Research Article

Dexmedetomidine as an Adjuvant to Bupivacaine in Brachial Plexus Block in Upper Limb Surgeries

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Abstract
Background and Objectives: Alpha-٢ agonists are mixed with local anaesthetic agents to extend the duration of spinal, extradural and peripheral nerve blocks. We used dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block with respect to onset and duration of sensory and motor block and duration of analgesia. **Methods:** Sixty ASA I and II patients scheduled for upper limb surgeries under supraclavicular brachial plexus block were divided into two equal groups in a randomized, double-blinded fashion**.** *Group (I) or control group*; will be formed of (١٥ml of ٢٪ lidocaine+١٥ml of ٠.٥٪ hypobaric bupivacaine+١٠ml ٠.٩ normal saline).*Group (DEX) or study group*; will be formed of (١٥ml of ٢٪ lidocaine+١٥ml of ٠.٥٪ hypobaric bupivacaine+٩ml of ٠.٩٪ normal saline+١ml of dexmedetomidine solution). Dexmedetomidine solution will be contacting ١ microgram per kilogram body weight dexmedetomidine).Onset and recovery time of sensory and motor block, duration of analgesia and quality of block were studied in both the groups. **Conclusion:** Dexmedetomidine when added to local anaesthetic in supraclavicular brachial plexus block enhanced the duration of sensory and motor block and also the duration of analgesia. The time for rescue analgesia was prolonged in patients receiving dexmedetomidine. It also enhanced the quality of block as compared to the control group.
Key words:dexmedetomidine, supraclavicular block.

Introduction
Upper limb surgeries are mostly performed under peripheral blocks as the brachial plexus block. peripheral nerve block not only provide intraoperative anaesthesia but also extend analgesia in the post-operative period without any systemic side-effects[(١)] There has always been a search for adjuvants to the regional nerve block with drugs that prolong the duration of analgesia with lesser adverse effects. The search continues, and led us to try the novel α-٢ adrenergic agent, dexmedetomidine.

Dexmedetomidine is a potent α٢ adrenergic receptor agonist. It has sedative, analgesic, sympatholytic and cardiovascular stabilizing effects. In humans, dexmedetomidine has also shown to prolong the duration of block and post-operative analgesia when added to local anaesthetic in various regional blocks.[(٢-٥)].

Methods
After ethical committee approval and written informed consent, a double-blind randomized prospective clinical study was carried out on ٦٠ American Society of Anaesthesiologist (ASA) Grade I and II patients of either sex, aged ١٨–٦٠ years, undergoing various bony orthopaedic surgeries on the upper limb under supraclavicular brachial plexus block. The study was conducted in two groups of ٣٠ patients each. The patients were randomly assigned using "slips in a box technique" to one of the following groups:

Group (I) or control group; will be formed of (١٥ml of ٢٪ lidocaine+١٥ml of ٠.٥٪ hypobaric bupivacaine+١٠ml ٠.٩ normal saline). Group (DEX) or study group; will be formed of (١٥ml of ٢٪ lidocaine+١٥ml of ٠.٥٪ hypobaric bupivacaine+٩ml of ٠.٩٪ normal saline+١ml of dexmede-tomidine solution).

Dexmedetomidine solution will be contacting ١ microgram per kilogram body weight dexmedetomidine).

Patients on adrenoreceptor agonist or antagonist therapy, with known hyper-sensitivity to local anaesthetic drugs, bleeding disorders, uncontrolled diabetes mellitus, pregnant women and pre-existing peripheral neuropathy, were excluded from the study.On arrival in the operation room, baseline heart rate, blood pressure and oxygen saturation were recorded.

An intravenous line was secured in the unaffected limb and Ringer's lactate was started.All the patients received brachial plexus block through supraclavicular approach by anaesthesiologist different from the one assessing the patient intra- and post-operatively. Both were blinded to the treatment groups. Neural localization was achieved by using a nerve locator (Fisher and Paykel, New Zealand) connected to a ٢٢ G, ٥٠-mm-long stimulating needle (Stimuplex, Braun, Germany).

The location end point was a distal motor response with an output lower than ٠.٥ mA in the median nerve region. Following negative aspiration, ٤٠ mL of a solution containing local anaesthetic alone or combined with dexmedetomidine as mentioned above was injected. A ٣-min massage was performed to facilitate an even drug distribution. Sensory block was assessed by the pin prick method. Assessment of sensory block was done at each minute after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pin prick along the distribution of any of the above-mentioned nerves.

Complete sensory block was considered when there was complete loss of sensation to pin prick. Sensory block was graded as-
Grade ٠: Sharp pin felt
Grade ١: Analgesia, dull sensation felt
Grade ٢: Anaesthesia, no sensation felt. Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blokade was considered when there was Grade ١ motor blockade. Peak motor block was considered when there was Grade ٢ motor blockade. Motor block was determined according to a modified Bromage scale for upper extremities on a ٣-point scale.
[Grade ٠: Normal motor function with full flexion and extension of elbow, wrist and fingers
Grade ١: Decreased motor strength with ability to move the fingers only
Grade ٢: Complete motor block with inability to move the fingers

The block was considered incomplete when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve did not have analgesia even after ٣٠ min of drug injection. When more than one nerve remained unaffected, it was considered a failed block. In this case, general anaesthesia was given intraoperatively.

Patients were monitored for haemodynamic variables such as heart rate, blood pressure and oxygen saturation every ٣٠ min after the block intraoperatively and every ٦٠ min post-operatively. Sedation of patient was assessed by the Ramsay Sedation Score.At the end of the procedure, quality of operative conditions were assessed according to the following numeric scale:
Grade ٤: (Excellent) No complaint from patient
Grade ٣: (Good) Minor complaint with no need for the supplemental analgesics
Grade ٢: (Moderate) Complaint that required supplemental analgesia
Grade ١: (Unsuccessful) Patient given general anaesthesia

Assessment of blood loss was done and fluid was administered as per the loss. Duration of surgery was noted. The intra- and post-operative assessment was done by an anaesthesiologist who was unaware of the drug used. Patients were assessed for duration of analgesia as per a numeric rating scale of ٠ to ١٠. The numeric rating scale was recorded post-operatively every ٦٠ min till the score of ٥. The rescue analgesia was given in the form of inj.

diclofenac sodium (١.٥mg/kg) intravenously at the Neumeric Rating Scale of ٥ and the time of administration was noted. All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, haematoma, local anaesthetic toxicity and post-block neuropathy in the intra- and post-operative periods.

The duration of sensory block was defined as the time interval between the end of local anaesthetic administration and the complete resolution of anaesthesia on all nerves. The duration of motor block was defined as the time interval between the end of local anaesthetic administration and the recovery of complete motor function of the hand and forearm.

Statistical analysis:
The data was analysed by SPSS version (Statistical Package for Social Sciences) software. Unpaired t-test was applied for demographic data, haemodynamic parameters, onset and duration of sensory and motor blockade and duration of analgesia. Fisher exact test was applied for assessment of quality of block. P-value was considered significant if <٠.٠٥ and highly significant if <٠.٠٠١.

Results

Eighty patients posted for upper limb surgeries were assessed for suitability to enroll in the study. Seven patients declined to participate in the study. Five patients were excluded as they were posted for soft tissue surgeries of the upper limb. Eight patients were excluded as they were found to be on beta blockers, anticoagulation drugs and had uncontrolled diabetes mellitus. The remaining ٦٠ patients fulfilling the inclusion criteria were randomly assigned to one of the two groups. There was no protocol deviation pre-operatively and intraoperatively.

Quality of block:
There were statistically significant differrences (P < ٠.٠٥) between the two groups as regards to onset time of sensory block and, onset time of motor block,and duration of sensory and motor block. Group I was significantly shorter in sensory duration (٨.٦٠٧±٠.٨٩ hr.) than group II (١٢.٢٦٣±١.٢٢ hr.) and group I was also significantly shorter in motor duration (٨.٩٨٠±٠.٥٣ hr.) than group II (١١.٧٧٧±١.٤٥ hr.) .

Table ١: Quality of block

	Group I (n=٣٠)	Group II (n=٣٠)	P value
Sensory onset (min) Range Mean ± SD	(٥-١٠) ٧.١٣±١.٥٩	(٥-٨) ٦.٣٦±١.٠٣	٠.٠٣٢*
Sensory duration (hrs) Range Mean ± SD	(٧.١٦-١٠) ٨.٦٠٧±٠.٨٩	(٩-١٤.٥) ١٢.٢٦٣±١.٢٢	< ٠.٠٠١*
Motor onset (min) Range Mean ± SD	(٨-١٤) ١٠.٤٦±١.٤٧	(٦-١٠) ١٠.١٦±١.٣٩	٠.٠٤*
Motor duration (hrs) Range Mean ± SD	(٨-١٠) ٨.٩٨٠±٠.٥٣	(٨.١٦-١٤.٢٥) ١١.٧٧٧±١.٤٥	< ٠.٠٠١*

P value <٠.٠٥ means there is significant difference between both groups.

First analgesic request:
As illustrated in figure (١) the time to ١st analgesic request was significantly longer in group II (١١.٠٤٥±١.٠٦ hr) in comparison to group I (٩.١٦٣±٠.٨١ hr).

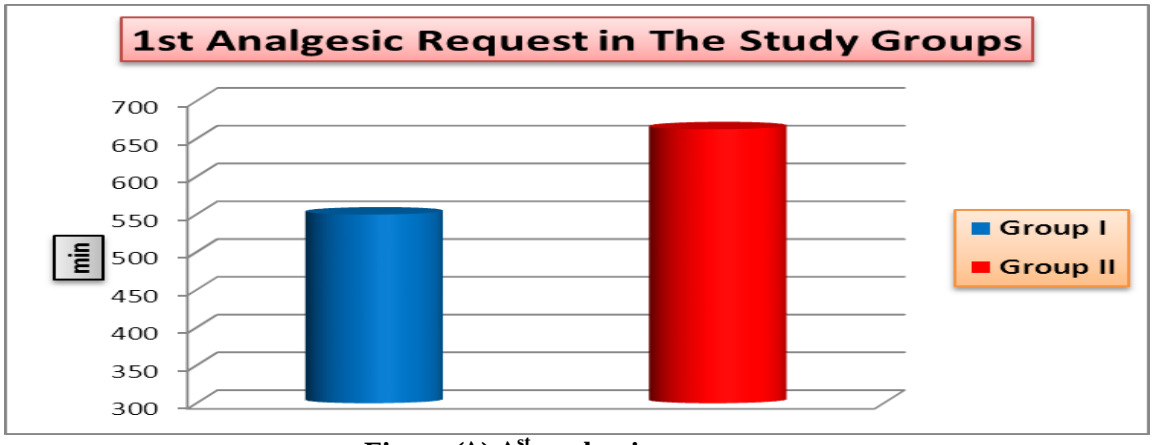
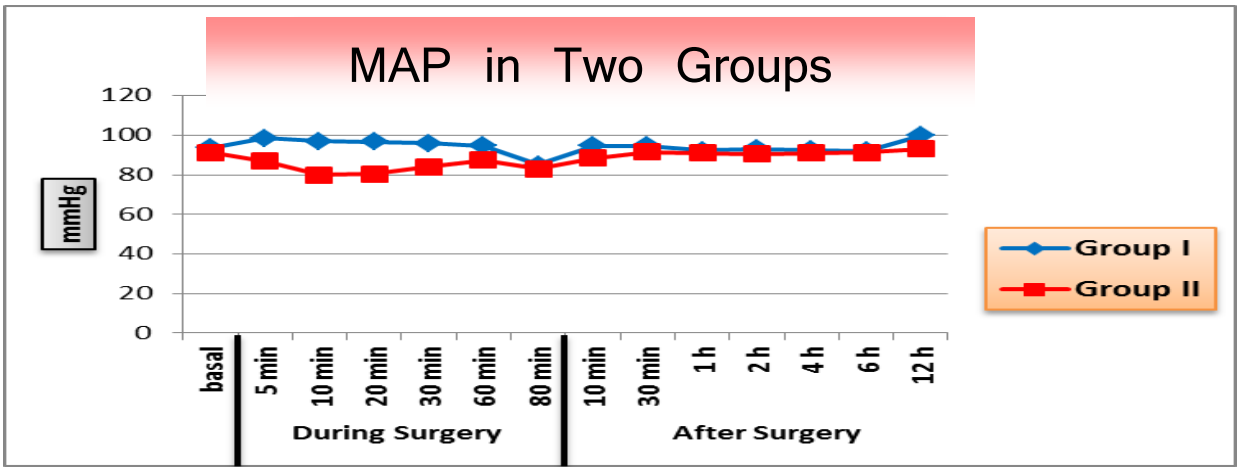
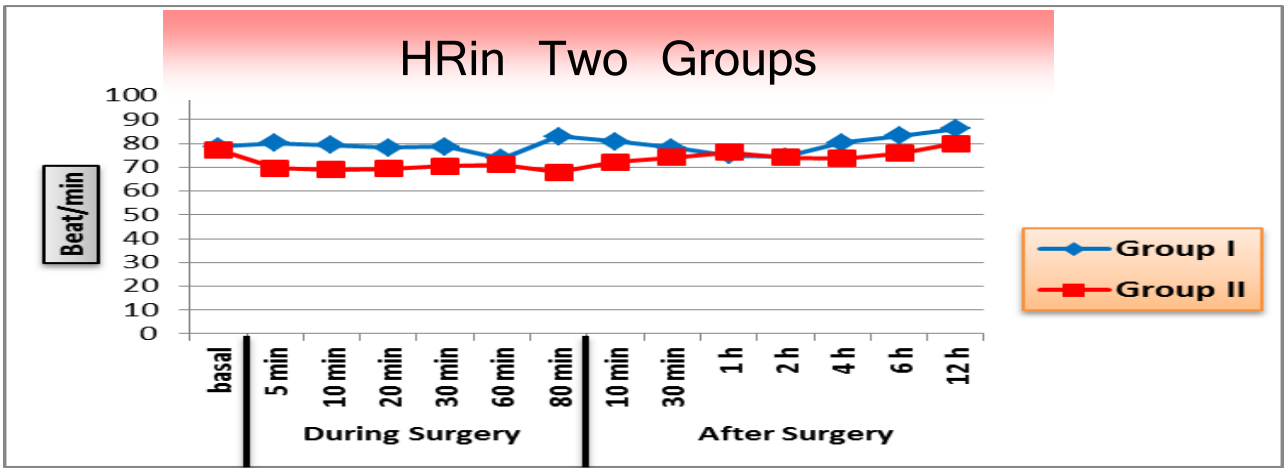


Figure (١):١st analgesic request

Mean Arterial blood Pressure (mmHg):
As illustrated in figure (٢) , the differences between the two groups at all time intervals were statistically significant except at ٦hrs and ١٢hrs after surgery.



Heart rate (beat/min.):
Between the two groups, differences were statistically significant at all time intervals except at ٦hrs and ١٢hrs after surgery as shown in figure(٣)



Sedation score:
As regard sedation score, there were significant differences between the two groups. It was higher in group II (٣.٥٦±٠.٦٢) than in group I (٠.٠٦±٠.٢٥).

Table ٢: Sedation score

	Group I (n=٣٠)	Group II (n=٣٠)	P value
Sedation Score			
Range	(٠-١)	(٢-٤)	< ٠.٠٠١*
Mean ± SD	٠.٠٦±٠.٢٥	٣.٥٦±٠.٦٢	

P value <٠.٠٥ means there is significant difference between both groups.

Discussion
In this randomized, double-blinded trial, weused dexmedetomidine (a٢agonist) as an adjuvant to Bupivacaine in supraclavicular brachial plexus block, and found that there was a significantly increased duration of sensory and motor blockade in the dexmedetomidine group than in the control group .

Conclusion
To conclude, we would like to state that dexmedetomidine prolongs the duration of sensory and motor block and enhances the quality of block as when used as an adjuvant to Bupivacaine in peripheral nerve block.

References

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