The Egyptian Journal of Hospital Medicine (July 2019) Vol. 76 (1), Page 3373-3379

Effect of Paracetamol and Dexamethasone with Lidocaine in Intravenous Regional Anesthesia of Upper Limb Surgeries

Saad El-Deen Mahmoud El-Khateeb, El-Desoky Mohammed Ibraheem Nouh, Mohammed Abd-Elsalam Abd-Allah Ali

Department of Anaesthesiology and Intensive Care, Faculty of Medicine – Al-Azhar University

Corresponding author: Mohammed Abd-Elsalam Abd-Allah Ali, email: muhammedmuhsen1989@gmail.com

ABSTRACT

Background: Upper limb surgeries may be done under general anaesthesia or other methods such as nerve block or regional anaesthesia such as intravenous regional anesthesia (IVRA). Intravenous regional anesthesia has many advantages such as cost effectiveness, day case surgeries and reduced hemorrhage risk.

Objective: The primary objective was to evaluate the effect of paracetamol and dexamethasone when combined with lidocaine on the depth and duration of IVR anesthesia in upper limbs. The secondary objective was to evaluate the onset of tourniquet-associated pain, time of 1st analgesic request, total opioid consumption and haemodynamic stability.

Patients and Methods: Patients of this study were classified into 4 groups, 1st group received 3 mg/kg lidocaine 2% completed by normal saline to 40 cc total volume without any additives and named as group L. 2nd group received 3 mg/kg lidocaine 2% plus 8 mg dexamethason completed by normal saline to 40 cc total volume and named as group D. 3rd group received 3 mg/kg lidocaine 2% plus 250 mg paracetamol completed to 40 cc total volume and named as group P. 4th group received 3 mg/kg lidocaine 2% plus 8 mg dexamethasone plus 250 mg paracetamol completed to 40cc total volume and named as group LDP. These groups were evaluated for haemodynamics and onset of sensory and motor block and time of recovery of sensory and motor block as well as intraoperative VAS score and fentanyl consumption.

Results: As regard average values of intraoperative VAS, 4th group had the lowest numbers then 2nd group, 3rd group then 1st group which had the highest numbers. As regard the time to 1st analgesic request, the 1st group showed the shortest time meanwhile the 4th group showed the longest time to 1st analgesic request while 2nd and 3rd groups were in between. Total opioid consumption was the least among the 4th group in comparison with the other three groups especially the 1st one, which showed the highest consumption. Finally, 4th group proved to be the best one as regarding good anaesthesia and analgesia and reduction in intraoperative pain score as well as reduction in opioid consumption.

Conclusion: Paracetamol and dexamethasone when combined to lidocaine in intravenous regional anaesthesia in upper limb produce synergistic effect on sensory and motor block, reduce intraoperative pain score and decrease amount of intra operative opioid consumption.

Keywords: Intravenous regional anesthesia, dorsal root ganglia.

INTRODUCTION

Surgeries of upper limb may be done under general anaesthesia or other methods such as nerve block or regional anaesthesia such as intravenous regional anesthesia (IVRA)**.** Intravenous regional anesthesia was developed by German Surgeon August Bier in 1908. This technique is still useful and recommended for limb surgeries, especially when general anaesthesia (GA) is highly associated with risks such as difficult intubation or other condition at which patient cannot tolerate GA [(1)]**.** This technique has many advantages such as cost effectiveness, day case surgeries and reduced risk of hemorrhage [(2)]**.** However, it is also associated with a many side effects as local anaesthetic toxicity, failure of action, delayed onset of block, tourniquet pain, fatigue and hypotonia of affected limb following deflation of the tourniquet [(3)]**.**

The ideal anesthetic agent that is to be used in this type of block should be of rapid onset, long duration, low dose and minimal side effects [(4)]**.**

AIM OF THE WORK

The primary aim of this work was to evaluate the combined effect of paracetamol and dexamethasone with lidocaine on intraoperative pain score. In addition, evaluation of the onset of tourniquet associated pain, time of 1st analgesic request, total opioid consumption and haemodynamic stability.

PATIENTS AND METHODS

Setting: The study was carried out in AL-Azhar University Hospitals.

Ethical Considerations: Approval of The Institutional Ethics Committee of The Faculty of Medicine, Al-Azhar University was obtained. 80 Patients scheduled for elective upper limb surgery were enrolled in this prospective blind randomized study. All patients were counseled for the study protocol and a written informed consent was obtained from the study participants.

Inclusion criteria: Age 20-60 years old. ASA I-II. Elective upper limb surgery.

Exclusion criteria: Patients that refuse regional anaesthia. Patients who had allergy to lidocaine. Patients who had sustained open fractures of upper limb. Hepatic patient. Cases, which were complicated

Received:5/4/2019
Accepted:4/5/2019

by infection at the site of surgery. Patients who received any other anesthetic or analgesic medication prior to the operation. Reynaud's disease. Sickle cell patient. Duration of procedure more than 90 minutes.

Methods of randomization: Randomization of patients was done using a computerized program. Packing, sealing and numbering of the envelops were performed by a medical personnel (Under the supervision of doctors from the Department of Anesthesiology). The number of cases included in this study was randomly allocated into four groups (20 in each group).

Materials: Lidocaine 2% and fentanyl, dexamethasone and paracetamol, esmarch bandage and double tourniquet. Monitor, pulse oximetry, NIBP, ECG, intralipid 20% and emergency drugs.

Study groups: Group L(control group), 20 patients that received 3 mg/kg lidocaine 2% to be completed by normal saline to 40 cc total volume injected in distal cannula 22G at the operable limb after inflation of proximal tourniquet. Group D, 20 patients that received 3 mg/kg lidocaine 2% plus 8 mg dexamethasone to be completed by normal saline to 40 cc total volume injected in distal cannula 22G at the operable limb after inflation of proximal tourniquet. Group P, 20 patients that received 3 mg/kg lidocaine 2% plus 250 mg paracetamol to be completed to 40 cc total volume injected in distal cannula 22G at the operable limb after inflation of proximal tourniquet. Group LDP, 20 patients that received 3 mg/kg lidocaine 2% plus 8 mg dexamethasone plus 250 mg paracetamol to be completed to 40 cc total volume injected in distal cannula 22G at the operable limb after inflation of proximal tourniquet.

Anesthetic techniques: All patients were medically checked in the preoperative assessment clinic {history, physical examination, investigations (e.g. complete blood picture, coagulation profile, liver, kidney functions and FBG.

Patient monitoring: Pulse oximetry. ECG. Non-invasive blood pressure.

Premedication: Patients were fasted according to fasting guidelines for 8 h before operation and were given 0.06 mg/kg anxiolytic in the form of midazolam I.V. in addition to antacid prophylaxis in the form of ranitidine 50 mg I.V.

Induction: After patient arrival to operating room, I.V. catheter 20G was inserted in the non-operable hand and ringer solution was infused at a rate of 10ml/kg/h. I.V cannula 22G was inserted to distal part of the affected limb. 2 tourniquet were placed (distal and proximal) in the operable limb. The limb was elevated for 2 min and then the limb was squeezed by esmarch bandage for the purpose of blood evacuation then the proximal tourniquet was inflated to reach a pressure of 250 mmHg. Isolation of circulation was verified by skin colour or pulse oximeter. An anesthesiologist who was blinded to the content of medications, administered them over a period of 90 sec.

Sensory function was evaluated in the dermatomes of the ulnar, median and radial nerves. Motor function was also assessed by flexion and extension of the wrist and fingers. Absence of any movement was regarded as a good motor nerve block. After completion of both sensory and motor nerve blocks, the distal tourniquet was inflated up to 250 mmHg and the proximal tourniquet was deflated after assessment of onset of tourniquet associated pain.

Blood pressure, heart rate and arterial O2 saturation readings were recorded before and after application of the tourniquet as well as at 5, 10, 15, 30, 40, 50 and 60 min past the start of the operation. The onset and degree of pain was measured by using the Visual Analog Scale (VAS) at 5, 10, 15, 30, 40, 50 and 60 min after inflation of the tourniquet. Once the VAS score exceeded 3, 1 mic/kg of Fentanyl will be administered to the patient.

During the surgery if nausea or vomiting developed 4 mg ondansetron was administrated I.V, each time the BP was dropped to lower than 90 mmHg, it was treated by 5 mg of IV ephedrine and when the heart rate was dropped to lower than 50 b/min, the patient would receive 0.5 mg of IV atropine.

At the end of the operation, an anesthesiologist who was unaware of the group of the patients is assigned to label the quality of the patient's anesthesia as poor (in need of further analgesia), moderate (patient often complaining of minor pain but no need for analgesia), good or excellent (no complain of pain).

Tourniquets remained inflated for no shorter than 30 minutes and no longer than 90 minutes.

The following variables were recorded: HR (beats/min), SBP and DBP (mmHg) as well as onset of sensory and motor block, onset of tourniquet pain and pain scale by visual analog scale were recorded at 5, 10, 15, 30, 40, 50 and 60 minutes after inflation of the tourniquet was recorded. The recovery time of the sensory function, the recovery time of the motor function and the number of patients that need analgesia was recorded. Time of 1st analgesic request and total amount of opioid consumption was recorded in each group.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done: One-way analysis of variance (ANOVA) when comparing between more than two means. Post hoc test; Least Significant Difference (LSD) was used for multiple comparisons between different variables. Chi-square (x^2) test of significance was used in order to compare proportions between qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

Probability (P-value): P-value < 0.05 was considered significant. P-value < 0.001 was considered as highly significant and P-value > 0.05 was considered insignificant.

RESULTS

As regard demographic data and duration of surgery there is no statistically significant difference between groups as in table (1).Average VAS score during 60 min decreased in group LDP it was about (1.81) while increased in group L it was about (4.02) as in table (2). As regard time of onset of sensory block there is statically significant difference between groups where group LDP show the shortest time (1.93 min) and group L show the longest time (5.41min).The same result as regard onset of motor block where group LDP show the shortest time (3.54 min) and group L show the longest time (7.59 min) as in table (3) .

There is no statically significant difference between group D and group P. As regard time of recovery of sensory and motor function there is significant difference between groups, where group LDP had the longest time of recovery of sensory and motor function it was about (59.15 min and 62.52min),while group L had the shortest time of recovery it was about (39.45 min and 42.72 min) for sensory and motor function as in table (4).As regard time of tourniquet associated pain there is significant difference between study groups where group L show rapid onset of tourniquet associated pain after about (23.54 min) while group LDP show delayed onset of tourniquet associated pain after about (37.88 min) as in table (5). Also as regard time of 1st analgesic request group LDP show the longest time about (59.15 min) till the patient need analgesia in contrast group L show the shortest time about(39.45 min) as in table (5).

As regard number of patient that need analgesia there is 15 patients (75%) in group L need analgesia ,while in group D there was 6 patients (30%) that need analgesia, and in group P there was 7 patients (35%) that need analgesia ,but in group LDP there was only 2 patients (10%) that need analgesia as in table (6). As regard total amount of fentanyl consumption there is statistically significant difference between groups where group LDP had alittle amount of fentanyl consumption about (6.8 µg) while group L consume about (51.9 µg) as in table (7).As regard blood pressure and heart rate ther was no statically significant difference between groups as in table (8,9,10).

Table (1): Comparison between groups according to demographic data

Demographic Data	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	F/x2#	p-value
Age (years) Range Mean ± SD	 20-60 41.20 ± 9.06	 20-60 42.44 ± 9.34	 20-60 40.79 ± 8.97	 20-60 42.01 ± 9.24	0.141	0.869
Sex Male Female	 11 (55%) 9 (45%)	 12 (60%) 8 (40%)	 10 (50%) 10 (50%)	 13 (65%) 7 (35%)	0.160#	0.691
Weight (kg)	67.29 ± 3.36	69.11 ± 3.46	66.17 ± 3.31	68.74±3.44	1.258	0.241
Height (cm)	168.90 ± 8.44	173.47 ± 8.67	166.09± 8.30	172.54±8.63	2.033	0.139
Duration of surgery (min) Range Mean ± SD	 40-60 51.50 ± 6.18	 40-60 53.05 ± 6.37	 40-60 50.47 ± 6.06	 40-60 51.98 ± 6.24	0.067#	0.797

F-ANOVA: One way analysis of variance; #x^2: Chi-square test p-value>0.05 NS

Table (2): Comparison between groups according to intraoperative VAS

VAS	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	Kruskal Wallis	p-value
At 5 min.	2.99 ± 0.21a	1.13 ± 0.08	1.14 ± 0.08	1.10 ± 0.08	2.212	0.019*
At 10 min.	2.93 ± 0.21	1.93 ± 0.14	1.95 ± 0.14	1.88 ± 0.13	0.271	0.205
At 15 min.	2.87 ± 0.20	2.03 ± 0.14	2.05 ± 0.14	1.93 ± 0.13	0.986	0.331
At 30 min.	2.96 ± 0.21	2.11 ± 0.15	2.13 ± 0.15	1.98 ± 0.14	1.085	0.365
At 40 min.	4.09 ± 0.22a	2.20 ± 0.15	2.22 ± 0.16	2.02 ± 0.14	3.461	0.027*
At 50 min.	4.22 ± 0.23	3.08 ± 0.16x	3.31 ± 0.16y	2.04 ± 0.15z	4.061	0.010*
At 60 min.	4.12 ± 0.22	3.86 ± 0.16	3.94 ± 0.16	2.08 ± 0.15z	5.215	<0.001**
Average VAS	4.02 ± 0.21	2.99 ± 0.14x	3.11 ± 0.14y	1.81 ± 0.13z	6.516	<0.001**

Using: Kruskal Wallis
p-value>0.05 NS; *p-value <0.05 S; **p-value <0.001 HS
a: Significant difference between group L and other groups
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (3): Comparison between groups concerning onset of sensory and motor block (min)

	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Time of onset (min)						
Onset of sensory block (min)	5.41 ± 0.73	3.33 ± 0.42x	3.1 3 ± 0.34y	1.93 ± 0.52z	2.491	0.038*
Onset of motor block (min)	7.59 ± 0.83	5.51±0.42x	5.62 ± 0.52y	3.54 ± 0.52z	3.011	0.032*

ANOVA: One-way analysis of variance
p-value>0.05 NS; *p-value <0.05 S
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (4): Comparison between groups in relation to time of recovery of sensory and motor function (min).

	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Time of recovery (min)						
Motor function (min)	42.72 ± 2.39	48.82 ± 2.70x	46.50 ± 1.56y	62.52 ± 2.39z	2.737	0.029*
Sensory function (min)	39.45 ± 1.82	43.55 ± 2.06x	42.23 ± 1.19y	59.15 ± 1.82z	2.573	0.027*

ANOVA: One-Way analysis of variance
P-value>0.05 NS; *p-value <0.05 S
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (5): Comparison between groups regarding the time of onset of tourniquet- associated pain and time of 1st analgesic request (min)

	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Onset of tourniquet associated pain (min)	23.54 ± 1.71	29.53 ± 1.28 x	29.75 ± 1.18y	37.88 ± 2.03z	2.830	0.030*
Time of 1st analgesic request (min)	39.45 ± 1.82	43.55 ± 2.06x	42.23 ± 1.19y	59.15 ± 1.82z	2.737	0.027*

ANOVA: One-Way analysis of variance
P-value>0.05 NS; *p-value <0.05 S
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (6): Comparison between groups concerning patients of needs analgesic

Patients of needs analgesic	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	F/x2#	p-value
Time at which patients need analgesic	39.45 ± 1.82	43.55 ± 2.06x	42.23 ± 1.19y	59.15 ± 1.82z	17.229	<0.001**
Number of patients that need analgesia (%)	15 (75%)	6 (30%) x	7 (35%) y	2 (10%) z	6.331#	0.023*

P-value>0.05 NS; *p-value <0.05 S
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (7): Comparison between groups regarding total amount of fentanyl consumption (µg)

	Group L	Group D	Group P	Group LDP	ANOVA	p-value
Total amount of fentanyl consumption (µg)	51.98 ± 9.88	17.65 ± 2.59x	20.22 ± 3.27y	6.83 ± 1.30z	22.452	<0.001**

P-value>0.05 NS; *p-value <0.05 S; **p-value <0.001 HS
x: Significant difference between group D and group L.
y: Significant difference between group P and group L.
z: Significant difference between group LDP and other groups.

Table (8): Comparison between groups as regards the systolic blood pressure (mmHg)

Systolic blood ressure (mmHg)	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Baseline	131.19 ± 5.25	130.48 ± 5.22	131.91 ± 5.28	130.95 ± 5.24	0.538	0.466
At 5 min.	128.57 ± 5.14	126.57 ± 5.06	127.95 ± 5.12	124.40 ± 4.98	1.096	0.341
At 10 min.	125.99 ± 5.04	122.77 ± 4.91	124.11 ± 4.96	119.43 ± 4.78	0.206	0.244
At 15 min.	123.47 ± 4.94	119.09 ± 4.76	120.39 ± 4.82	114.65 ± 4.59	0.749	0.395
At 30 min.	121.01 ± 4.84	115.51 ± 4.62	116.78 ± 4.67	112.36 ± 4.49	0.824	0.435
At 40 min.	124.64 ± 4.99	118.98 ± 4.76	120.28 ± 4.81	115.73 ± 4.63	0.704	0.371
At 50 min.	128.37 ± 5.13	124.93 ± 5.00	126.30 ± 5.05	121.51 ± 4.86	0.774	0.408
At 60 min.	134.79 ± 5.39	131.17 ± 5.25	132.61 ± 5.30	127.59 ± 5.10	0.662	0.349

ANOVA: One way analysis of variance; p-value >0.05 NS

Table (9): Comparison between groups regarding the diastolic blood pressure (mmHg)

Diastolic blood pressure (mmHg)	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Baseline	85.27 ± 3.41	84.81 ± 3.39	85.74 ± 3.43	85.12 ± 3.40	0.592	0.443
At 5 min.	83.57 ± 3.34	82.27 ± 3.29	83.17 ± 3.33	80.86 ± 3.23	1.206	0.324
At 10 min.	81.90 ± 3.28	79.80 ± 3.19	80.67 ± 3.23	77.63 ± 3.11	0.227	0.232
At 15 min.	80.26 ± 3.21	77.41 ± 3.10	78.25 ± 3.13	74.52 ± 2.98	0.824	0.375
At 30 min.	78.65 ± 3.15	75.08 ± 3.00	75.91 ± 3.04	73.03 ± 2.92	0.906	0.413
At 40 min.	81.01 ± 3.24	77.34 ± 3.09	78.18 ± 3.13	75.22 ± 3.01	0.774	0.353
At 50 min.	83.44 ± 3.34	81.20 ± 3.25	82.09 ± 3.28	78.98 ± 3.16	0.852	0.388
At 60 min.	87.62 ± 3.50	85.26 ± 3.41	86.20 ± 3.45	82.93 ± 3.32	0.728	0.332

ANOVA: One way analysis of variance; p-value >0.05 NS

Table (10): Comparison between groups concerning the heart rate (beat/min).

Heart Rate (Beat/min)	Group L *(n=20)*	Group D *(n=20)*	Group P *(n=20)*	Group LDP *(n=20)*	ANOVA	p-value
Baseline	70.84 ± 2.83	70.46 ± 2.82	71.23 ± 2.85	70.71 ± 2.83	0.621	0.425
At 5 min.	69.43 ± 2.78	68.35 ± 2.73	69.09 ± 2.76	67.18 ± 2.69	1.266	0.311
At 10 min.	68.04 ± 2.72	66.30 ± 2.65	67.02 ± 2.68	64.49 ± 2.58	0.238	0.223
At 15 min.	66.68 ± 2.67	64.31 ± 2.57	65.01 ± 2.60	61.91 ± 2.48	0.865	0.360
At 30 min.	65.34 ± 2.61	62.38 ± 2.50	63.06 ± 2.52	60.67 ± 2.43	0.952	0.396
At 40 min.	67.30 ± 2.69	64.25 ± 2.57	64.95 ± 2.60	62.49 ± 2.50	0.813	0.339
At 50 min.	69.32 ± 2.77	67.46 ± 2.70	68.20 ± 2.73	65.62 ± 2.62	0.895	0.372
At 60 min.	72.79 ± 2.91	70.83 ± 2.83	71.61 ± 2.86	68.90 ± 2.76	0.764	0.318

ANOVA: One way analysis of variance; p-value >0.05 NS

DISCUSSION

IVRA is a safe, reliable, cost-effective technique suitable surgery for upper limb and of less than 60 min duration performed on the basis of day case surgery. IVRA may be used for surgey of forearm and minor hand surgeries such as tendon repair and repair of finger tip, forearm fractures that require duration of less than 60 min. [(5)].

The ideal anaesthetic agent that could be used in IVRA should have the following advantages: rapid onset, long duration, low dose of local anesthetics, reduced tourniquet pain, prolonged post-deflation analgesia with high therapeutic index and low probability of local anaesthetic toxicity. In addition, this may be achieved by additives to local anesthetics [(1)]. However, this technique has some disadvantages as delayed onset of action, poor muscle relaxation, lack of postoperative analgesia and local anesthetic toxicity. IVRA does not provide effective tourniquet tolerance and postoperative analgesia after tourniquet deflation. Also, IVRA has several mechanisms that affect haemodynamics stability through ischemia from tourniquet compression , presence of high concentrations of local anesthetics in blood and from reperfusion after tourniquet release [(6)]. The mechanism of action of IVRA is through diffusion of local anesthetic from nerve mantle (outer surface to the nerve core) to the central core. Explaining why anaesthesia starts first proximally then spread to the distal structure [(7)].

Many adjuvants have been added to local anesthetics for IVRA in attempts to improve intraoperative anesthesia and postoperative pain relieve such as opioids (pethidine), clonidine (α_2-agonist), NSAIDs, neostigmine, sodium bicarbonate, and muscle relaxants (atracurium) [(8)].

This study evaluates the effect of adding dexamethasone (8 mg) and paracetamol (250 mg) to lidocaine 2% and their combined effect in IVRA in upper limb surgeries. The synergistic effects of paracetamol as an analgesic and dexamethasone as anti-inflammatory agent in pain suppression, when combined with other analgesic medications, have been proved previously in several studies.

The present study showed a more pronounced analgesic effect for lidocaine when combined with these two widely used drugs.

As a week inhibitor of prostaglandin synthesis, paracetamol acts in a similar fashion to selective inhibitors of COX II, however, it lacks their anti-inflammatory effects [(9)]. Several mechanisms have been discussed for the analgesic effects of paracetamol; for example, ***Ottani et al.*** [(10)] hypothesized that it exerts its effects primarily by modification of cannabinoid receptors. The recent discovery of COX-3 suggested a central mechanism for paracetamol-induced analgesia, which has increasing popularity for the purpose of pain control [(11)]. ***Canbay et al.*** [(12)] showed that paracetamol might decrease the pain at the site of propofol injection, which is consistent with the goals of the present study in using the peripheral anti-nociceptive effect of paracetamol. Two other reports by ***Celik et al.*** [(13)] also discussed positive results with adjuvant use of paracetamol in IVRA.

Several studies have addressed the use of corticosteroids and dexamethasone in particular for induction and prolongation of analgesia. For example, in a study on 75 candidates of hand surgery, ***Bigat et al.*** [(14)] showed that dexamethasone improves the quality and quantity of analgesia during the first day after IVRA.

According to the present study, combination of paracetamol and dexamethasone significantly enhances the analgesic effect of lidocaine in IVRA by accelerating the establishment of both the sensory and motor nerve blocks and prolonging the period of analgesia as well as improving the quality of analgesia and reducing the need for analgesic medications during the operation. Hence, a combination of a specific pain killer and an anti-inflammatory agent may be considered as the standard medication in IVRA.

As regard, demographic data there was no statistically significant difference between groups.

As regards the hemodynamic and respiratory changes during our study, there was clinical stability observed in these variables throughout the study period, and there was no significant difference between the 4 groups at all of the study.

In our study, there was a rapid onset of sensory block in group D and group P (3.33 ± 0.42 & 3.13 ± 0.34 respectively) and it was more rapid in group LDP (1.93 ± 0.52) as compared to group L (5.41 ± 0.73). The same result was observed as regard motor block, which showed statistically significant difference between the groups.

Also, we observed that time of motor recovery was delayd in group LDP (62.52 ± 2.39) and less delayed in group D & group P (48.82 ± 2.70 & 46.50 ± 1.56 respectively), which was statistically significant as compared to group L.

As regard time of recovery of sensory function, it was 39.45 ± 1.82 min in group L, 43.55 ± 2.06 min in group D, 42.23 ± 1.19 min in group P and 59.15 ± 1.82 min in group LDP. These results showed significant difference between the 4 groups.

Our results are in agreement with a previous study by ***Huseyin et.al.*** [(15)] Their study is more or less in agreement with our study concerning the onset of sensory block.

Ko et al. [(3)] reported in their study that there was no statistical difference as regards hemodynamic and respiratory data among the groups. As regards the onset of sensory loss in their study, it was shortened due to the antinociceptive effect of acetaminophen at the peripheral site. Thus, this result is in agreement with ours.

In our study, we observed that the tourniquet-associated pain was delayed in group LDP to about compared to other groups. So adding of dexamethason and paracetamol to lidocaine delay the onset of tourniquet-associated pain and their combination together produce more delay.

As regard intra-operative evaluation of VAS, we found that average VAS during operation in group LDP was 1.81 ± 0.13, and in group L it was 4.02 ± 0.21.

The maximum values of VAS was observed in group L at 40, 50 and 60 min that was 4.09 ± 0.22, 4.22 ± 0.23, 4.12 ± 0.22 respectively. However, in group D & P, it was 2.20 ± 0.15, 3.28 ± 0.16, 3.26 ± 0.16. While in group LDP, it was 2.02 ± 0.14, 2.04 ± 0.15, 2.08 ± 0.15. These results showed statistically significant difference between the 4 groups.

The first fentanyl requirement time was delayed in patients of group LDP followed by group D & P and lastly group L who were first to request for fentanyl injection intra-operatively with mean values of 39.45 ± 1.82 min. In addition, the percentage of patient who needed fentanyl injection intra-operatively in group L was 75% and in group D 30% and 35% in group P but in group LDP it was 10%. The current study is in agreement with a previous study by ***Ko et al.*** [(3)] who demonstrated that the time elapsed until the first analgesia requirement by fentanyl was longer in group P (paracetamol) (34.6 ± 7.8 min) when compared to group C (control) (26.4 ± 10.7 min). Moreover, in their study, the number of patients who required fentanyl was eight (40%) in group P and 11 (55%) in group C. There was no significant difference among the groups for total amount of fentanyl consumed intra-operatively due to tourniquet pain in group C, which was 35.3 ± 33.1 and was 22 ± 28.7 µg in group P. This may be attributed to the increase in the number of patients who received fentanyl.

All above-mentioned results; improved tourniquet tolerance, stable pain scores intra-operatively and less number of patients receiving fentanyl, can be attributed to the fact that adding of dexamethasone or/ and

paracetamol to lidocaine has increased potency and duration of IVRA and increased tolerance to tourniquet-associated pain and decreased opioid consumption during operation.

CONCLUSION

Adding dexamethasone and paracetamol to lidocaine in intravenous regional anaesthesia in upper limb produced synergistic effect on sensory and motor block as well as decrease amount of intra-operative opioid consumption as well as reduction in intra-operative pain score.

REFERENCES

1. **Choyce A, Peng P (2002):** A systematic review of adjuncts for intravenous regional anesthesia for surgical procedures. Can J Anesth., 49: 32–45.
2. **Johnson CN (2000):** Intravenous regional anesthesia: new approaches to an old technique. CRNA., 11 (2): 57–61.
3. **Ko MJ, Lee JH, Cheong SH *et al.* (2010):** Comparison of the effects of acetaminophen to ketorolac when added to lidocaine for intravenous regional anesthesia. Korean J Anesthesiol., 58: 357–361.
4. **Guay J (2009):** Adverse events associated with intravenous regional anesthesia (Bier block): a systematic review of complications. J Clin Anesth., 21 (8): 585–94.
5. **Gazmuri R, Munoz JA, Ilic JA (2002):** Vasospasm after use of a tourniquet: another cause of postoperative limb ischemia? Anesth Analg., 94: 1152–1154.
6. **Perlas A, Peng PW, Palza MB (2003):** Forearm rescue cuff improves tourniquet tolerance during intravenous regional anesthesia. Reg Anesth Pain Med., 28: 98–102.
7. **Auroy Y, Narchi P, Messiah A *et al.* (1997):** Serious complications related to regional anesthesia: results of a prospective survey in France. Anesthesiology, 87: 479–486.
8. **Zekiye B, Neval B, Hadimioglu N (2004):** Does dexamethazone improve the quality of IVRA and analgesia? A randomized, controlled clinical study. Anesth Analg., 102: 605–609.
9. **Anderson BJ (2008):** Paracetamol (Acetaminophen): mechanisms of action. Paediatr Anesth., 18 (10): 915–21.
10. **Ottani A, Leone S, Sandrini M *et al.* (2006):** The analgesic activity of paracetamol is prevented by the blockade of cannabinoid CB1 receptors. Eur J Pharmacol., 531 (1–3): 280–1.
11. **Pettersson PH, Jakobsson J, Owall A (2005):** Intravenous acetaminophen reduced the use of opioids compared with oral administration after coronary artery bypass grafting. J Cardiothorac Vasc Anesth., 19 (3): 306–9.
12. **Canbay O, Celebi N, Arun O *et al.* (2008):** Efficacy of intravenous acetaminophen and lidocaine on propofol injection pain. Br J Anesth., 100 (1): 95–8.
13. **Celik M, Saricaoglu F, Canbay O *et al.* (2011):** Withdrawn the analgesic effect of paracetamol when added to lidocaine for intravenous regional anesthesia. Minerva Anestesiol., 241: 206–225.
14. **Bigat Z, Boztug N, Hadimioglu N *et al.* (2006):** Does dexamethasone improve the quality of intravenous regional anesthesia and analgesia? A randomized, controlled clinical study. Anesth Analg., 102 (2): 605–9.
15. **Huseyin S, Yalcin K, Enis B *et al.* (2009):** Analgesic effect of paracetamol when added to lidocaine for intravenous anesthesia. Anesth Analg., 109: 1327–1330.