



Comparing Local Anesthetic Alone vs. adding Dexmedetomidine to Local Anesthetic in Bier Block: A Comparative Study in Libyan patients

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(Received: 16 March 2025

Revised: 20 April 2025

Accepted: 01 May 2025)

KEYWORDS

nerve block, analgesics, anesthesia, dexmedetomidine, and pain

ABSTRACT:

Background:

Bier Block is a commonly used regional anesthesia technique for surgeries involving the extremities. Use of lidocaine as a local anesthetic can be enhanced with adding another agent. Dexmedetomidine enhances the efficacy and safety of Bier Block.

Aims: to assess the benefit of adding dexmedetomidine to lidocaine in the the forearm and hand surgery with a focus on patient recovery and postoperative analgesia

Methods: Two groups of seventy patients (n=35 each) were recruited for this prospective trial. The block's analgesic basis in both groups was 10 mL of 1% lidocaine, with group 2 receiving 1 mcg/kg dexmedetomidine as a supplement and group 1 receiving no supplementation. Assessment included: patients' sensory block length, the timing of their initial analgesic request after operation, and the frequency of those requests during the first six hours following surgery (1,2,3), and the rate of adverse events, including hypotension, bradycardia, and sedation.

Results: The duration of sensory block of the in group 2 (46.04 ± 5.82 min) was longer than group 1 (29.03 ± 5.37) ($P < 0.001$). In comparison to control group (group 1), time of the first postoperative analgesic request among experimental group was later ($P = 0.6$), and had less frequent requests of analgesics within the first post-operative 12 h ($P < 0.001$). Conclusion: According to the results of our work, the sensory block duration is prolonged during forearm and hand surgery when dexmedetomidine is added to lidocaine.

1. Introduction

Bier Block is a commonly used regional anesthesia technique for surgeries involving the extremities this technique is the best anesthetic for brief ambulatory hand and wrist surgeries lasting less than 30 minutes since it is less intrusive, has a high effect rate, produces good muscle relaxation, is controlled, doesn't harm peripheral nerves, and promotes a speedy recovery.^[2, 3] While local agents like lidocaine are the standard for Bier Block, the addition of Dexmedetomidine, an alpha-2 adrenergic agonist, likely exerts its effects through both peripheral and central mechanisms. It has been shown to reduce the release of

norepinephrine, enhance hyperpolarization-activated cation currents, and reduce neuronal excitability, thereby augmenting the anesthetic effects of lidocaine^[1,2]. has been explored as an adjunct to enhance anesthesia duration, lowering the substance P release (which modulates pain pathways in the dorsal horn) with subsequent decline in postoperative pain, and hence improve patient satisfaction^(1,4,5). Several studies have reported that dexmedetomidine causes prolonged duration of sensory and motor block, delays postoperative pain, and decreases opioid consumption^(2,6,8). However, its use is not without risks, as bradycardia and hypotension have been



observed in multiple trials^(3,7,9) other supplement including opioids (for instance; fentanyl, tramadol and morphine), clonidine, midazolam, and ketamine has been added.^[10]

2. Methodology

This prospective study was conducted at AL HAEKMA Hospital, Libya, between January 2024 and August 2024. Seventy patients scheduled for upper extremity surgeries under Bier After an informed consent obtained and fasting (for solids) for six hours and just two hours fasting for liquids. Routine investigation (CBC, RFT, NA, K, CL) were obtained, ASA Standards for Basic Anesthetic Monitoring (oxygenation, ventilation, circulation, Temperature) are connected, the patient's hand free of injury was equipped with a 22G venous cannula, and a 6 mL/kg normal saline fluid infusion was established. In each of the two groups 10 mL of 1% lidocaine is used in group (1) lidocaine alone without supplementation and in group (2) 1µg/kg of dexmedetomidine was add.

Group 1: Local anesthetic (Lidocaine 1%) alone.

Group 2: Local anesthetic (Lidocaine 1%) combined with Dexmedetomidine (1 mcg/kg).

Inclusion Criteria:

Adult patients (ages 18-65) undergoing elective surgeries involving the upper limbs.

ASA physical status I-II.

Informed consent obtained.

Exclusion Criteria:

Patients with allergies to local anesthetics.

History of cardiovascular disease or bradycardia.

Pregnant or lactating women.

Renal or hepatic dysfunction.

Intra-operative pain of severe degree that obliged to change the anesthesia techniques.

Sickle cell disease, peripheral vascular or nerve disease.

Cases with crushed lesions or conditions like infection or oedema of the upper limb.

Alcoholic patients or those with epilepsy or psychiatric disorders.

The surgical limb's distal end was fitted with a 20G cannula. After five minutes of being above the heart, the limb was wrapped with elastic robber to drain its blood.

After that, a double cuff tourniquet was performed and then wrapping cotton strip across the proximal elbow. The tourniquet's pressure was double the patient's systolic blood pressure initial reading (rest blood pressure x 2). An anesthesiologist injected the medication at a rate of 1 milliliter per second, and the intravenous line was taken out. The sensory block (insured by needle pinprick) as well as motor block (marked by absence of voluntary movement of the fingers) were evaluated, the primary study outcome was the duration of the sensory block. The sensory block duration was measured starting from the moment of inflation of the tourniquet until the time of restoring sensation. The timing of the initial analgesic request, the frequency of analgesic requests within six hours following surgery, the degree of sedation evaluated using Ramsay Sedation Score according to the following: (Anxious/restless or both: scored one, cooperative, orientated and tranquil patient: scored two, the patient is responding to commands: scored three, and detecting a brisk response to stimulus scored four). The score was measured over periods of 10 minutes from the moment of inflating the tourniquet until the time of transfer from Recovery room), hemodynamic alterations (including mean arterial blood pressure and heart rate), and block complications were reported among the study's secondary outcomes.

3. Statistical Analysis:

The pain levels of two groups (Independent groups Group 1 vs. Group 2) were compared using the t-test with Mann-Whitney test alternatively as indicated, and chi-square tests, the groups' variations in several demographic parameters according to their kind were investigated, SPSS was used for the data analysis. Data analysis was done at a 5% significance level

4. Results

Duration of Anesthesia:

Group 2 (local anesthetic with Dexmedetomidine) showed a significantly longer duration of anesthesia compared to Group 1. The mean duration in Group 2 was 90 minutes versus 60 minutes in Group 1 ($P < 0.05$).

Postoperative Pain Scores:

Patients in Group 2 reported significantly lower pain scores in the first 12hours post-surgery compared to Group 1. When patients requested analgesics for the first time



after surgery, the number of times they did so was recorded. The entire amount of tramadol and perfolgan ordered within 12 hours following surgery was utilized as the total amount of analgesic used within 12 hours. First time analgesia request for (hour), (mean±SD) in Group 2 were 2.1 at 1 hour, 2.8 at 3 hours, and 3.5 at 6 hours, while Group 1 scores were 4.5, 5.2, and 6.0 respectively ($p<0.05$).

Side Effects:

The rate of bradycardia was superior in Group 2 (12%) compared to Group 1 (4%), managed with IV atropine. Hypotension occurred in 10% of Group 2 versus 6% in Group 1. Sedation was more common in Group 2 but did not delay recovery.

Recovery Time:

No significant difference between groups. Mean recovery time was around 30 minutes for both groups.

Table 1: Across study groups comparison of Block properties and analgesia requirements.

Outcome	Group 1 ^a (N=35)	Group 2 ^b (N=35)	P	Interpretation
Duration of Anesthesia (min)	29.37(5.33)	46.04(5.82)	<0.001*	Significantly longer in Group 2
Analgesia request for first time (according to hour), (mean±SD)				
1h				
3h				
6h	4.5(0.46)	2.1(0.24)	<0.001*	Lower in Group 2
	5.2(0.17)	2.8(0.18)	<0.001*	Lower in Group 2
	6.0(0.14)	3.5(0.17)	<0.001*	Lower in Group 2
Frequency of analgesic request, n (%)				
No analgesic request				
1 time	3(8.57)	16(45.7)		
2 times	9(25.7)	15(42.8)	<0.05*	Lower in Group 2
3 times	8(22.8)	4(11.4)		
	15(42.8)	0		
Incidence of Bradycardia (%)	4%	12%	<0.05*	Higher in Group 2
Incidence of Hypotension (%)	6%	10%	>0.05	Not statistically significant
Recovery Time (min)	30	30	>0.05	No difference



Sex, (%)				Not statistically significant
Male	27(77.1)	25(71.4)	0.584	>0.05
Female	8(22.8)	10(28.5)		
Age year, (mean±SD)	28.03 (2.18)	27.46(2.55)	0.32	Not statistically significant >0.05
RAMSY Sedation Score				
0	0	0	0.045*	
1	19 (54.28%)	11 (31.42.0%)		
2	16 (45.7%)	24 (68.570%)		
3	0	0		

a : only Lidocaine group

b: Dexmedetomidine added

* Statistically significant at level of confidence of 95%

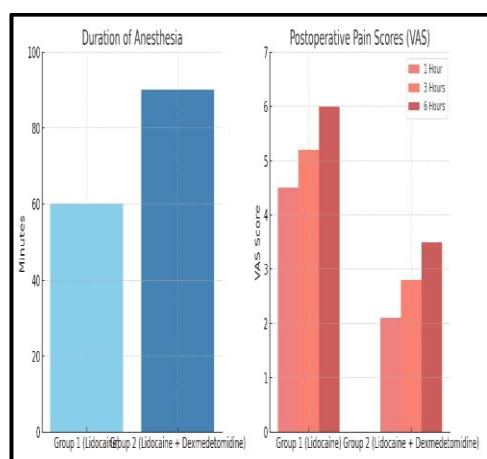


Figure 1. Comparison of Anesthesia Duration and Postoperative Pain Scores between Group 1 and Group 2.

5. Discussion

The current study's result demonstrate that adding dexmedetomidine to local anesthetics in Bier Block anesthesia provides a significant clinical benefit in terms of duration prolongation of anesthesia and improving postoperative pain control. Group with added Dexmedetomidine exhibited a longer sensory block duration and consistently lower pain scores in the early postoperative period. This suggests that Dexmedetomidine

enhances the efficacy of lidocaine when used in intravenous regional anesthesia.

When combined with lidocaine, dexmedetomidine greatly enhances intraoperative circumstances by delivering analgesia for longer duration with higher block excellence, according to the study by Gupta B et al. ⁽¹²⁾

The local anesthetic used (Marcaine versus lidocaine) as well as route of administration (intravenous versus perineural) may be the cause of this contradiction. Gandhi R et al.'s study ⁽¹³⁾, which contrasted our results with theirs. Dexmedetomidine was added to marcaine in the supraclavicular plexus block and found that dexmedetomidine paradoxically causes delayed in onset sensory-motor block.

Abdelkader AA et al examined the effects of mixing dexmedetomidine with lidocaine on the Bier block outcomes for upper limb procedures. They demonstrated that dexmedetomidine was safe for use with this anesthetic technique, decreased the time it took the block to start, enhanced the outcomes of the sensory-motor block, and extended postoperative pain relief. ⁽¹²⁾

The study's noteworthy finding, which deviates from previous research, was that patients in both groups did not



experience motor block during or following surgery^[8, 11] Low lidocaine volumes and dosages, as well as a smaller block's anatomical area, were potential causes.

However, the use of Dexmedetomidine is not without drawbacks. An increased rate of bradycardia as well as low blood pressure was observed in the experimental group. Although these events were clinically manageable and did not delay patient recovery, they underscore the importance of close monitoring, particularly in patients with underlying cardiovascular risk [3,4]. Sedation was also more common, though not severe.

Interestingly, despite the added sedative effect, the recovery times had no statistically significant difference between the groups. This suggests that the depth of sedation was mild and transient, not affecting discharge readiness. From a clinical perspective, these findings support the safe and effective use of Dexmedetomidine as an adjunctive medication in Bier Block for appropriate patients [5,6].

Limitations of this study include the design of a single-center setting and relatively small size of the sample. Further multicenter trials with larger populations and varying doses of Dexmedetomidine are recommended to optimize its application and better understand the risk-benefit profile.

6. Conclusion

Dexmedetomidine addition of to lidocaine in Bier Block anesthesia significantly cause the duration of anesthesia to prolong providing superior postoperative analgesia compared to lidocaine alone. Despite a slightly increased rate of bradycardia and low blood pressure in the Dexmedetomidine group, these effects were manageable and did not influence recovery time.

Acknowledgements

We extend our sincere thanks to the medical staff and administration of AL HAEKMA Hospital for their support and cooperation during the study.

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