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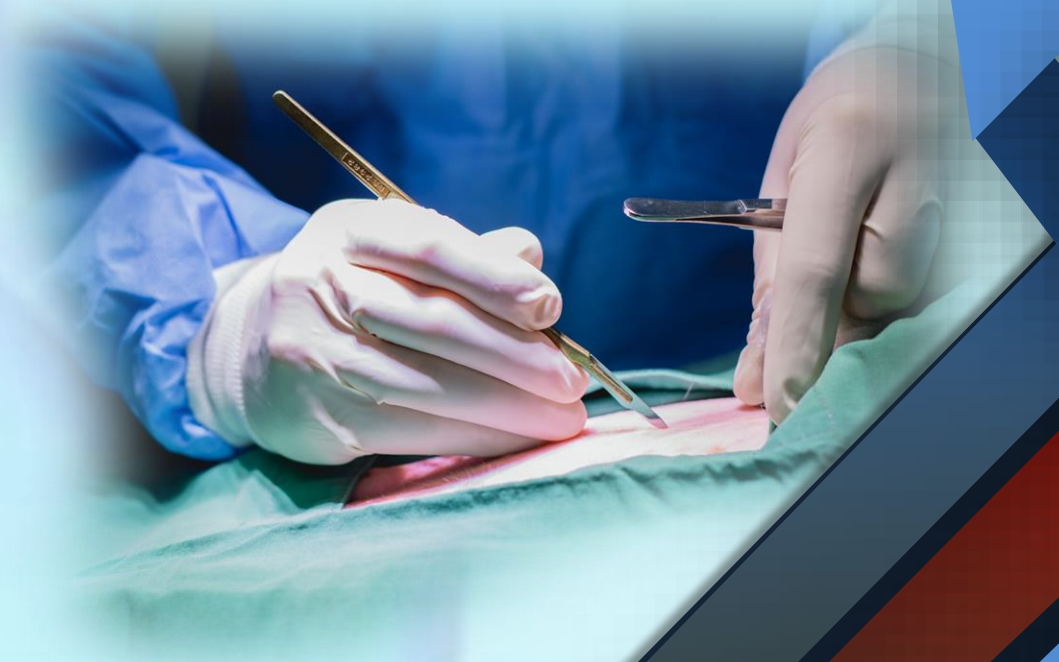

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Original article

Atracurium with or without Dexmedetomidine as an Adjuvant to Lignocaine for Intravenous Regional Anesthesia in Upper Limb Surgeries

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ABSTRACT

Background: The use of adjuvants in intravenous regional anesthesia [IVRA] for upper limb surgeries seems to increase efficacy and reduce side effects. Trials are continued to reach the ideal combination.

Aim of the work: The study aimed to evaluate the efficacy and safety of IVRA for upper limb surgery using different adjuvants [atracurium and dexmedetomidine].

Patients and methods: 120 patients scheduled for elective upper limb surgeries were included. Patients were divided randomly into four equal groups. Group I received 40 ml lignocaine 0.5% alone, group II: received 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg], group III received 40 ml [lignocaine 0.25% plus atracurium 2 mg], and group IV received 40 ml [[lignocaine 0.25% plus dexmedetomidine 50 µg and atracurium 2 mg]. surgery duration, quality of anesthesia, postoperative analgesia, and hemodynamics were monitored.

Results: The onset of sensory and motor block was significantly shorter in groups II and IV than in group I or III. Also, both sensory and motor block were significantly shorter in group IV when compared to group II [2.53±0.57, 3.60±0.62 vs. 3.33±0.54 and 5.20±0.84 respectively]. Besides, the pain was significantly lower in groups II and IV than groups I or III after deflation at 5, 15, 30, 60 minutes, and up to 8 hours. The need for postoperative analgesia was significantly higher among groups I and III when compared to groups II and IV [56.7%, 63.3% vs. 30.0% and 20.0%, respectively]. No major adverse events were reported.

Conclusion: The use of dexmedetomidine as an adjuvant had a significantly better postoperative analgesia, longer duration of sensory and motor block, and earlier onset of action. In addition, the use of atracurium besides dexmedetomidine improves the quality of IVRA.

Keywords: Intravenous regional anesthesia; Upper limb surgery; Lignocaine; Dexmedetomidine; Atracurium.

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* Main subject and any subcategories have been classified according to the research topic.

INTRODUCTION

Regional anesthesia represented the corner-stone of modern anesthetic clinical practice. It benefits from technological advancements; and had many advantages [e.g., increased patient satisfaction, quick recovery, and enhanced safety][1]**.** Intravenous regional anesthesia is typically used for upper limb surgery lasting less than an hour, being an effective, reliable, simple, and safe technique with minimal complications. However, it is not devoid of unwanted effects [e.g., local anesthetic toxicity, delayed onset of action, poor muscle relaxation, tolerance of tourniquet time is short, rapid onset of post-deflation pain][2]**.**

The selection of drugs for intravenous regional anesthesia is challenging; the ideal solution must have a rapid onset, satisfactory potency, prolonged post-deflation analgesia, and reduced tourniquet pain. This could be achieved by using adjuvants to the local anesthetic solution. Anesthesiologist uses different adjuvants with different concentrations, aiming to increase efficacy and reduce side effects. Different drugs were tried [e.g., tramadol, nalbuphine, butorphanol, and ketorolac][3-5]**.**

Lignocaine is the most frequent drug used in local or regional intravenous anesthesia. However, it had many disadvantages, such as a relatively short duration of action [with limitations of postoperative analgesia]. The use of adjuvant could reduce such effects and increase its potency[6]**.**

Choyce and Peng[7] conducted a systematic review of adjuncts for intravenous local anesthetics and reported that opioids, muscle relaxants, non-steroidal anti-inflammatory drugs [NSAIDS], sodium bicarbonate, and potassium. They suggested that NSAIDS is the most potential, while opioids are disappointing adjuncts to local, intravenous anesthesia.

Alpha-2 [α2] agonists are used with local anesthetics to reduce their overall dose and the risk of its toxicity. Besides, α2 agonists improved the anesthesia quality and prolonged the postoperative analgesic effects, with reduction of adverse effects[8]**.**

As an imidazole compound, dexmedetomidine is highly selective and specific to α_2 receptors. Intravenous [iv] dexmedetomidine, added to regional anesthetics, prolonged sensory and motor blockade duration with sedative and postoperative analgesic effects[9-10]**.** The search for the optimal intravenous regional anesthetic adjunct that improves efficacy and, at the same time, limit side effects is ongoing. The present study is one of these trials.

AIM OF THE WORK

The current study aimed to evaluate the efficacy and safety of intravenous regional anesthesia for upper limb surgery using the original Bier's technique and different adjuvants [Atracurium with or without Dexmedetomidine]

PATIENTS AND METHODS

The current study was performed at Al-Azhar university hospital [Damietta] after Research and Ethics Committee approval; 120 patients of both sexes, age between 25 – 70 years; ASA I-II who were submitted to elective upper limb surgeries were included. They were selected during the period from January 2020 to October 2020. Patients were divided randomly by sealed envelopes into four equal groups [n=30]. Group I [L]: Patients received 40 ml lignocaine 0.5% alone. Group II Patients received 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III received 40 ml [lignocaine 0.25% plus atracurium 2mg], and group IV: patients received 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50 µg and atracurium 2mg].

Exclusion criteria were: any significant coexisting diseases, including severe renal or hepatic disease, any contraindications to regional anesthesia, such as local infection or bleeding disorder or allergy to local anesthetic, patient refusal to give consent, and neuropathy.

Sample size calculation depended on prolonging the duration of postoperative analgesia. A total of 26 patients in each group were needed to detect a difference at the 5% significance level and give the trial 80% power. With a 10% dropout rate, 30 patients were needed in each group.

Preoperative evaluation included a detailed history, physical examination, and investigations [complete blood count, kidney function tests, liver function tests, prothrombin time, and international normalized ratio].

After the patient arrived at the theatre, a 20G intravenous line was inserted, and fluid [normal saline] administration started at 10ml/kg. A double pneumatic tourniquet was then placed around the operative upper limb, over a pad of cotton. The upper limb was elevated for 2 min then exsanguinated with a bandage. The proximal cuff was inflated to 100 mmHg above the patient's systolic pressure. The upper limb's circulatory isolation was verified by inspection through the absence of radial pulse and loss of pulse oximetry tracing in the ipsilateral index finger. Then, intravenous regional anesthesia [IVRA] drugs were administered according to groups. At the end of the surgery, a cyclic deflation technique was used to deflate the tourniquet. Baseline hemodynamic parameters [means arterial pressure [MAP], heart rate, peripheral oxygen saturation [SpO_2]], and electrocardiograms were monitored. Two minutes after the end of the injections, the surgical area was checked with the pinprick test at two minutes' interval. Besides, hemodynamic parameters were recorded every 5 minutes for 30 minutes and every 10 minutes for 60 minutes and at 2, 4, 8, 12, 16, 20, and 24 hours.

Sensory block was assessed by pinprick and touch, with 3-point scale [0 = No sensory loss, 1 = Loss of sensation to pinprick, 2 = Loss of sensation to touch]. On the other side, the motor block was evaluated by thumb abduction [radial nerve], thumb adduction [ulnar nerve], thumb opposition [median nerve], and flexion at the elbow [musculocutaneous nerve] on a 3-point scale for motor function: 0 - normal motor function, 1 - reduced motor strength but able to move fingers, 2 - complete motor block.

The intraoperative pain score was assessed by a visual analogue scale, then at 5 and 15 minutes after deflation of the tourniquet. Then assessed postoperatively at 30 minutes, 60 minutes, 2, 4, 8, 12, 16, 20, and 24 hours. The Ramsay sedation score [RSS] was used for sedation after deflation and for the first hour. The presence of any complications and their frequency were documented, such as bradycardia, hypotension, and hematoma formation. Finally, the time of the first analgesic request and total dose of postoperative analgesia were documented. Additional postoperative analgesia was achieved according to the patient's request by ketorolac 30 mg/IV.

Statistical analysis of data: Data were expressed as mean values±standard deviation, percentages [%], and numbers [n]. A statistical Package performed the statistical analysis for Social Science [SPSS] version 20 [IMB®SPSS®, Inc., Chicago, Illinois, USA]. Two statistical tests were primarily used to analyze the difference between numerical data, and p value<0.05 was considered statistically significant. 1] t-tests were used to analyze differences between the two groups. 2] Analysis of variance [ANOVA] to analyze differences in more than two means. However, the Chi-square test was used to compare categorical data.

Ethical considerations: the study protocol was approved by the local research and ethics committee. In addition, patient consent provided informed consent to participate in the study. The study was conducted according to the codes of the declaration of Helsinki.

RESULTS

In the present work, study groups were comparable regarding patient age, gender, ASA class, and surgery duration. However, the onset of sensory and motor block was significantly shorter in groups II and IV than in groups I or III. Besides, both sensory and motor block were significantly shorter in group IV when compared to group II [2.53±0.57, 3.60±0.62 vs. 3.33±0.54 and 5.20±0.84 respectively] [Table 1].

Intraoperative pain was significantly lower in group IV than groups I and III [1.53±0.50 vs. 1.90±0.61 and 1.73±0.44 respectively]. Also, pain score was significantly lower in groups II and IV than group I or III after deflation at 5, 15, 30, 60 minutes, and at 2, 4, and 8 hours. Additionally, the pain score was lower in group IV than group III at the same times [from 5 minutes to 8 hours after deflation] [Table 2].

Regarding sedation score, it was significantly higher among groups II and IV compared to either group I or III, five minutes after deflation of the cuff. At 15 minutes, although there was a non-significant variance between the four groups, there was a significant decrease of RSS in group III when compared to group II [1.13±0.34 vs. 1.27±0.45

respectively] [group 3] [Table 3].

Table [4] revealed hemodynamic stability among studied groups intraoperatively and post-deflation until the end of the first day [Table 4, a,b,c].

In the current study, the need for postoperative analgesia was significantly higher among groups I and III when compared to groups II and IV [56.7%, 63.3% vs. 30.0% and 20.0%, respectively]. The first analgesic request time was significantly shorter, and total postoperative analgesics were significantly higher in groups I and III than in groups II and IV. Finally, restlessness was confined to the group I and reported in 20.0% of group I [Table 5].

Table [1]: Patient demographics, onset of sensory and motor blocks among studied groups

Variable		Group I	Group II	Group III	Group IV	Test	P
Age [years]		51.93±10.09	52.36±7.44	49.43±8.33	48.36±8.76	1.47	0.22
Sex	Male	17[56.7%]	15[50.0%]	19[63.3%]	20[66.7%]	2.03	0.56
	Female	13[43.3%]	15[50.0%]	11[36.7%]	10[33.3%]		
ASA	I	16[53.3%]	14[46.7%]	18[60.0%]	15[50.0%]	1.17	0.76
	II	14[46.7%]	16[53.3%]	12[40.0%]	15[50.0%]		
Duration of surgery [min]		51.30±4.64	52.00±4.11	51.83±4.16	50.46±5.23	0.68	0.56
Onset of sensory block [min]		6.83±1.14	3.33±0.54$^{\#}$	6.60±1.00$^{\$}$	2.53±0.57$^{\#\$@}$	***198.90***	***<0.001****
Onset of motor block [min]		9.00±1.28	5.20±0.84$^{\#}$	8.60±0.89$^{\$}$	3.60±0.62$^{\#\$@}$	***232.89***	***<0.001****

*Group I [L]: lignocaine 0.5% alone. Group II: 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III: 40 ml [lignocaine 0.25% plus atracurium 2mg], group IV: 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50µg and 50 atracurium 2mg]. *: significant variance between groups, #: significant difference when compared to the first group, $: significant difference when compared to group II, @: significant difference when compared to group III. ASA: American Society of Anesthesiology, VAS: Visual Analogue scale, RSS: Ramsay sedation score*

Table [2]: Pain assessment among studied groups [Visual Analogue Scale]

Variable	Group I	Group II	Group III	Group IV	Test	P
Intraoperative pain	1.90±0.61	1.73±0.44	1.80±0.48	1.53±0.50$^{\#@}$	***2.70***	***0.049****
VAS, 5 minutes after deflation	1.23±0.43	0.90±0.48$^{\#}$	1.13±0.34$^{\$}$	0.70±0.47$^{\#\$@}$	***9.13***	***<0.001****
VAS, 15 minutes after deflation	2.10±0.61	1.43±0.50$^{\#}$	1.90±0.66$^{\$}$	1.20±0.61$^{\#@}$	***14.34***	***<0.001****
30 minutes PO	2.17±0.60	1.37±0.49$^{\#}$	2.10±0.54$^{\$}$	1.17±0.59$^{\#@}$	***24.91***	***<0.001****
60 minutes PO	2.50±0.86	1.57±0.57$^{\#}$	2.73±0.98$^{\$}$	1.26±0.45$^{\#@}$	***27.15***	***<0.001****
2 hours	2.63±0.89	1.70±0.60$^{\#}$	2.87±0.97$^{\$}$	1.40±0.50$^{\#@}$	***25.82***	***<0.001****
4 hours	2.77±0.94	1.77±0.63$^{\#}$	2.97±0.96$^{\$}$	1.50±0.51$^{\#@}$	***25.68***	***<0.001****
8 hours	2.90±0.96	2.23±1.0$^{\#}$	3.23±0.89$^{\$}$	2.06±0.74$^{\#@}$	***11.07***	***<0.001****
12 hours	3.20±0.85	3.24±0.86	3.10±0.84	3.0±0.91	0.97	0.40
16 hours	2.87±0.78	2.90±0.76	3.0±0.74	2.97±0.76	0.19	0.90
20 hours	2.67±0.71	2.70±0.70	2.80±0.71	2.67±0.66	0.25	0.86
24 hours	2.37±0.49	2.43±0.50	2.47±0.50	2.33±0.61	0.40	0.76

*Group I [L]: lignocaine 0.5% alone. Group II: 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III: 40 ml [lignocaine 0.25% plus atracurium 2mg], group IV: 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50µg and 50 atracurium 2mg]. *: significant variance between groups, #: significant difference when compared to the first group, $: significant difference when compared to group II, @: significant difference when compared to group III.*

Table [3]: Sedation score [RSS] among studied groups

Variable	Group I	Group II	Group III	Group IV	Test	P
RSS, 5 minutes after deflation	1.13±0.34	2.27±0.45$^{\#@}$	1.67±0.37	2.50±0.73$^{\#@}$	***61.88***	***<0.001****
RSS, 15 minutes after deflation	1.17±0.37	1.27±0.45	1.13±0.34$^{\$}$	1.23±0.43	0.68	0.56
RSS, 30 minutes after deflation	1.03±0.18	1.13±0.35	1.03±0.18	1.17±0.38	1.71	0.16
RSS, 60 minutes after deflation	1.06±0.25	1.10±0.31	1.03±0.18	1.13±0.34	0.71	0.54

*Group I [L]: lignocaine 0.5% alone. Group II: 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III: 40 ml [lignocaine 0.25% plus atracurium 2mg], group IV: 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50µg and 50 atracurium 2mg]. *: significant variance between groups, #: significant difference when compared to the first group, $: significant difference when compared to group II, @: significant difference when compared to group III. RSS: Ramsay sedation score.*

Table [4a]: Hemodynamics [Heart rate] among studied groups

Variable	Group I	Group II	Group III	Group IV	Test	P
HR-basal	76.0±3.0	77.0±5.0	75.0±2.0	76.0±4.0	1.06	0.36
HR 5 minutes	76.5±3.3	77.5±4.9	76.0±2.6	77.0±4.3	0.85	0.47
HR-10 minutes	77.7±3.1	78.7±4.2	77.2±2.1	78.1±3.2	1.16	0.32
HR- 15 minutes	77.5±1.9	77.1±3.6	77.6±2.0	76.6±2.2	0.96	0.41
HR-20 minutes	77.7±1.8	77.5±3.3	77.9±1.8	78.0±1.8	0.92	0.44
HR-25 minutes	77.0±1.8	76.8±2.7	77.2±1.6	76.3±1.6	1.01	0.39
HR-30 minutes	77.5±1.6	77.2±2.5	76.8±1.8	76.3±1.6	2.2	0.10
HR-40 minutes	77.5±1.7	77.2±2.6	76.8±1.9	76.3±1.7	2.1	0.12
HR-50 minutes	77.7±1.7	77.1±2.5	76.7±1.9	76.3±1.6	1.93	0.18
HR-60 minutes	77.5±1.8	77.2±2.6	76.7±1.9	76.3±1.5	2.1	0.09
HR-2 hours	77.6±1.8	77.1±2.5	76.8±1.8	76.3±1.7	1.10	0.30
HR-4 hours	77.5±1.7	77.1±2.4	76.7±1.7	76.3±1.6	0.93	0.48
HR- 8 hours	77.5±1.8	77.0±2.5	76.6±1.9	76.2±1.5	1.9	0.22
HR- 12 hours	76.5±1.7	76.2±2.6	75.7±1.7	75.3±1.3	1.47	0.20
HR- 16 hours	75.6±1.4	75.1±2.4	75.6±1.9	75.2±1.4	1.56	0.19
HR-20 hours	74.5±1.7	74.2±2.5	74.5±1.7	74.1±1.2	1.50	0.20
HR-24 hours	74.7±1.9	74.0±2.3	74.7±1.4	74.3±1.6	1.90	0.18

Table [4b]: Hemodynamics [mean arterial pressure] among studied groups

Variable	Group I	Group II	Group III	Group IV	Test	P
MAP-basal	85.3±3.5	85.7±3.3	86.4±3.1	85.9±2.9	0.67	0.57
MAP 5 minutes	84.7±3.1	84.7±2.9	86.3±2.9	85.2±2.6	1.98	0.12
MAP-10 minutes	85.2±3.1	84.1±2.8	85.7±2.6	84.9±2.4	1.70	0.16
MAP- 15 minutes	84.5±2.9	84.1±2.6	85.4±2.3	84.4±2.0	1.55	0.21
MAP-20 minutes	83.8±2.6	83.4±2.5	84.7±2.1	83.5±1.9	1.93	0.13
MAP-25 minutes	83.1±2.4	82.9±2.4	83.8±1.9	82.5±1.9	2.02	0.11
MAP-30 minutes	82.6±2.2	82.0±2.2	82.8±1.9	82.2±1.5	0.96	0.41
MAP-40 minutes	83.1±2.6	83.2±2.5	83.9±1.8	83.1±1.8	0.95	0.42
MAP-50 minutes	83.2±2.6	83.4±2.5	82.0±3.2	83.0±2.5	1.51	0.21
MAP-60 minutes	5.1±2.6	84.6±1.3	84.4±2.4	84.5±1.5	0.75	0.52
MAP-2 hours	83.7±2.6	8.4±2.5	83.0±2.6	83.0±2.8	0.45	0.71
MAP-4 hours	83.2±2.6	83.6±2.5	83.2±2.6	83.5±2.8	0.20	0.89
MAP- 8 hours	82.9±2.7	83.7±2.4	82.9±2.7	83.5±2.7	0.74	0.53
MAP- 12 hours	83.6±2.4	83.4±2.5	82.9±2.8	83.5±2.4	0.46	0.71
MAP- 16 hours	84.4±1.9	84.1±2.0	84.4±1.8	84.5±2.0	0.21	0.89
MAP-20 hours	83.9±2.3	83.7±2.6	84.4±2.6	83.8±2.2	0.58	0.63
MAP-24 hours	83.5±2.5	83.4±2.5	83.7±2.4	83.5±2.5	0.05	0.99

Table [4C]: Hemodynamics [oxygen saturation] among studied groups

	Group I		Group II		Group III		Group IV		Test	p
	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D		
SpO_2-basal	97.77	0.86	97.67	0.66	97.73	0.87	97.97	0.85	0.755	0.52
SpO_2 5 minutes	97.90	0.84	98.00	0.79	97.90	0.84	98.00	0.79	0.150	0.93
SpO_2-10 minutes	97.89	0.88	98.00	0.74	97.90	0.88	98.00	0.74	0.159	0.92
SpO_2- 15 minutes	97.96	0.82	97.90	0.80	98.00	0.83	97.90	0.80	0.108	0.95
SpO_2-20 minutes	98.00	0.83	97.90	0.80	98.00	0.83	97.90	0.80	0.142	0.93
SpO_2-25 minutes	97.95	0.84	97.93	0.83	97.97	0.81	97.93	0.83	0.012	0.99
SpO_2-30 minutes	97.95	0.83	97.90	0.84	98.00	0.79	97.90	0.84	0.100	0.96
SpO_2-40 minutes	98.00	0.82	97.87	0.86	98.03	0.76	97.87	0.86	0.317	0.81
SpO_2-50 minutes	97.94	0.80	97.90	0.88	98.00	0.74	97.90	0.88	0.097	0.96
SpO_2-60 minutes	97.88	0.81	98.00	0.83	97.90	0.80	98.00	0.83	0.156	0.92
SpO_2-2 hours	97.92	0.86	98.00	0.83	97.90	0.80	98.00	0.83	0.108	0.95
SpO_2-4 hours	97.95	0.83	97.90	0.84	98.00	0.79	97.90	0.84	0.100	0.96
SpO_2P- 8 hours	97.95	0.84	97.93	0.83	97.97	0.81	97.93	0.83	0.012	0.99
SpO_2- 12 hours	98.00	0.83	97.90	0.80	98.00	0.83	97.90	0.80	0.142	0.93
SpO_2- 16 hours	97.96	0.82	97.90	0.80	98.00	0.83	97.97	0.85	0.076	0.97
SpO_2-20 hours	97.90	0.83	97.97	0.85	97.93	0.78	97.97	0.85	0.032	0.99
SpO_2-24 hours	97.88	0.78	97.93	0.91	97.97	0.72	97.90	0.84	0.051	0.98

Group I [L]: lignocaine 0.5% alone. Group II: 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III: 40 ml [lignocaine 0.25% plus atracurium 2mg], group IV: 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50µg and 50 atracurium 2mg].

Table [5]: Outcome among studied groups

Variables		Group I	Group II	Group III	Group IV	Test	P
Need for PO analgesia		17[56.7%]	9[30.0%]	19[63.3%]	6[20.0%]	***15.92***	***0.001****
Time for first analgesic request		4.8±3.8; 1-12	10.2±2.1;8-12	4.1±4.2;1-12	11.3±1.6;8-12	***11.23***	***<0.001****
Total PO analgesics [mg]		53.3±12.8	33.3±10.0	53.7±12.6	35.0±12.3	***9.07***	***<0.001****
Adverse Effects	Restless	6[20.0%]	0[0.0%]	0[0.0%]	0[0.0%]	***18.94***	***0.001****
	Bradycardia	2[6.7%]	4[13.8%]	1[3.3%]	3[10.0%]	2.31	0.51
	Fasciculation	14[13.3%]	0[0.0%]	1[3.3%]	1[3.3%]	6.31	0.097
	Drowsiness	5[16.7%]	4[13.8%]	3[10.0%]	3[10.0%]	0.83	0.84
	Nausea	0[0.0%]	0[0.0%]	0[0.0%]	0[0.0%]	-	-
	Vomiting	0[0.0%]	0[0.0%]	0[0.0%]	0[0.0%]	-	-
	Bronchospasm	0[0.0%]	0[0.0%]	0[0.0%]	0[0.0%]	-	-

*Group I [L]: lignocaine 0.5% alone. Group II: 40 ml [lignocaine 0.25% plus dexmedetomidine 50 µg]. Group III: 40 ml [lignocaine 0.25% plus atracurium 2mg], group IV: 40 ml [[lignocaine 0.25% plus, dexmedetomidine 50µg and 50 atracurium 2mg]. *: significant difference between groups.*

DISCUSSION

The present study demonstrates that the use of dexmedetomidine 50µg as an adjuvant to lignocaine for intravenous regional anesthesia [IVRA] provides better quality of block, leads to earlier onset of sensory and motor block, and prolongs the duration of postoperative analgesia without any significant side effect [due to lower doses of lignocaine]. These improvements were associated with more sedation. The addition of atracurium enhances these effects. These results are comparable to those reported by **Shilpashri *et al*.**[11]. They reported that dexmedetomidine as an adjuvant to lignocaine in IVRA is associated with a faster onset of sensory and motor blockade, significantly longer postoperative analgesia, and a low incidence of postoperative pain compared to lignocaine alone in upper limb surgeries. They reported that the onset of sensory block was significantly shorter in the dexmedetomidine group than lignocaine only group [1.8±0.76 minutes vs. 5.27±0.58 minutes, $p < 0.001$]. Furthermore, as in the current work, they reported that the operative time was around 50 minutes, and there was no significant difference between groups. They added that 70% of the first group need rescue analgesia, while none in the dexmedetomidine group need rescue analgesia.

The tourniquet pain mechanism is still understood irrespective of unmyelinated C fibers' role. Dexmedetomidine working by the depression of nerve action potentials, especially in C fibers, by a mechanism other than stimulation of α-2-adrenergic receptors. Proposed mechanism is responsible for strengthening and lengthening the local anesthetic block achieved by the drug's perineural administration. Finally, α-2-adrenergic receptors located at nerve endings may play a role in the drug's analgesic effect by the prevention of norepinephrine release[12].

In this study, it is found that dexmedetomidine reduced postoperative analgesic requirements.

Yoshitomi and Kohjitani[13] reported that the addition of dexmedetomidine to lignocaine shortened the onset of the sensory and motor block, delayed the recovery of sensory and motor block, and an improved grade of the block. Also, **Memis *et al*.**[14] reported that the addition of dexmedetomidine to lignocaine improves RSS in IVRA by improving the quality of block in terms of onset, offset, and visual analogue scale [VAS] score and exerts transient postoperative sedative effect owing to systemic effect, which depends on the amount of drug reaching systemic circulation.

Results of the current work are in line with **Ozturk *et al*.**[15] who reported that the addition of dexmedetomidine to lignocaine delayed the onset time of tourniquet pain in IVRA by improving the quality of block in terms of onset and offset. In addition, VAS scores were significantly low VAS scores of incisional and tourniquet pain in adjuvant groups compared when compared to lignocaine group, up to 8 hours after deflation. Moreover, the current work results are in accordance with **Esmaoglu *et al*.**[16] who reported no significant hemodynamic changes in groups received adjuvant drugs compared to lignocaine for IVRA. This can be due to the fact that the tourniquet was not deflated before 30 min, and the tourniquet deflation was

performed by the cyclic deflation technique at the end of surgery.

The current work's side effects were confined to the lignocaine only group, and it was in the form of restlessness [20.0%]. These results are in accordance with previous studies of **Gorgias *et al*.** [17], **Honarmand *et al*.**[18], and **Hegazy *et al*.** [19], who revealed no adverse effects occurred during IVRA with the use of adjuvants.

Additionally, **Memis *et al*.**[14] did not report significant postoperative sedation, hypotension, or brady-cardia on the addition of dexmedetomidine to lignocaine 0.5% for IVRA. Furthermore, no adverse nervous system effects were reported, which is in line with **Viscomi *et al*.**[5]**.** They did not report any neurological adverse effects during IVRA using dexmedetomidine as an adjuvant to lignocaine. This may be because of the local metabolism of drugs in an isolated limb, proper use of tourniquet did not allow the significant dose of drugs to reach systemic circulation, and the dose and the concentration of drugs used in the current study [20].

Kol *et al*.[21] reported that dexmedetomidine's addition to lignocaine delayed onset time of tourniquet pain in IVRA through improving quality of block as regards onset and offset**.** Also, in accordance with the present study, **Subramanya *et al*.**[22] evaluated the effect of dexmedetomidine [0.5 mcg/kg] as an adjuvant for lignocaine [0.5%] in intravenous regional anesthesia, noticed that there was the earlier onset of sensory and motor block in Group II when compared to Group I, delayed onset of tourniquet pain in group II when compared with Group I, and decrease pain scores [VAS] intra-operatively and postoperatively

Finally, **Mahmoud *et al*.**[23] concluded that the addition of dexmedetomidine to lignocaine for IVRA improved the quality of intraoperative and postoperative analgesia with minimal adverse effects. Dexmedetomidine was superior in delaying the onset of tourniquet pain, prolonging postoperative analgesia duration, and leading to higher patient and surgeon satisfaction. Similarly, **Mahrose**[24] concluded that adding 1 µg/kg dexmedetomidine or 1 µg/kg fentanyl to lignocaine for IVRA improves anesthesia quality and perioperative analgesia without causing adverse effects. More recently, **Abo El-Enin *et al*.**[25] concluded that dexmedetomidine as an adjuvant to lignocaine in intravenous regional anesthesia produces early onset of sensory and motor block, delayed onset of tourniquet pain, lower postoperative visual analog score, longer duration of postoperative analgesia.

In line with the use of muscle relaxant as an adjuvant, **Flamer and Peng**[6] concluded that muscle relaxants enhance the motor block and, when combined with fentanyl, allow for equivalent quality of IVRA with 50% reduction in LA dose. Additionally, **Esmaoglu *et al*.**[16] reported that, the addition of cisatracurium to lignocaine in intravenous regional anesthesia shortened the sensory and motor block onset times, improved the quality of anesthesia, and decreased analgesic requirements without causing clinical side effects.

Finally, **Haider and Mahdi**[26] concluded that drug combination of ketamine, atracurium, and a low dose of lignocaine lead to the rapid onset of sensory block, motor block, lower VAS score for pain, and decrease the adverse effect of Bier's block accompany lignocaine alone

On the other side, **Kurt *et al*.**[27] concluded that no clinical benefits of adding alfentanil or atracurium to lignocaine solution for the arm's intravenous regional anesthesia could be shown. This could be attributed to the small number of patients in each group in their study [11 patients in each group].

Conclusion: the use of dexmedetomidine as an adjuvant had significantly better postoperative analgesic effects, longer duration of sensory and motor blockade, and earlier onset of action. In addition, atracurium, besides dexmedetomidine, improves the quality of IVRA.

Financial and Non-Financial Relationships and Activities of Interest

None

REFERENCES

1. **Prabhakar A, Lambert T, Kaye RJ, Gaignard SM, Ragusa J, Wheat S, *et al*.** Adjuvants in clinical regional anesthesia practice: A comprehensive review. Best Pract Res Clin Anaesthesiol. **2019** Dec; 33 [4]:415-423. doi: 10.1016/j.bpa.2019.06.001.
2. **Farbood A, Khademi S, Tajvidi R, Hooshangi M, Salari S, Ghani M, Tahmasebi S, Jamali H.** Comparison of Intravenous Regional Anesthesia with Single-Cuff Forearm Tourniquet and Hematoma Block and Traditional Method in Patients with Distal Radius Fractures; A Randomized Clinical Trial. Bull Emerg Trauma. **2020**; 8[2]: 77-82. doi: 10.30476/ BEAT. 2020.46446.
3. **Youssef MM, ElZayyat NS.** Lignocaine nalbuphine versus lignocaine tramadol for intravenous regional anesthesia. Ain-Shams J Anaesthesiol. **2014**; 7[2]: 198. DOI: 10.4103/1687-7934.133441
4. **Bansal A, Gupta S, Sood D, Kathuria S, Tewari A.** Bier's block using lignocaine and butorphanol. J Anaesthesiol Clin Pharmacol. **2011**; 27 [4]:4 65-9. doi: 10.4103/0970-9185.86580
5. **Viscomi C, FriendA,ParkerC, Murphy T,Yarnell M.** Ketamine as an adjuvant in lignocaine intravenous regional anesthesia. a randomized, double-blind, systemic control trial. Reg Anesth Pain Med **2009**; 34:130–133. doi: 10.1097/AAP.0b013e31819bb006.
6. **Flamer D, Peng PW.** Intravenous regional anesthesia: a review of common local anesthetic options and the use of opioids and muscle relaxants as adjuncts. Local Reg Anesth. **2011**; 4:57-76. doi: 10.2147/ LRA.S16683.
7. **Choyce A, Peng P.** A systematic review of adjuncts for intravenous regional anesthesia for surgical procedures. Can J Anaesth. **2002**; 49 [1]: 32-45. doi: 10.1007/ BF03020416.
8. **Somsunder RG, Archana NB, Shivkumar G, Krishna K.** Comparing Efficacy of Perineural Dexmedetomidine with Intravenous Dexmedetomidine as Adjuvant to Levobupivacaine in Supraclavicular Brachial Plexus Block. Anesth Essays Res. **2019** Jul-Sep; 13[3]:441-445. doi: 10.4103/aer.AER_105_19.
9. **Abdallah FW, Abrishami A, Brull R.** The facilitatory effects of intravenous dexmedeto-midine on the duration of spinal anesthesia: a systematic review and meta-analysis. Anesth Analg. **2013**;117[1]:271-8. doi: 10.1213/ANE.0b013e318290c566.
10. **Sivakumar RK, Panneerselvam S, Cherian A, Rudingwa P, Menon J.** Perineural vs. intravenous dexmedetomidine as an adjunct to bupivacaine in ultrasound-guided fascia iliaca compartment block for femur surgeries: A randomized control trial. Indian J Anaesth. **2018**;62[11]:851-857.
11. **Shilpashri AM, Kavya KG, Priodarshi R.** Dexmedetomidine as an adjunct to 0.5% lignocaine for intravenous regional anesthesia for upper limb surgeries. J Evidence-based Med Healthcare **2015**; 2 [34]: 5171-5178. doi: 10.18410/jebmh/2015/720
12. **Gupta B, Verma RK, Kumar S, Chaudhary G.** Comparison of analgesic efficacy of dexmedetomidine and midazolam as adjuncts to lignocaine for intravenous regional anesthesia. Anesth Essays Res. **2017**; 11[1]:62-66. doi: 10.4103/ 0259-1162.200245.
13. **Yoshitomi T,Kohjitani A.** Dexmedetomidine enhance the local anesthetic action of Lignocaine via an α2A adrenoceptor. Anesth Analg **2008**; 107:96–101.
14. **Memis D, Turan A, Karamanlioglu B, Pamukçu Z, Kurt I.** Adding dexmedetomidine to lignocaine for intravenous regional anesthesia. Anesth Analg **2004**; 98: 835-40. doi:10.1213/01.ane.0000100680.77978.66.
15. **Ozturk H, Kaygusuz K, Gursoy S, Comert B, Mimaroglu C.** Addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anesthesia for hand or forearm surgery: a randomized controlled study. Clin Drug Investig **2009**; 29:121–129.
16. **Esmaoglu A, Akin A, Mizrak A, Turk Y, Boyaci A.** Addition of cisatracurium to lignocaine for intravenous regional anesthesia. J Clin Anesth. **2006** May; 18 [3]: 194-7. doi: 10.1016/j.jclinane.2005.08.003.
17. **Gorgias N, Maidatsi P, Kyriakidis A, Karakoulas K, Alvanos D, Giala M.** Clonidine versus ketamine to prevent tourniquet pain during intravenous regional anesthesia with lignocaine. Reg Anesth Pain Med **2001**; 26: 512–517. doi: 10.1053/rapm. 2001.27857
18. **Honarmand A, Safavi M, Nemati K, Oghab P.** The efficacy of different doses of Midazolam added to Lignocaine for upper extremity Bier block on the sensory and motor block characteristics and postoperative pain. J Res Pharm Pract **2015**; 4:160–166. doi: 10.4103/2279-042X.162359
19. **Hegazy N, Elmetwaly K, Aboelseoud A, Alshaer A.** Does the use of ketamine or nitroglycerin as an adjuvant to lignocaine improve the quality of intravenous regional anesthesia? Saudi J Anesth **2010**; 4:55–62. doi: 10.4103/1658-354X.65122
20. **Sen S, Ugur B, Aydin ON, Ogurlu M, Gursoy F, Savk O.** The analgesic effect of nitroglycerin added to lidocaine on intravenous regional anesthesia. Anesth Analg. **2006**;102 [3]: 916-20. doi: 10.1213/01.ane. 0000195581.74190.48.
21. **Kol IO, Ozturk H, Kaygusuz K, Gursoy S, Comert B, Mimaroglu C.** Addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anaesthesia for hand or forearm surgery: A randomized controlled study. Clin Drug Investig **2009**; 29:121-9. doi: 10.2165/0044011-200929020-00006

22. Subramanya V, Kapinigowda ST, Math AT, Chennaiah VB. Dexmedetomidine as an Adjuvant for Intravenous Regional Anesthesia in Upper Limb Surgeries. Anesth Essays Res. **2017** Jul-Sep;11[3]: 661-664. doi: 10.4103/ 0259-1162.206851.

23. Mahmoud AE, Saleh AA, Mahareak AA, Alkumity AA. Comparative study of midazolam, dexmedetomidine, and ketamine as an adjuvant to lignocaine in intravenous regional anesthesia for forearm and hand surgeries. AZMJ **2017**; 15:127–134. doi: 10.4103/ AZMJ.AZMJ_32_17

24. Mahrose R. Fentanyl versus dexmedetomidine as adjuvants to lignocaine in intravenous regional anesthesia. Res Opin Anesth Intensive Care [serial online] **2019**; 6:164–175. doi: 10.4103/roaic.roaic_ 100_17.

25. Abo El-Enin MA, El-Garhy AM, Abd El-Geleal AM, Elewa HM. Dexmedetomidine as an adjuvant for intravenous regional anesthesia in upper limb surgeries. Al-Azhar Med J **2020**; 49[2]; 503-512. doi: 10.12816/amj.2020.82568

26. Haider HS, Mahdi FA. The Combination Effect of Lignocaine, Ketamine and Atracurium in Intravenous Regional Anesthesia. Al Kindy College Medical Journal [KCMJ] **2013**; 9 [2]: 61-63. Available at: https://www.iasj.net/iasj/article/86332.

27. Kurt N, Kurt I, Aygünes B, Oral H, Tulunay M. Effects of adding alfentanil or atracurium to lignocaine solution for intravenous regional anesthesia. Eur J Anaesthesiol. **2002**; 19 [7]: 522-5. doi: 10.1017/ s0265021502000856.

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