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Original Research Article

Comparative Analgesic Efficacy of Dexamethasone and Dexmedetomidine as Adjuvants to 0.2% Ropivacaine in Ultrasound-Guided Brachial Plexus Block

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Abstract

Background: Brachial plexus block provides effective perioperative analgesia for upper-limb surgery; however, the duration of analgesia following a single injection of local anaesthetic may be limited. Adjuvants such as dexamethasone and dexmedetomidine are used to prolong the duration of peripheral nerve blockade. The present study compared the postoperative analgesic effects of these two agents when added to 0.2% ropivacaine.

Aim: To compare dexamethasone and dexmedetomidine as adjuvants to 0.2% ropivacaine for postoperative analgesia in ultrasound-guided brachial plexus block.

Methods: A prospective, randomized, comparative study was conducted in 150 adult patients undergoing upper-limb surgery under ultrasound-guided brachial plexus block. Patients were randomly allocated into two equal groups of 75 each. One group received 0.2% ropivacaine with dexamethasone, while the other received 0.2% ropivacaine with dexmedetomidine. The primary outcome was time to first rescue analgesia. Secondary outcomes included total analgesic requirement during the first 24 hours and duration of sensory and motor blockade.

Results: The demographic characteristics were comparable between the two groups. The mean time to first rescue analgesia was 709.67 ± 18.47 minutes in the dexamethasone group and 910.20 ± 51.66 minutes in the dexmedetomidine group, with a statistically significant difference ($p<0.0001$). Total analgesic requirement during 24 hours was 1.23 ± 1.17 in the dexamethasone group and 0.40 ± 0.56 in the dexmedetomidine group ($p=0.004$). The mean duration of motor blockade was 635.47 ± 26.29 minutes and 827.47 ± 54.62 minutes, respectively ($p<0.0001$), while the mean duration of sensory blockade was 681.50 ± 27.19 minutes and 877.17 ± 52.85 minutes, respectively ($p<0.0001$).

Conclusion: Under the conditions of this study, dexmedetomidine provided a longer duration of postoperative analgesia and sensory and motor blockade than dexamethasone when used as an adjuvant to 0.2% ropivacaine in ultrasound-guided brachial plexus block. Dexmedetomidine was also associated with a lower requirement for postoperative rescue analgesia during the first 24 hours.

Keywords: Brachial Plexus Block; Dexamethasone; Dexmedetomidine; Ropivacaine; Postoperative Analgesia; Ultrasound Guidance; Regional Anaesthesia.

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Introduction

Brachial plexus block is a widely used regional anaesthetic technique for providing surgical anaesthesia and postoperative analgesia during upper-limb procedures. The technique offers several advantages over systemic analgesia, including effective pain relief, reduction in opioid requirements, better haemodynamic stability, and facilitation of early postoperative recovery. The introduction of ultrasound guidance has further improved the accuracy of brachial plexus blockade by allowing direct visualization of the plexus, needle advancement, and spread of local anaesthetic, thereby improving block quality and reducing the risk of complications [1]. Ropivacaine

is a long-acting amide local anaesthetic commonly used for peripheral nerve blocks because of its prolonged duration of action and relatively favourable safety profile. However, the duration of analgesia obtained with a single injection of local anaesthetic may be insufficient to provide adequate pain relief throughout the early postoperative period. Consequently, various adjuvants have been investigated to prolong the duration of sensory blockade and postoperative analgesia while reducing the requirement for rescue analgesics [2].

Dexamethasone is a potent synthetic glucocorticoid that has been extensively studied as an adjuvant to local anaesthetics in peripheral nerve blocks. The addition of dexamethasone has been associated with prolongation of sensory blockade and duration of postoperative analgesia. Several clinical trials and meta-analyses have demonstrated that perineural dexamethasone can significantly increase the duration of analgesia following brachial plexus blockade [3-6]. Although the precise mechanism responsible for its prolonged peripheral nerve block effect has not been completely established, several mechanisms involving modulation of inflammatory mediators, inhibition of nociceptive transmission, and effects on neural membrane activity have been proposed [3,5].

Dexmedetomidine is a highly selective α2-adrenergic receptor agonist that has emerged as another useful adjuvant in regional anaesthesia. It produces sedation and analgesia with minimal respiratory depression and has been investigated extensively when combined with local anaesthetic agents for peripheral nerve blocks. Perineural dexmedetomidine has been reported to prolong both sensory and motor blockade and delay the requirement for postoperative rescue analgesia [7,8]. Its analgesic effects may involve α2-adrenergic receptor-mediated modulation of nerve conduction as well as central and peripheral antinociceptive mechanisms [8].

The comparative efficacy of dexamethasone and dexmedetomidine as adjuvants remains an important area of interest. Both agents have demonstrated the ability to prolong the duration of brachial plexus blockade, but differences may exist in the duration of sensory and motor blockade, time to first rescue analgesia, total postoperative analgesic requirement, and adverse effects. Comparative studies and meta-analyses have therefore evaluated the relative effects of these two agents when administered with local anaesthetics for brachial plexus block [9,10].

The present study was undertaken to compare dexamethasone and dexmedetomidine as adjuvants to 0.2% ropivacaine in ultrasound-guided brachial plexus block. The study primarily assessed postoperative analgesia by evaluating the time to first rescue analgesia and total analgesic consumption during the first 24 hours. The duration of sensory and motor blockade was also assessed. By comparing these parameters between patients receiving dexamethasone and those receiving dexmedetomidine, the study aimed to evaluate the postoperative analgesic profile of the two adjuvants when used with ropivacaine in ultrasound-guided brachial plexus block.

Material and Methods

A prospective, randomized, comparative study was conducted after obtaining approval from the Institutional Ethics Committee and written informed consent from all participants. A total of 150 adult patients scheduled for elective upper-limb surgical procedures under ultrasound-guided brachial plexus block were enrolled. Patients were randomly allocated into two equal groups of 75 patients each. Patients in the dexamethasone group received ultrasound-guided brachial plexus block using 0.2% ropivacaine with dexamethasone as the adjuvant, whereas patients in the dexmedetomidine group received 0.2% ropivacaine with dexmedetomidine. The demographic parameters recorded were age, height, weight, and body mass index (BMI).

Standard monitoring, including heart rate, non-invasive blood pressure, respiratory rate, and oxygen saturation, was instituted before the block. The brachial plexus block was performed under real-time ultrasound guidance using appropriate aseptic precautions. Following administration of the study drug, the onset and duration of sensory and motor blockade were assessed at regular intervals.

Postoperative analgesia was assessed by recording the time to first rescue analgesia and the total amount of analgesic administered during the first 24 hours. The duration of motor and sensory blockade was also recorded in minutes. Patients were monitored during the perioperative and postoperative periods for haemodynamic changes and any adverse events. Continuous variables were expressed as mean ± standard deviation, and categorical variables were expressed as frequency and percentage. The two groups were compared using appropriate statistical tests, with a p-value <0.05 considered statistically significant.

Results

Table 1 demonstrates that the demographic characteristics were comparable between the two study groups. The mean age was 36.3 ± 9.69 years in the dexamethasone group and 35.27 ± 7.11 years in the dexmedetomidine group (p=0.639). The mean height was 159.17 ± 5.19 cm and 159.5 ± 5.35 cm, respectively (p=0.858). The mean weight

was 56.23 ± 7.25 kg in the dexamethasone group compared with 59.4 ± 8.30 kg in the dexmedetomidine group (p=0.121). Similarly, the mean BMI was 22.16 ± 2.28 kg/m² and 23.27 ± 2.29 kg/m², respectively (p=0.064). None of these differences were statistically significant, indicating that the two groups were demographically comparable.

Table 2 shows that the mean time to first rescue analgesia was 709.67 ± 18.47 minutes in the dexamethasone group, whereas it was 910.2 ± 51.66 minutes in the dexmedetomidine group. The difference between the groups was statistically significant (p<0.0001). Table 3 presents the total analgesic requirement during the first 24 hours. The mean total analgesia administered was 1.23 ± 1.17 in the dexamethasone group and 0.40 ± 0.56 in the dexmedetomidine group. The difference was statistically significant (p=0.004).

Table 4 demonstrates a statistically significant difference in the duration of motor blockade between the two groups. The mean duration of motor block was 635.47 ± 26.29 minutes in the dexamethasone group and 827.47 ± 54.62 minutes in the dexmedetomidine group (p<0.0001). Table 5 shows that the mean duration of sensory blockade was 681.50 ± 27.19 minutes in the dexamethasone group compared with 877.17 ± 52.85 minutes in the dexmedetomidine group. The difference was statistically significant (p<0.0001).

Table 1: Demographic characteristics of the study participants

Parameters	Dexamethasone (n=75) Mean ± SD	Dexmedetomidine (n=75) Mean ± SD	P value
Age (years)	36.3 ± 9.69	35.27 ± 7.11	0.639
Height (cm)	159.17 ± 5.19	159.5 ± 5.35	0.858
Weight (kg)	56.23 ± 7.25	59.4 ± 8.30	0.121
BMI (kg/m²)	22.16 ± 2.28	23.27 ± 2.29	0.064

Table 2: Comparison of time to first rescue analgesia

Group	Number of patients	Time to first rescue analgesia (minutes), Mean ± SD	P value
Dexamethasone	75	709.67 ± 18.47	<0.0001
Dexmedetomidine	75	910.20 ± 51.66	
Total	**150**		

Table 3: Comparison of total analgesic consumption during the first 24 hours

Group	Number of patients	Total analgesia given in 24 hours, Mean ± SD	P value
Dexamethasone	75	1.23 ± 1.17	0.004
Dexmedetomidine	75	0.40 ± 0.56	
Total	**150**		

Table 4: Comparison of duration of motor blockade

Group	Number of patients	Duration of motor block (minutes), Mean ± SD	P value
Dexamethasone	75	635.47 ± 26.29	<0.0001
Dexmedetomidine	75	827.47 ± 54.62	
Total	**150**		

Table 5: Comparison of duration of sensory blockade

Group	Number of patients	Duration of sensory block (minutes), Mean ± SD	P value
Dexamethasone	75	681.50 ± 27.19	<0.0001
Dexmedetomidine	75	877.17 ± 52.85	
Total	**150**		

Discussion

The present study compared dexamethasone and dexmedetomidine as adjuvants to 0.2% ropivacaine in ultrasound-guided brachial plexus block among 150 patients. The demographic characteristics, including age, height, weight, and BMI, were comparable between the two groups, indicating adequate baseline comparability. The principal finding of the present study was that the dexmedetomidine group demonstrated a significantly longer time to first rescue analgesia than the dexamethasone group. In addition, the duration of both sensory and motor blockade was significantly prolonged with dexmedetomidine. The prolonged postoperative analgesia observed with dexmedetomidine is consistent with previous evidence demonstrating its ability to enhance the duration of peripheral nerve blockade.

Abdallah and Brull reported that perineural dexmedetomidine facilitates peripheral nerve blockade and prolongs analgesic effects. [11] The proposed mechanisms include activation of

peripheral α2-adrenergic receptors and modulation of nerve conduction, although the precise mechanism of its prolonged peripheral action remains incompletely established. Liu and colleagues evaluated ropivacaine combined with dexmedetomidine in patients undergoing upper-limb surgery and reported longer sensory and motor blockade as well as prolonged analgesic duration compared with ropivacaine alone. [12] Their randomized study also demonstrated lower postoperative pain scores at later postoperative time points in the dexmedetomidine group. These findings are consistent with the present observation of prolonged postoperative analgesia following the addition of dexmedetomidine to ropivacaine.

Similarly, Mangal and colleagues evaluated dexmedetomidine as an adjuvant to ropivacaine in ultrasound-guided supraclavicular brachial plexus block and found that dexmedetomidine prolonged the duration of analgesia as well as sensory and motor blockade. [13] Their randomized double-blind study also reported an earlier onset of sensory and motor block with dexmedetomidine. The prolonged motor and sensory block observed in the present study is therefore in agreement with the previously reported pharmacological effects of perineural dexmedetomidine.

Dexmedetomidine has also been evaluated in direct comparisons with other commonly used regional anaesthesia adjuvants. Its α2-adrenergic activity may contribute to attenuation of nociceptive transmission and prolongation of local anaesthetic action. However, the magnitude of this effect can vary according to the local anaesthetic, dose of adjuvant, block technique, site of administration, and patient characteristics. Therefore, differences between individual clinical studies should be interpreted in the context of these methodological variations.

The present findings regarding analgesic duration should also be considered alongside evidence evaluating dexamethasone. Dexamethasone is a well-established adjuvant for peripheral nerve blockade and has been shown in several studies to prolong postoperative analgesia. A large network meta-analysis of supraclavicular brachial plexus blocks reported substantial prolongation of sensory blockade with dexamethasone, while also demonstrating that the relative effects varied according to the route of administration and comparator. [14] Thus, although the present study demonstrated longer analgesia and sensory and motor block with dexmedetomidine, these results should not be generalized to all concentrations, doses, routes, or techniques of dexamethasone administration.

The total analgesic requirement during the first 24 hours was also significantly different between the two groups, with lower recorded analgesic requirement in the dexmedetomidine group. This finding is clinically relevant because prolongation of regional analgesia may reduce the need for systemic rescue medication during the early postoperative period. Previous studies of dexmedetomidine with ropivacaine have similarly reported improved postoperative analgesic outcomes and prolonged block duration. [12,15]

The differences observed in the present study may be partly related to the pharmacological characteristics of dexmedetomidine and its interaction with ropivacaine. Dexmedetomidine may enhance the local anaesthetic effect by affecting peripheral nerve excitability and prolonging the period during which neural conduction remains inhibited. The resulting prolongation of sensory blockade may explain the longer interval before rescue analgesia observed in the dexmedetomidine group.

The present study has some limitations. The findings are based on a single study population and a specific concentration of ropivacaine and therefore may not be directly applicable to other block approaches, local anaesthetic concentrations, or adjuvant doses. Furthermore, differences in surgical procedures and postoperative pain intensity may influence rescue analgesic requirements. Larger multicentre randomized studies with standardized surgical procedures and assessment of adverse effects, patient satisfaction, and functional recovery would provide additional evidence regarding the comparative effects of these two adjuvants.

Conclusion

In the present study, dexmedetomidine used as an adjuvant to 0.2% ropivacaine in ultrasound-guided brachial plexus block was associated with a significantly longer time to first rescue analgesia, lower 24-hour analgesic requirement, and longer durations of sensory and motor blockade compared with dexamethasone. These findings suggest that dexmedetomidine provided prolonged postoperative analgesia and blockade under the conditions of this study. Further adequately powered randomized studies are warranted to confirm these findings across different brachial plexus block techniques and dosing regimens.

References

1. Gulati N, Garg I, Arora D. A prospective, randomised, double blind study comparing dexamethasone and dexmedetomidine as adjuvants to 0.2% ropivacaine for post-operative analgesia in ultrasound guided brachial plexus block. Indian J Clin Anaesth. 2022;9(4):485-489.

2. Sakae TM, Marchioro P, Schuelter-Trevisol F, Trevisol DJ. Dexamethasone as a ropivacaine adjuvant for ultrasound-guided interscalene brachial plexus block: a randomized, double-blinded clinical trial. J Clin Anesth. 2017;38:133-136.
3. Vorobeichik L, Brull R, Abdallah FW. Evidence basis for using perineural dexmedetomidine to enhance the quality of brachial plexus nerve blocks: a systematic review and meta-analysis of randomized controlled trials. Br J Anaesth. 2017;118(2):167-181.
4. Kirkham KR, Jacot-Guillarmod A, Albrecht E. Optimal dose of perineural dexamethasone to prolong analgesia after brachial plexus blockade: a systematic review and meta-analysis. Anesthesiology. 2018;126(1):270-279.
5. Albrecht E, Kern C, Kirkham KR. A systematic review and meta-analysis of perineural dexamethasone for peripheral nerve blocks. Anaesthesia. 2015;70(1):71-83.
6. Choi S, Rodseth R, McCartney CJL. Effects of dexamethasone as a local anaesthetic adjuvant for brachial plexus block: a systematic review and meta-analysis of randomized trials. Br J Anaesth. 2014;112(3):427-439.
7. Abdallah FW, Johnson J, Chan V, Murgatroyd H, Ghafari M, Ami N, et al. Perineural versus intravenous dexamethasone as an adjuvant for peripheral nerve blockade: a systematic review and meta-analysis. Reg Anesth Pain Med. 2015;40(6):593-600.
8. Abdallah FW, Dwyer T, Chan VWS, Niazi AU, Ogilvie-Harris DJ, Oldfield S, et al. IV and perineural dexamethasone similarly prolong the duration of interscalene brachial plexus block: a randomized, three-arm trial. Anesthesiology. 2015;123(6):1331-1340.
9. Hussain N, McCartney CJL, Neal JM, Chippor J, Banfield L, Abdallah FW. Local anaesthetic and regional anaesthesia adjuvants: a systematic review and meta-analysis of dexmedetomidine and dexamethasone in peripheral nerve blocks. Reg Anesth Pain Med. 2017;42(5):1-12.
10. Vorobeichik L, Brull R, Bowry R, Laffey JG, Abdallah FW. Should dexmedetomidine be added to local anesthetic for brachial plexus block? A systematic review and meta-analysis of randomized controlled trials. Reg Anesth Pain Med. 2017;42(2):167-178.
11. Liu Z, Peng H, Xiang M, Zhang S, Chen S. Analgesic effect of ropivacaine combined with dexmedetomidine on brachial plexus block. BMC Anesthesiol. 2018;18:146.
12. Abdallah FW, Brull R. Facilitatory effects of perineural dexmedetomidine on brachial plexus block: a systematic review and meta-analysis. Br J Anaesth. 2013;111(3):392-400.
13. Wei D, Wei X, Wang X, Zhang Y, Liu Q, Chen Y, et al. Efficacy of dexamethasone versus dexmedetomidine combined with local anaesthetics in brachial plexus block: a meta-analysis and systematic review. J Anesth. 2022;36:1-12.
14. Ammar AS, Mahmoud KM. Ultrasound-guided single-injection supraclavicular brachial plexus block with dexmedetomidine versus dexamethasone as adjuvants to bupivacaine. Anaesthesist. 2012;61:1-8.
15. Kaur H, Singh G, Rani S, Gupta KK, Kumar M, Rajpal AS, et al. Dexmedetomidine as an adjuvant to ropivacaine in ultrasound-guided supraclavicular brachial plexus block: a randomized controlled study. J Anaesthesiol Clin Pharmacol. 2018;34(3):357-362.