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ONSET TIME OF LIGNOCAINE ALONE IS LESS THAN OF MIXED BUPIVACAINE WITH LIGNOCAINE DURING ULTRASOUND GUIDED BRACHIAL PLEXUS BLOCKADE

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ABSTRACT

Background: Reduced dosage of local anesthetics can be administered during regional blockades when neural components via ultrasound are clear. The decreased dosage is not unambiguous. **Goal:** To determine the onset time of pain relief action of local anesthetics alone or in mixture solutions administered for brachial plexus blockade. **Methods:** Our prospective, double blind and randomized investigation included 113 subjects, aged 31-68 yrs., of both sexes, classed I by the American Society of Anesthesiologists and registered for upper limb operations under brachial plexus blockade with ultrasound guided using lignocaine 1% mixed with bupivacaine 0.5% (1:1) (Group LB, GI, n=22), bupivacaine alone 0.5%[2:1] (Group BS, GII, n=18), lignocaine alone 1%[2:1] (Group LS, GIII, n=18) and bupivacaine 0.5% mixed with lignocaine 1% (2:1) (Group BL, GIV, n=55), at Queen Alia military hospital and Royal rehabilitation center, Amman, JORDAN, during the period May 2020-May 2021. Every subject in all groups received 0.5 ml/kg. Median Onset time for sensory or motor blockade was defined as the period between the finish of overall local anesthetic administration and full sensory or motor blockade. Data were recorded before surgery and after surgery at 6 and 24hrs. intervals using verbal analogue scale for pain severity. Kruskal-Wallis with Mann–Whitney U tests were used for ordinal data. The Chi-square test was used for the categorical parameters between the groups. **Results:** The onset time was remarkably less in the lignocaine group (LS, GIII, 10.0 min.) than in the other groups (LB, GI, 13.0 min.; BS, GII, 14.0 min.; BL, GIV, 13.0 min., $P < 0.05$). No discrepancies were recorded in the onset times between LB(GI), BS(GII) and BL(GIV) groups ($P > 0.05$). Statistical discrepancies were recorded in the period of pain relief of local anesthetics between LB(GI) (340.0 min.), BS(GII) (491.0 min.), LS(GIII) (123.0 min.) and BL(GIV) (400.0 min., $P < 0.05$). The sensory onset time was remarkably less (10.0 min.) in the lignocaine group (LS, GIII) in comparison to that in the LB(GI), BS(GII) and BL(GVI) groups. The full motor onset time was less (14.0 min.) in the bupivacaine group (BS) in comparison to that in the LB (16.0 min.), LS (17.0 min.) and BL (15.0 min.) groups. **Conclusion:** Lignocaine has not reduced the onset time, but remarkably reduced the period of action of bupivacaine when mixed. Bupivacaine with no lignocaine possess the highest period of action of pain relief after surgery.

KEYWORDS: Brachial plexus blockade: lignocaine, bupivacaine; Pain relief: onset, period; Ultrasound.

INTRODUCTION

The ultrasound-guided nerve block methods[1] have multiple benefits for subjects scheduled for operations with uncommon hazards.[2] The differences of neural components shown by ultrasound may decrease the volume required to attain full nerve block[1] with increased success percentage.[3] Reduced dosages of local anesthetics are not correlated with fully neural blocks.[1] Increased dosages are not indicated due to the hazard of local anesthetic systemic toxicity.[1] The location of a peripheral nerve catheter in the same area of the operation and the insertion of peripheral nerve catheters before operation is questionable.[4] The one-shot administration method is used for anesthesia during surgery and pain control after surgery, although the period of the action of local anesthetics is restricted.

The least efficient volumes of various local anesthetic drugs are variable. Local anesthetic drugs were commonly administered in mixtures to utilize advantages of each element, increase the block and reduce the risk of adverse effects or the local anesthetic systemic toxicity. Reduced concentration of local anesthetics were used as 1:1 mixture of lignocaine 1% and bupivacaine 0.5%, 2:1 mixture of bupivacaine 0.5% and normal saline, 2:1 mixture of lignocaine 1% and normal saline or 2:1 mixture of bupivacaine 0.5% and lignocaine 1% were

used at 0.5 ml/kg with the maximum volume of 30 ml.[5-8]

The objective of this investigation was to compare the onset time of various local anesthetic solutions alone or in mixture solutions administered for brachial plexus blockade and attained by the same volume (0.5 ml/kg).

METHODS

This prospective, double blind and randomized investigation included 113 subjects, aged 31-68 yrs., of both sexes, classed I by the American Society of Anesthesiologists and registered for upper limb operations under brachial plexus blockade with ultrasound-guided using lignocaine 1% mixed with bupivacaine 0.5% (1:1) (Group LB, Group I=22), bupivacaine 0.5%[2:1] (Group BS, GII=18), lignocaine 1%[2:1] (Group LS, Group III=18) and bupivacaine 0.5% mixed with lignocaine 1% (2:1) (Group BL, Group IV=55). Every subject in all groups received 0.5 ml/kg. Table I. Median onset time was determined in all groups. Investigation was started at Queen Alia military hospital and Royal rehabilitation center, Amman, JORDAN, during the period May 2020-May 2021, after obtaining written informed consent from all participants and approval from our local ethical and research board review committee of the Jordanian Royal medical services. Subjects with chronic pain situations, neurological conditions, obstructive sleep apnea and local skin infections were ruled out.

Ultrasound-guided technique of the brachial plexus was done.[9] The blockade was achieved in-plane using one administration method[10] in the supine position. The most optimum in-plane or out-of-plane method was chosen based on the anatomical lining of the vessels and nerves.[11-12] A 25G, 4 cm non-insulated bevel needle was used with a high-frequency linear probe. The maximum one shot volume did not exceed 30 ml. Data were recorded before surgery and after surgery at 6 and 24hrs. intervals using verbal analogue scale for pain severity.

The sensory and motor block were evaluated at 3 min. after the administration of total dose of local anesthetic until fully block or at 20 min. Sensory blockade was evaluated on a 3point scale (0 – 2) as fully (2: no sensation to touch), partial (1: no sensations to pinprick) or normal (0). The motor block was investigated by muscle contraction functions as full motor blockade (2), decreased motor power (1) or normal (0). Onset time for sensory or motor blockade was defined as the period between the finish of overall local anesthetic administration and full sensory or motor blockade.

The investigation evaluated the onset times and the period of sensory actions of the same volumes of LB, B, L and BL for brachial plexus blockade. Verbal analogue scales for the evaluation of severity of pain (VAS) were assessed between the groups. Pain severity before the block (VNR0), at 6hrs.(VNR6) and at 24 hrs.(VNR24) after the block were determined.

Statistics

Kruskal-Wallis with Mann–Whitney U tests were used for ordinal data. The Chi-square test was used for the categorical parameters between the groups. ANOVA with Bonferroni tests were used for the variance between groups. P less than 0.05 was considered significant.

Table I: The volume of local anesthetics and saline in solutions.

	LB(GI, n=22)	BS(GII, n=18)	LS(GIII, n=18)	BL(GIV, n=55)
	1:1	2:1	2:1	2:1
Lignocaine 1%(L)	15 ml/150 mg	--	20 ml/200 mg	10 ml/100 mg
Bupivacaine 0.5%(B)	15 ml/75 mg	20 ml/100 mg	--	20 ml/100mg
Normal saline(ml)(S)	--	10	10	--
Total volume(ml)	18-20	22-24	26-28	28
Concentration (%)	L 1%/B 0.5%	B 0.5%	L 1%	B 0.5%/L 1%

RESULTS

There were no significant discrepancies between the groups regarding demographics (P > 0.05) (Table II). The administered total volumes and volumes per body weight were comparable between groups (P > 0.05). Table III. The sensory onset time was remarkably less (10.0 min.) in the lignocaine group (LS, GIII) in comparison to that in the LB(GI), BS(GII) and BL(GVI) groups. There was no remarkable discrepancy in the onset times between LB, BS and BL groups (P > 0.05). The full motor onset time was less (14.0 min.) in the bupivacaine group (BS) in comparison to that in the LB (16.0 min.), LS (17.0 min.) and BL (15.0 min.) groups. There was a statistical discrepancy between the groups (BS vs. LS; P< 0.05) and (BL vs. LS; P< 0.05). There was a statistical discrepancy between the sensory and motor onset times in the LB, BS, LS and BL groups (P < 0.05). There were statistical discrepancies in the period of pain relief of local anesthetics between the groups (LB 340.0 min. vs BS 491.0 min. vs LS 123.0 min. (with the least period) and BL 400.0 min.; P <0.05) (Table III). The motor features of block in the LS group (3.0) was remarkably less in comparison to the other groups (LB 3.3, BS 3.5, BL 3.4; P< 0.05).

The pain severity VNR6 score was zero in the LB (0.2), BS (0.01) and BL (0.05) groups 6 h after the blocks (P< 0.05), while VNR6 was statistically more in the LS group (1.9; P< 0.05). The least VNR24 score was in the BS group (0.8) vs LB (1.6) vs LS (1.2) and vs BL (1.1; P<0.05). (Table IV).

Table II: Patients demographics.

Parameter	LB(GI, n=22)	BS(GII, n=18)	LS(GIII, n=18)	BL(GIV, n=55)	P
Age(yrs.)median	44.0	41.0	42.0	43.0	>0.05
Sex(no) M **F**	12 10	4 14	6 12	20 35	>0.05
Weight (kg) median	63	62	64	65	>0.05
ASA(no) I	22	18	18	55	>0.05
Period of operation(hrs.)median	1.20	1.25	1.10	1.15	>0.05

Table III: Drugs features.

variable	LB(GI, n=22)	BS(GII, n=18)	LS(GIII, n=18)	BL(GIV, n=55)	P
Volume (ml)	28	24	25	26	>0.05
Onset time(sensory)min	13	14	10	13	<0.05
Onset time(partial motor)min	5	3	8	2	<0.05
Onset time(full motor)min	16	14	17	15	<0.05
Period(min)	340	491	123	400	<0.05

Table IV: The outcome after surgery.

	LB(GI, n=17)	BS(GII, n=14)	LS(GIII, n=14)	BL(GIV, n=40)	P
VAS					
before surgery	3.2	2.9	2.4	3.1	<0.05
6hr after adm.	0.2	0	1.9	0.05	<0.05
24hr after adm.	1.6	0.8	1.2	1.1	<0.05

DISCUSSION

In our investigation, the onset time and period of local anesthetics in standard volumes were assessed for brachial plexus block under ultrasound. There were discrepancies in the period of the pain relief of local anesthetic mixed solutions. Lignocaine alone is indicated for short and less painful surgery. The characteristics of anesthesia induced by mixed solutions or solitary local anesthetics is similar. The mixture of local anesthetics is not indicated to increase the outcome of nerve block. Bupivacaine with no lignocaine has the longest period of pain relief effect after surgery. Mixed solutions for optimum anesthesia with submaximal period is vital. Bupivacaine is used if the long pain relief action after surgery is the crucial objective of the brachial plexus block. High volumes of local anesthetic solutions were used before ultrasound, after which the volumes of local anesthetics can be reduced. There was no remarkable discrepancy in the onset times between 1% lignocaine, 0.25% bupivacaine and a 50/50 of 1% lignocaine and 0.25% bupivacaine, but bupivacaine had the main lengthened period of action.[12]

Full nerve blocks were performed using “low volumes” of LA under ultrasound in spite of various volumes, concentrations and adjuvants. Local anesthetic and systemic toxicity was avoided using lower concentrations in adequate volume to induce proper nerve block. Volumes of 1-1.5–2 ml per nerve were used, but, the ratio of the patient with partial or inadequate nerve block or lower period of effect or more increased severity of pain after surgery was recorded. Pinprick, touch and flexion were done before surgery to anticipate the full block of the brachial plexus. These can assess technical characteristics of the block and the time of the operation, as the full onset of sensory and motor block. As muscle relaxation is crucial for shoulder operation, the wrist and hand operation needs less muscle relaxation but excellent sensory block.

Regional anesthesia of the upper limb can be done by blocking the brachial plexus at different levels via the path of the trunks, divisions, cords and terminal nerves, through interscalene, the supraclavicular, the infraclavicular and the axillary blocks. The interscalene method is for the operation of the shoulder. The supraclavicular attains anesthesia and analgesia below the shoulder for all regions. The higher volumes and concentrations of the local anesthetic solutions are correlated with an increased frequency of Horner's syndrome and local anesthetic systemic toxicity. The infraclavicular can be used for operations of the elbow and below. The axillary method is used for operation of the forearm, wrist and hand.[11,13]

Lower concentrations and low volumes of local anesthetic solutions can be used to eliminate the risk of local anesthetic toxicity. The axillary-supraclavicular of brachial plexus block using 0.4 ml/kg (30 ml, maximum volume) of diluted local anesthetics is efficient to give optimum pain relief intraoperatively and after surgery. Lignocaine is used with bupivacaine to fasten the onset time of bupivacaine. In our investigation, the lignocaine content of the mixture didn't shorten the onset times of bupivacaine but remarkably reduced the period of pain relief effect of bupivacaine. The onset time of lignocaine alone was remarkably shorter. The onset time of the full motor block was lengthened using low concentration lignocaine in spite of the shorter sensory onset time. Lignocaine alone had a good block because of the lesser

motor block while the other solutions had excellent outcome. In the lignocaine group, the pain severity statistically came back to the level before surgery, there was no statistical discrepancy between the VAS 0 and VAS 6, and there was no pain relief.[14] Lignocaine has the shortest period of pain relief effect and it cannot eliminate the pain severity after surgery.

When the lignocaine reduces the period of the pain relief action of bupivacaine in mixed solution, the analgesia in the LB and BL groups was less than in the BS group.

IN CONCLUSION

Lignocaine does not shorten the onset times, but remarkably reduces the period of action of bupivacaine when used combined. Lignocaine has a good block, while other solutions have excellent blocks. Bupivacaine with no lignocaine has the longest period of action to attain the longest pain relief after surgery.

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