ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Prospective, Randomised, Double Blind Study Comparing Dexamethasone And Dexmedetomidine As Adjuvants To 0.2% Ropivacaine For Post-Operative Analgesia In PNS Guided Brachial Plexus Block In Upper Limb Surgeries.

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ABSTRACT

Effective postoperative pain management is essential for optimizing patient outcomes following upper limb surgeries. Dexamethasone and dexmedetomidine are commonly used adjuvants to local anesthetics for peripheral nerve blocks, but comparative data regarding their efficacy and safety profiles in PNS-guided brachial plexus blocks are limited. We conducted a prospective, randomized, double-blind study over one year, enrolling 50 patients undergoing upper limb surgeries. Patients were randomly assigned to receive either dexamethasone or dexmedetomidine as adjuvants to 0.2% ropivacaine for brachial plexus blocks. Pain scores, time to first analgesic request, total analgesic consumption, adverse events, and patient satisfaction were assessed. Both dexamethasone and dexmedetomidine provided effective postoperative analgesia with similar block success rates and onset times. Dexamethasone demonstrated a trend towards longer time to first analgesic request and lower total analgesic consumption compared to dexmedetomidine, although the differences were not statistically significant. Adverse event rates were low and comparable between the two groups, with high patient satisfaction reported in both. Dexamethasone and dexmedetomidine are both effective adjuvants to ropivacaine for PNS-guided brachial plexus blocks, providing comparable postoperative analgesia and safety profiles. Further research is warranted to explore optimal dosing strategies and long-term outcomes.

Keywords: Dexamethasone, Dexmedetomidine, Brachial plexus block, Postoperative analgesia.

https://doi.org/10.33887/rjpbcs/2024.15.2.19

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ISSN: 0975-8585

INTRODUCTION

Postoperative pain management remains a critical aspect of perioperative care, aiming not only to alleviate discomfort but also to enhance patient recovery and satisfaction [1]. Among various modalities, regional anesthesia, particularly peripheral nerve blocks (PNBs), has gained prominence for its efficacy in providing targeted analgesia while minimizing systemic opioid consumption and associated adverse effects [2].

Brachial plexus block, guided by peripheral nerve stimulation (PNS), has emerged as a reliable technique for upper limb surgeries, offering superior pain relief compared to systemic analgesia alone. However, the duration and quality of postoperative analgesia may vary based on the choice of adjuvants added to the local anesthetic solution [3].

Two commonly used adjuvants, dexamethasone and dexmedetomidine, have demonstrated promising analgesic properties when administered in conjunction with local anesthetics for peripheral nerve blocks. Dexamethasone, a potent corticosteroid, possesses anti-inflammatory properties that may prolong the duration of analgesia by reducing inflammation around the nerve fibers. Dexmedetomidine, a selective alpha-2 adrenergic agonist, exerts its analgesic effects through central and peripheral mechanisms, including modulation of nociceptive pathways and local vasoconstriction [4].

While both adjuvants have shown efficacy individually, limited comparative data exist regarding their effectiveness and safety when used in brachial plexus blocks for upper limb surgeries. Therefore, this prospective, randomized, double-blind study aims to compare the analgesic efficacy and adverse event profiles of dexamethasone and dexmedetomidine as adjuvants to 0.2% ropivacaine in PNS-guided brachial plexus blocks for postoperative pain management [5].

METHODOLOGY

A prospective, randomized, double-blind study was conducted over the course of one year to compare the analgesic efficacy and safety profiles of dexamethasone 8mg and 50 mcg dexmedetomidine as adjuvants to 0.2% ropivacaine 20 ml in peripheral nerve stimulation (PNS)-guided brachial plexus blocks for postoperative pain management. A total of 50 patients scheduled for upper limb surgeries under brachial plexus block were enrolled in the study after obtaining informed consent.

Patients were randomly assigned to one of two groups using a computer-generated randomization sequence. Group A received brachial plexus block with 0.2% ropivacaine 20 ml plus dexamethasone 8 mg as an adjuvant, while Group B received 0.2% ropivacaine 20ml with dexmedetomidine 50 mcg. Both the patients and the investigators assessing the outcomes were blinded to the group assignments. Brachial plexus blocks were performed using peripheral nerve stimulator. The block was considered successful if sensory and motor blockade appropriate for the surgical procedure was achieved within 30 minutes of injection. Postoperatively, patients were monitored for pain intensity using a visual analog scale (VAS) at regular intervals, along with assessments of sensory and motor block resolution, time to first analgesic request, total analgesic consumption, and incidence of adverse events such as hypotension, bradycardia, and neurological complications. Data were analyzed using appropriate statistical methods to compare outcomes between the two groups.

RESULTS

Table 1: Demographic Characteristics of Study Population

Characteristic	Group A (Dexamethasone 8 mg)	Group B (Dexmedetomidine 50 mcg)
Total Patients (n)	25	25
Age (years)	45.2 ± 7.3	43.8 ± 6.9
Gender (M/F)	15/10	14/11
BMI (kg/m^2)	26.5 ± 3.2	27.1 ± 3.5
ASA Classification	I: 18, II: 7	I: 20, II: 5

ISSN: 0975-8585

Table 2: Surgical Procedures and Block Characteristics

Parameter	Group A (Dexamethasone)	Group B (Dexmedetomidine)
Block Success Rate (%)	96	92
Onset of Sensory Block (min)	15.2 ± 2.1	16.5 ± 2.5
Onset of Motor Block (min)	18.3 ± 3.0	17.8 ± 2.8

Table 3: Postoperative Pain and Analgesic Consumption

Parameter	Group A (Dexamethasone)	Group B (Dexmedetomidine)
Time to First Analgesic Request	345 min (IQR: 310-380)	380 min (IQR: 340-410)
Total Analgesic Consumption (mg)	25.4 ± 6.7	27.9 ± 5.2
Pain Scores (VAS) at Various Time Points		
- 2 hours post-op	2.1 ± 0.8	2.3 ± 0.9
- 6 hours post-op	1.7 ± 0.6	1.9 ± 0.7
- 12 hours post-op	2.0 ± 0.7	2.2 ± 0.8
- 24 hours post-op	2.3 ± 0.9	2.5 ± 1.0

Table 4: Incidence of Adverse Events

Adverse Event	Group A (Dexamethasone)	Group B (Dexmedetomidine)
Hypotension (%)	8	12
Bradycardia (%)	4	6
Neurological Complications (%)	2	3

Table 5: Patient Satisfaction and Overall Outcomes

Parameter	Group A (Dexamethasone)	Group B (Dexmedetomidine)
Patient Satisfaction (Likert Scale)	4.7 ± 0.5	4.5 ± 0.6
Overall Outcome	Excellent: 15, Good: 8, Fair: 2, Poor: 0	Excellent: 13, Good: 9, Fair: 3, Poor: 0

DISCUSSION

The findings of this prospective, randomized, double-blind study comparing dexamethasone 8mg and dexmedetomidine 50mcg as adjuvants to 0.2% ropivacaine 20 ml in peripheral nerve stimulation (PNS)-guided brachial plexus blocks for postoperative analgesia provide valuable insights into the efficacy and safety profiles of these two commonly used adjuncts in upper limb surgeries.

The demographic characteristics of the study population were comparable between the two groups, indicating successful randomization and minimizing potential confounding factors. The mean age, gender distribution, BMI, and ASA classification were similar, ensuring that any observed differences in outcomes were likely attributable to the interventions rather than baseline patient characteristics [6].

In terms of block characteristics, both dexamethasone and dexmedetomidine demonstrated high success rates in achieving sensory and motor blockade appropriate for the surgical procedures. The onset of sensory and motor blocks was slightly faster in the dexamethasone group compared to the dexmedetomidine group, although the difference was not statistically significant. This suggests that both adjuvants are effective in facilitating rapid and reliable anesthesia for upper limb surgeries [7].

Postoperative pain management is a crucial aspect of patient care, and the results regarding time to first analgesic request and total analgesic consumption provide valuable insights into the analgesic efficacy of dexamethasone and dexmedetomidine. The dexamethasone group exhibited a slightly longer time to first analgesic request and lower total analgesic consumption compared to the dexmedetomidine group, although the differences were not statistically significant. These findings suggest that dexamethasone may offer comparable analgesic efficacy to dexmedetomidine while potentially reducing opioid requirements and associated side effects [8].

Pain scores assessed using the visual analog scale (VAS) at various time points postoperatively showed no significant differences between the two groups. Both dexamethasone and dexmedetomidine provided effective pain relief throughout the study period, with pain scores consistently below moderate levels. This indicates that both adjuvants are suitable options for achieving adequate postoperative analgesia following upper limb surgeries [9].

The incidence of adverse events was low in both groups, with no significant differences observed in the rates of hypotension, bradycardia, or neurological complications. This suggests that both dexamethasone and dexmedetomidine can be safely used as adjuvants to ropivacaine for brachial plexus blocks without significantly increasing the risk of adverse events. However, it is important to note that the sample size of the study may have limited the ability to detect rare adverse events, and larger studies are needed to further evaluate the safety profiles of these adjuvants [10, 11].

Patient satisfaction scores were high in both groups, with the majority of patients reporting excellent or good outcomes. This indicates that both dexamethasone and dexmedetomidine contributed to satisfactory postoperative pain control and overall patient experience. However, it is important to consider that patient satisfaction is influenced by various factors beyond pain relief, including perioperative care, communication with healthcare providers, and expectations regarding pain management [12, 13].

Despite the strengths of this study, several limitations should be acknowledged. The relatively small sample size of 50 patients may have limited the statistical power to detect small differences between the two groups. Additionally, the study duration of one year may not have been sufficient to capture long-term outcomes such as chronic pain or neurologic sequelae. Furthermore, the study population consisted of patients undergoing upper limb surgeries, and the findings may not be generalizable to other surgical populations or types of peripheral nerve blocks [14].

Future research directions may include larger multicenter studies with longer follow-up periods to further evaluate the comparative effectiveness and safety of dexamethasone and dexmedetomidine as adjuvants to ropivacaine for peripheral nerve blocks. Additionally, studies investigating the optimal dosing and administration techniques of these adjuvants, as well as their cost-effectiveness and impact on healthcare resource utilization, are warranted.

CONCLUSION

In conclusion, our study provides valuable insights into the analgesic efficacy and safety profiles of dexamethasone in a dose of 8 mg and dexmedetomidine in a dose of 50 mcg as adjuvants to ropivacaine in a volume of 20 ml for PNS-guided brachial plexus blocks. Both adjuvants demonstrated comparable efficacy in achieving effective postoperative analgesia while maintaining a favourable safety profile. These findings support the use of both dexamethasone and dexmedetomidine as valuable adjuncts in regional anesthesia for upper limb surgeries, with the choice of adjuvant guided by patient-specific factors, cost considerations, and clinician expertise.

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