Original Article

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Dexmedetomidine-bupivacaine versus Ketamine-bupivacaine for Ultrasound-guided Axillary Brachial Plexus Block in Forearm and Hand Surgeries: A Triple-blind Randomised Clinical Study

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ABSTRACT

Introduction: Single-injection ultrasound-guided axillary brachial plexus block provides effective anaesthesia for forearm and hand surgery, but analgesia is limited by local anaesthetic duration. Dexmedetomidine and ketamine are used as adjuvants, though their comparative axillary-block efficacy remains inadequately defined in clinical studies.

Aim: To compare dexmedetomidine and ketamine as adjuvants to bupivacaine for ultrasound-guided axillary block in adult patients undergoing elective forearm and hand surgeries.

Materials and Methods: This triple-blind randomised parallel-group clinical study was conducted in the Department of Anaesthesiology, Krishna Hospital and Medical Centre, Karad, Maharashtra, India. The study included 60 American Society of Anesthesiologists Physical Status (ASA-PS) I-II adults aged more than 18 years undergoing elective forearm and hand surgeries under ultrasound-guided axillary block. Participants were randomised into two equal groups. Group D received 30 mL of 0.25% bupivacaine with dexmedetomidine 100 µg diluted in 2 mL, while Group K received 30 mL of 0.25% bupivacaine with ketamine 100 mg in 2 mL. Sensory and motor onset, sensory, and motor duration, duration of analgesia, rescue analgesic requirement, Visual Analogue Scale (VAS) scores, sedation, satisfaction, haemodynamic variables and adverse events were recorded. Continuous variables were expressed as mean±standard deviation and compared using Student's unpaired t-test or appropriate parametric tests. Categorical variables were expressed as number and percentage and compared using Chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Results: Demographic characteristics were comparable between the groups. Sensory onset was similar in Group D and Group K (11.6±2.6 versus 12.1±2.4 minutes; p-value=0.442), whereas motor onset was significantly earlier in Group D (13.46±3.31 versus 16.83±1.37 minutes; p-value<0.001). Group D had longer sensory block duration (413.97±87.31 versus 227.00±48.36 minutes), motor block duration (472.24±90.06 versus 292.67±59.13 minutes), and duration of analgesia (440.2±121.2 versus 251.7±57.1 minutes) (all p-value<0.001). The proportion of patients requiring rescue analgesia was lower in Group D than in Group K (53.3% versus 86.7%; p-value=0.010). Group D also demonstrated lower VAS scores at 6, 12, and 18 hours, with clinically acceptable haemodynamic changes.

Conclusion: Dexmedetomidine added to bupivacaine for ultrasound-guided axillary block produced faster motor onset, prolonged sensory-motor blockade and better postoperative analgesia than ketamine, with manageable sedation and infrequent bradycardia.

Keywords: Anaesthesia, Analgesia, Conduction, Pain measurement, Postoperative pain, Treatment outcome, Upper extremity

INTRODUCTION

Forearm and hand surgeries require anaesthetic techniques that provide dense surgical anaesthesia as well as reliable postoperative pain control. Regional anaesthesia is increasingly preferred for distal upper limb surgery because it limits airway manipulation, reduces systemic opioid exposure and permits smoother early recovery when compared with general anaesthesia in suitable patients [1,2]. Among brachial plexus approaches, the axillary technique is particularly relevant for operations at or below the elbow because the terminal branches of the plexus can be blocked at a superficial and compressible site [3].

Ultrasound guidance has strengthened the clinical value of the axillary approach. Direct visualisation of the axillary artery, median nerve, ulnar nerve, radial nerve and the separately located musculocutaneous nerve improves needle placement and allows controlled perineural spread of local anaesthetic [4,5]. The distal location also avoids several complications associated with proximal brachial plexus approaches, including pneumothorax and phrenic nerve palsy. Even so, a single-injection block remains limited by the duration of the local anaesthetic, and patients may experience early breakthrough pain once sensory function returns [6].

Bupivacaine is widely used for peripheral nerve blockade because of its long duration and strong sensory block. However, when used alone, its analgesic cover may not always be adequate for painful orthopaedic procedures involving the forearm, wrist and hand. To address this limitation, several adjuvants have been evaluated. Dexmedetomidine, a highly selective alpha-2 adrenergic agonist, prolongs analgesia through peripheral and systemic mechanisms and has shown consistent benefit in brachial plexus block studies [7-9]. Its clinical advantage should be balanced against dose-related sedation and haemodynamic effects, including bradycardia

and hypotension, as reported in pooled evidence on perineural dexmedetomidine in brachial plexus blocks [9].

Ketamine is another adjuvant because N-methyl-D-aspartate receptor antagonism can reduce central sensitisation and opioid requirement. Evidence on perineural ketamine is less uniform than that for dexmedetomidine; some studies report better pain scores and delayed rescue analgesia, while others show limited change in sensory or motor block duration [10,11]. Although both dexmedetomidine and ketamine have been evaluated as adjuvants in brachial plexus blocks, direct comparative studies have predominantly involved the supraclavicular approach [12,13]. Therefore, their comparative efficacy in ultrasound-guided axillary brachial plexus block, particularly regarding sensory and motor block characteristics, postoperative analgesia and rescue analgesic requirement, remains inadequately defined. The present study was therefore undertaken to compare dexmedetomidine-bupivacaine and ketamine-bupivacaine for ultrasound-guided axillary brachial plexus block in adult patients undergoing elective forearm and hand surgery. The primary objectives were to assess sensory and motor onset, sensory and motor duration, duration of postoperative analgesia and rescue analgesic requirement. The secondary objectives were to compare haemodynamic variables, sedation, satisfaction and adverse events.

MATERIALS AND METHODS

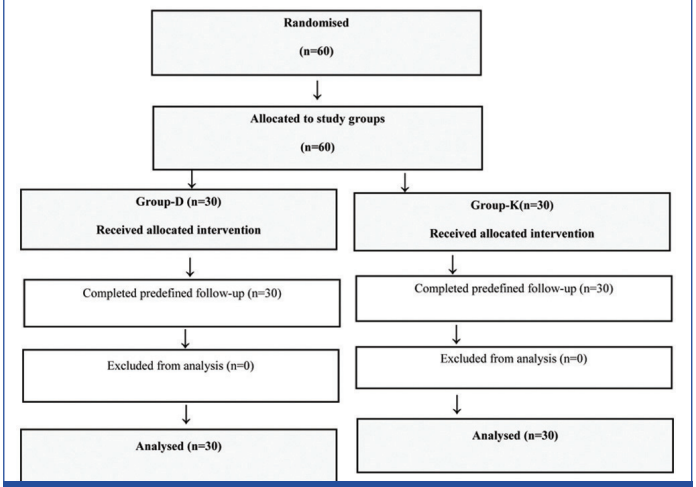
This triple-blind, randomised, parallel-group clinical study was conducted in the Department of Anaesthesiology, Krishna Hospital and Medical Centre, Krishna Institute of Medical Sciences, Karad, Maharashtra, India, over 18 months from June 2024 to November 2025. The protocol was approved by the Institutional Ethics Committee, Krishna Vishwa Vidyapeeth, vide Protocol Number 310/2023-2024, KVV/IEC/05/2024, dated 15/04/2024. Written informed consent was obtained from all participants before enrolment.

Sample size: Sample size was calculated using duration of analgesia as the primary reference endpoint from a prior comparative study on dexmedetomidine-bupivacaine versus ketamine-bupivacaine for ultrasound-guided brachial plexus block [13]. The formula used for comparing two independent means was: $n=\{(Z\alpha/2+Z\beta)^2\times(SD1^2+SD2^2)\}/d^2$. Using $Z\alpha/2=1.96$, $Z\beta=0.84$, SD1=97.99 minutes, SD2=62.50 minutes and a clinically meaningful difference of 60 minutes, $n=\{(1.96+0.84)^2\times(97.99^2+62.50^2)\}/60^2=29.41$. Therefore, 30 patients were required in each group, and a total of 60 patients were enrolled.

Inclusion criteria: Patients aged more than 18 years, of either sex, belonging to ASA-PS I or II, and scheduled for elective forearm or hand orthopaedic surgery suitable for ultrasound-guided axillary brachial plexus block were included in the study.

Exclusion criteria: Patients with obesity as per institutional criteria, severe or systemic bacterial infection, bleeding disorder, uncontrolled diabetes mellitus, pregnancy, pre-existing neurological deficit in the operative limb, local infection at the block site, refusal to participate, or known allergy to local anaesthetics, dexmedetomidine or ketamine were excluded from the study. No patient was excluded after randomisation, and all 60 randomised patients completed the predefined follow-up and were included in the final analysis.

Randomisation, blinding and bias reduction: Participants were randomly allocated in a 1:1 ratio into two groups using a computer-generated random sequence prepared by an investigator not involved in block performance or outcome assessment [Table/Fig-1]. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes. The envelope was opened by an independent anaesthesia team member, who prepared the study solutions in identical syringes with an equal final volume and had no role in block performance, intraoperative observation or postoperative outcome assessment. Participants, the anaesthesiologist performing the block, the intraoperative observer and the postoperative outcome assessor remained blinded to group allocation. Thus, participants, the intervention provider and the outcome assessors were blinded. Bias was reduced through concealed allocation, triple blinding, identical injectate volumes, a standardised ultrasound-guided block technique, predefined outcome definitions, fixed observation time points and complete follow-up. A total of 60 participants were randomised, with 30 patients allocated to each group. All randomised patients received the allocated intervention, completed the predefined follow-up and were included in the final analysis [Table/Fig-1].



[Table/Fig-1]: CONSORT participant flow.
Group D: Dexmedetomidine group; Group K: Ketamine group.

Intervention and block technique: Group D received 30 mL of 0.25% bupivacaine with dexmedetomidine 100 µg diluted in 2 mL. Group K received 30 mL of 0.25% bupivacaine with ketamine 100 mg diluted in 2 mL. Thus, the total injectate volume was 32 mL in both groups. The selected drug doses were based on earlier comparative brachial plexus block studies evaluating dexmedetomidine and ketamine as adjuvants to bupivacaine [13,14]. All patients followed standard fasting instructions. In the operating theatre, a 20G intravenous cannula was secured, and standard monitors were applied, including electrocardiography, non-invasive blood pressure and pulse oximetry. Ranitidine and ondansetron were administered intravenously approximately 20 minutes before the block. Intravenous crystalloid infusion was started, and midazolam 0.02 mg/kg i.v. was given for anxiolysis while preserving patient cooperation for block assessment. Patients were placed supine with the operative arm abducted. Under aseptic precautions, a high-frequency linear ultrasound transducer was used to identify the axillary artery and terminal nerves in short-axis view. A 22G needle was advanced using an in-plane approach with continuous needle-tip visualisation. The study solution was injected in divided aliquots after repeated negative aspiration, and adequate perineural spread around the target nerves was confirmed sonographically.

Intraoperative and postoperative anaesthetic protocol: After confirming adequate sensory and motor block, surgery was allowed to proceed. No routine systemic intraoperative opioid or additional analgesic was administered after successful block. If the block was incomplete or the patient complained of surgical pain, intraoperative rescue analgesia with intravenous fentanyl 1 µg/kg was planned, followed by conversion to general anaesthesia if analgesia remained inadequate. Such cases were to be recorded as block failure. In the postoperative period, pain was assessed using a 0-10 VAS at 1, 6, 12 and 18 hours. Rescue analgesia was given when VAS score was ≥4 or when the patient requested analgesia. Diclofenac was administered as per institutional adult dosing protocol, and total diclofenac consumption, time to first analgesic request and number of rescue doses were recorded.

Outcome measures and study parameters: The primary outcome measures were sensory block onset, motor block onset, sensory block duration, motor block duration, duration of postoperative analgesia and rescue analgesic requirement. Sensory block was assessed every two minutes after completion of injection using pinprick or cold sensation in the median, ulnar, radial, and musculocutaneous nerve territories. Sensory onset was defined as the time from completion of injection to complete loss of sensation in the relevant nerve distributions. Motor onset was defined as the time from completion of injection to complete motor block, assessed by elbow flexion and forearm, wrist and finger movements. Sensory block duration was defined as the interval from complete sensory block to return of normal sensation in the blocked nerve territories. Motor block duration was defined as the interval from complete motor block to complete motor recovery. Duration of analgesia was defined separately as the time from completion of injection to the first postoperative rescue analgesic requirement. Rescue analgesic requirement was recorded as the need for rescue analgesia, time to first rescue analgesic, number of rescue doses and total diclofenac consumption.

The secondary outcome measures were heart rate, mean arterial pressure, peripheral oxygen saturation, Ramsay sedation score, patient satisfaction score and adverse events. Haemodynamic parameters were recorded at baseline, after completion of block, after skin incision and every 15 minutes intraoperatively. Sedation was assessed using the Ramsay sedation score. Bradycardia was defined as heart rate <50/minute or >20% fall from baseline requiring treatment. Hypotension was defined as >20% fall in mean arterial pressure or systolic blood pressure <90 mmHg. Oversedation, nausea, vomiting and block-related complications were actively documented.

Patient satisfaction was assessed at 18 hours after surgery by the blinded postoperative observer using a three-point satisfaction scale. The assessment considered overall anaesthetic experience, intraoperative comfort, postoperative analgesic comfort and willingness to receive the same anaesthetic technique again. The score was graded as 1=dissatisfied, 2=satisfied and 3=highly satisfied. Therefore, the minimum possible score was 1 and the maximum possible score was 3. The satisfaction score was recorded before group allocation was revealed for final analysis.

STATISTICAL ANALYSIS

Data were entered in Microsoft Excel and analysed using standard statistical methods. Quantitative variables were expressed as mean±standard deviation, while categorical variables were expressed as frequency and percentage. Normality of continuous variables was checked before between-group comparison. Continuous variables with normal distribution were compared using Student's unpaired t-test. Categorical variables were compared using the Chi-square test. Fisher's exact test was applied when the expected cell frequency was less than 5. A p-value <0.05 was considered statistically significant.

RESULTS

Baseline demographic and clinical variables were comparable between the two groups. There was no statistically significant difference in age, sex distribution, ASA physical status, duration of surgery or baseline haemodynamic parameters [Table/Fig-2].

Sensory onset was comparable between the groups. Motor onset developed significantly earlier in Group D than in Group K. Dexmedetomidine produced a marked prolongation of sensory and motor block duration. Duration of analgesia was reported as the time from completion of block injection to the first rescue analgesic requirement; therefore, the duplicate row previously labelled "time to first analgesic request" was removed for internal consistency. Rescue requirement, total diclofenac consumption and number of rescue doses were lower in Group D [Table/Fig-3].

Variable	Group D (n=30)	Group K (n=30)	p-value
Age (years), mean±SD	36.4±10.2	37.1±9.6	0.78
Sex (M/F), n (%)	18/12 (60.0/40.0)	17/13 (56.7/43.3)	0.79
ASA I/II, n (%)	19/11 (63.3/36.7)	18/12 (60.0/40.0)	0.79
Duration of surgery (mins), mean±SD	68.0±14.5	70.2±15.1	0.56
Baseline HR (beats/mins), mean±SD	78.4±8.6	79.1±8.1	0.74
Baseline MAP (mmHg), mean±SD	92.3±7.8	91.6±8.4	0.73
Baseline SpO2 (%), mean±SD	99.0±0.9	98.9±1.0	0.66

[Table/Fig-2]: Baseline demographic and clinical profile.
ASA: American Society of Anesthesiologists; HR: Heart rate; MAP: Mean arterial pressure; SpO2: Peripheral oxygen saturation

Outcome	Group D (n=30)	Group K (n=30)	p-value
Sensory onset (mins), mean±SD	11.6±2.6	12.1±2.4	0.442
Motor onset (mins), mean±SD	13.46±3.31	16.83±1.37	<0.001
Sensory duration (mins), mean±SD	413.97±87.31	227.00±48.36	<0.001
Motor duration (mins), mean±SD	472.24±90.06	292.67±59.13	<0.001
Duration of analgesia/time to first rescue analgesic requirement (mins), mean±SD	440.2±121.2	251.7±57.1	<0.001
Diclofenac consumption (mg), mean±SD	100.0±42.56	160.5±44.7	<0.001
Number of rescue doses, mean±SD	1.1±0.8	2.1±0.9	<0.001
Patients requiring rescue, n (%)	16 (53.3)	26 (86.7)	0.010

[Table/Fig-3]: Block characteristics and analgesic outcomes.
Note: Duration of analgesia was defined as the interval from completion of block injection to first rescue analgesic requirement. Hence, a separate "time to first analgesic request" row is not retained

VAS scores at one hour were comparable between the two groups. Thereafter, Group D showed significantly lower pain scores at 6, 12 and 18 hours, indicating better sustained postoperative analgesia [Table/Fig-4].

Ramsay sedation score was significantly higher in Group D. Patient satisfaction was also higher in Group D [Table/Fig-5].

Time point	Group D mean±SD	Group K mean±SD	p-value
1 hour	1.6±0.8	1.8±0.9	0.42
6 hours	2.3±0.9	3.5±1.0	<0.001
12 hours	3.1±1.0	4.7±1.1	<0.001
18 hours	3.7±1.1	5.3±1.0	<0.001

[Table/Fig-4]: Postoperative VAS pain scores.
VAS: Visual analogue scale

Outcome	Group D mean±SD	Group K mean±SD	p-value
Ramsay sedation score	3.71±0.50	2.50±0.59	<0.001
Patient satisfaction score (1-3 scale)*	3.00±0.00†	2.40±0.50	<0.001

[Table/Fig-5]: Sedation and satisfaction scores.
†All 30 patients in Group D had a satisfaction score of 3 (highly satisfied); therefore, there was no variability in the scores and the SD was 0.00
*Satisfaction score: 1=dissatisfied, 2=satisfied, 3=highly satisfied

Intraoperative haemodynamic variables remained clinically acceptable in both groups. Heart rate was lower in Group D after block and during intraoperative observation. Mean arterial pressure showed statistically lower values in Group D at 15 and 30 minutes, but the observed differences remained clinically manageable. Peripheral oxygen saturation was comparable at all-time points [Table/Fig-6a-c].

Adverse events were infrequent. Bradycardia occurred in two patients in Group D and none in Group K. Hypotension was recorded in one patient in each group. Nausea/vomiting occurred in three patients in Group D and four patients in Group K. Oversedation was

Time point	Group D	Group K	p-value
Baseline	78.4±8.6	79.1±8.1	0.747
Post-block	72.6±8.2	76.8±8.0	0.049
Post-incision	74.8±8.5	81.0±8.6	0.007
15 mins	71.9±7.9	80.2±8.3	<0.001
30 mins	70.8±7.6	79.0±8.1	<0.001
45 mins	71.2±7.8	78.2±8.0	0.001
60 mins	72.0±8.0	77.5±7.8	0.009

[Table/Fig-6a]: Intraoperative heart rate.
Values are expressed as mean±SD. Between-group p-values were calculated using Student's unpaired t-test.

Time point	Group D	Group K	p-value
Baseline	92.3±7.8	91.6±8.4	0.739
Post-block	88.6±7.4	90.4±7.9	0.366
Post-incision	89.2±7.6	93.0±8.2	0.068
15 mins	87.9±7.2	92.4±8.0	0.026
30 mins	87.1±7.0	91.8±7.8	0.017
45 mins	87.5±7.1	91.2±7.6	0.056
60 mins	88.0±7.3	90.8±7.5	0.148

[Table/Fig-6b]: Intraoperative mean arterial pressure.
Values are expressed as mean±SD. Between-group p-values were calculated using Student's unpaired t-test.

Time point	Group D	Group K	p-value
Baseline	99.0±0.9	98.9±1.0	0.685
Post block	99.1±0.8	98.9±1.0	0.396
Post incision	99.0±0.9	98.8±1.1	0.444
15 mins	99.0±0.9	98.8±1.0	0.419
30 mins	99.1±0.8	98.9±1.0	0.396
45 mins	99.0±0.9	98.9±0.9	0.669
60 mins	99.0±0.9	98.8±1.0	0.419

[Table/Fig-6c]: Intraoperative peripheral oxygen saturation.
Values are expressed as mean±SD. Between-group p-values were calculated using Student's unpaired t-test.

observed in one patient in Group D. No block-related complication was observed [Table/Fig-7].

Event	Group D n (%)	Group K n (%)	p-value
Bradycardia	2 (6.7)	0	0.492
Hypotension	1 (3.3)	1 (3.3)	1.000
Nausea/vomiting	3 (10.0)	4 (13.3)	1.000
Oversedation	1 (3.3)	0	1.000
Block-related complications	0	0	Not applicable

[Table/Fig-7]: Adverse events.
Values are expressed as number and percentage. Fisher's exact test was applied for sparse event counts.

DISCUSSION

In the present study, dexmedetomidine added to bupivacaine produced a better block and analgesic profile than ketamine in ultrasound-guided axillary brachial plexus block. Sensory onset was comparable between groups, but motor onset was significantly faster in the dexmedetomidine group. Dexmedetomidine also prolonged sensory block duration, motor block duration and postoperative analgesia, with lower rescue analgesic requirement. These findings are consistent with the pharmacological profile of dexmedetomidine as an alpha-2 adrenergic agonist that can enhance local anaesthetic action through peripheral nerve hyperpolarisation, local vasoconstriction and systemic analgesic modulation. Similar prolongation of bupivacaine-based brachial plexus block was reported by Agarwal S et al., and improved block duration with dexmedetomidine in infraclavicular block was observed by Morsi YH et al., [7,8]. A meta-analysis by Ping Y et al., also concluded that perineural dexmedetomidine prolongs sensory block, motor block and duration of analgesia in brachial plexus blocks, although sedation and haemodynamic effects may occur [9].

The analgesic outcomes in the present study further support the superiority of dexmedetomidine over ketamine. Duration of analgesia was longer in the dexmedetomidine group, VAS scores were lower at 6, 12 and 18 hours, and diclofenac consumption and number of rescue doses were reduced. Ketamine also provided effective surgical anaesthesia, but the degree of block prolongation and postoperative analgesic benefit was lower than dexmedetomidine. Lashgarinia M et al., reported that ketamine as an adjuvant in ultrasound-guided supraclavicular block reduced postoperative pain and analgesic requirement, but the effect on block characteristics was less consistent [10]. Solomos D et al., observed that ketamine supplementation in axillary plexus blockade may reduce rebound pain, although the magnitude of benefit depended on route and timing [11]. In direct comparative studies, Mohmed A et al., and Mohamed HS et al., found that dexmedetomidine produced longer sensory-motor block duration, delayed first analgesic request and reduced analgesic consumption when compared with ketamine as a brachial plexus block adjuvant [12,13]. These observations are closely aligned with the present axillary block findings.

The present study also supports earlier evidence that dexmedetomidine improves sensory and motor block characteristics across different brachial plexus approaches and local anaesthetic combinations. Gandhi R et al., demonstrated improved quality and duration of brachial plexus block when dexmedetomidine was added to bupivacaine [14]. Tripathi A et al., reported more favourable block characteristics with dexmedetomidine than clonidine as an adjunct to bupivacaine in supraclavicular block [15]. Mangal V et al., observed prolonged sensory and motor blockade when dexmedetomidine was added to ropivacaine during ultrasound-guided supraclavicular brachial plexus block [16]. Iyengar SS et al., also found dexmedetomidine to be an effective adjuvant in ultrasound-guided infraclavicular block for upper-limb surgeries [17]. These findings suggest that the block-prolonging action of dexmedetomidine is not restricted to a single anatomical approach.

Sedation, satisfaction and haemodynamic findings require balanced interpretation. In the present study, Ramsay sedation scores and patient satisfaction scores were higher in the dexmedetomidine group. Mild sedation during awake regional anaesthesia may improve patient comfort; however, excessive sedation can interfere with early neurological assessment and requires careful monitoring. Hashim RM and Hassan RM compared dexmedetomidine, ketamine and fentanyl as adjuvants to bupivacaine and reported superior analgesic performance with dexmedetomidine, accompanied by more pronounced sedation and haemodynamic reduction [18]. Iyer LS et al., similarly reported faster onset and prolonged duration of block and analgesia when dexmedetomidine was added to levobupivacaine in ultrasound-guided brachial plexus block [19]. In contrast, Akhondzadeh R et al., compared ketamine-lidocaine and fentanyl-lidocaine in ultrasound-guided axillary block and found that ketamine may contribute to postoperative analgesia, although it did not demonstrate clear superiority over other adjuvant options [20]. In the present study, bradycardia and hypotension were infrequent and manageable, and no serious block-related complication was observed.

Clinically, dexmedetomidine appears useful when longer postoperative analgesia and reduced rescue analgesic use are desired after forearm and hand surgery. Ketamine may still be considered when avoidance of alpha-2 agonist-related bradycardia or sedation is important, but its block-prolonging effect appears less predictable. The strengths of the present study include its prospective, randomised, triple-blind design, equal group allocation,

concealed intervention, uniform injectate volume, ultrasound-guided technique, predefined outcomes and complete follow-up. However.

Limitation(s)

This was a single-centre study with 30 participants per group, and follow-up was limited to the early postoperative period. Consequently, uncommon adverse events, long-term neurological safety and outcomes among elderly or high-risk patients could not be fully assessed. Only ASA I-II adults were included, limiting generalisation to elderly or high-risk patients. Fixed doses of dexmedetomidine and ketamine were used instead of weight-based doses, which may have produced variable exposure. Follow-up was limited to the early postoperative period up to 18 hours, and outcomes such as rebound pain beyond 24 hours, discharge readiness, hand function and sleep quality were not evaluated. Midazolam premedication may also have influenced sedation and satisfaction scores.

CONCLUSION(S)

Dexmedetomidine added to bupivacaine for ultrasound-guided axillary brachial plexus block provided faster motor onset, longer sensory and motor block duration, prolonged postoperative analgesia and lower rescue analgesic requirement compared with ketamine in patients undergoing forearm and hand surgery. The haemodynamic profile remained clinically acceptable, although higher sedation and occasional bradycardia were noted with dexmedetomidine. Dexmedetomidine may therefore be preferred when sustained postoperative analgesia is the main goal, provided appropriate monitoring is available.

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