before SA to improve haemodynamic stability, particularly in patients at risk of early post-spinal hypotension and bradycardia.

Conclusion: The present randomized double-blinded study showed that prophylactic intravenous ondansetron before SA was associated with better haemodynamic stability. Patients receiving ondansetron had significantly lower incidence of hypotension and bradycardia compared with the placebo group. Ondansetron also reduced vasopressor requirement, atropine requirement and postoperative nausea and vomiting, while the incidence of shivering was comparable between groups. These findings suggest that ondansetron may be a useful adjunct for preventing SA-induced haemodynamic disturbances in patients undergoing elective surgeries. The study had certain limitations. It was conducted at a single centre with a relatively modest sample size, which may limit generalizability. Only short-term intraoperative haemodynamic outcomes were assessed. The study did not compare different doses of ondansetron or evaluate high-risk cardiac, elderly and emergency surgical patients separately. Fluid administration and vasopressor use were based on institutional protocol. Larger multicentric studies are required to confirm these findings.

References

1. Qin R, Xu X, Zhao N, Shi Y, Chen Y, Chen J, Ni X. Effect of different prophylactical doses of ondansetron for the hemodynamic stability in patients undergoing cesarean section: a randomized controlled study. Front Med (Lausanne). 2025; 12: 1495721.
2. Zhang Y, Xiao F, Zhang W. Intravenous ondansetron for the prevention of supine hypotensive syndrome during spinal anesthesia for cesarean section: a randomized controlled trial. Front Pharmacol. 2024; 15: 1194196.
3. Hou X-M, Chen Y-J, Lai L, Liu K, Shen Q-H. Ondansetron Reduces the Incidence of Hypotension after Spinal Anaesthesia: A Systematic Review and Meta-Analysis. Pharmaceuticals. 2022; 15(12):1588.
4. Mendonça FT, Crepaldi Junior LC, Gersanti RC, de Araújo KC. Effect of ondansetron on spinal anesthesia-induced hypotension in non-obstetric surgeries: a randomised, double-blind and placebo-controlled trial. Braz J Anesthesiol. 2021; 71(3): 233 – 40.
5. Ferré F, Martin C, Bosch L, Kurrek M, Lairez O, Minville V. Control of Spinal Anesthesia-Induced Hypotension in Adults. Local Reg Anesth. 2020; 13: 39 – 46.
6. Patel S, Ninave S. Postspinal Anesthesia Hypotension in Caesarean Delivery: A Narrative Review. Cureus. 2024; 16(4): e59232.
7. D Tubog T, S Bramble R. Ondansetron reduces the incidence of hypotension after spinal anaesthesia in non-caesarean delivery: A systematic review and meta-analysis. J Perioper Pract. 2022; 32(3): 29 – 40.
8. Heesen M, Klimek M, Hoeks SE, Rossaint R. Prevention of Spinal Anesthesia-Induced Hypotension During Cesarean Delivery by 5-Hydroxytryptamine-3 Receptor Antagonists: A Systematic Review and Meta-analysis and Meta-regression. Anesth Analg. 2016; 123(4): 977 – 88.
9. Gao L, Zheng G, Han J, Wang Y, Zheng J. Effects of prophylactic ondansetron on spinal anesthesia-induced hypotension: a meta-analysis. Int J Obstet Anesth. 2015; 24(4): 335 – 43.
10. Xiao F, Wei C, Chang X, Zhang Y, et al. A Prospective, Randomized, Double-Blinded Study of the Effect of Intravenous Ondansetron on the Effective Dose in 50% of Subjects of Prophylactic Phenylephrine Infusions for Preventing Spinal Anesthesia-Induced Hypotension During Cesarean Delivery. Anesth Analg. 2020; 131(2): 564 – 9.
11. Sheng ZM, Sun HQ, Mao JQ, Liu J, Liang G, Mei Z. Comparative dose-response study on the infusion of norepinephrine combined with intravenous ondansetron versus placebo for preventing hypotension during spinal anesthesia for cesarean section: a randomised controlled trial. Int J Surg. 2024; 110(2): 832 – 8.

12. Zheng G, Zhang J, Liu J, Chen C, Zhang L, Cao F. A meta-analysis of randomized controlled trials: efficiency and safety of ondansetron in preventing post-anesthesia shivering during cesarean section. Arch Gynecol Obstet. 2023; 307(1): 223 – 31.
13. Karachanidi S, Paraskeva A, Theodosopoulou P, Micha G, Staikou C. Effect of Ondansetron on Maternal Hypotension During Spinal Anesthesia with Ropivacaine for Cesarean Sections: A Randomized, Double-Blind Trial. Cureus. 2024; 16(7): e65073.
14. Chooi C, Cox JJ, Lumb RS, et al. Techniques for preventing hypotension during spinal anaesthesia for caesarean section. Cochrane Database Syst Rev. 2020; 7(7): CD002251.
15. Elsakka AI, Mostafa G, Mohamed MRA, Mahrous R, Abdelnasser A. Prevention of post-spinal anaesthesia hypotension in caesarean delivery using delayed supine positioning - A randomised controlled trial. Indian J Anaesth. 2024; 68(2): 153 – 8.