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Research Article

EFFECT OF ADDITION OF BUPRENORPHINE VERSUS DEXMEDETOMIDINE TO LIGNOCAINE WITH ADRENALINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK- A COMPARATIVE STUDY

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A B S T R A C T

Background and objectives: Brachial plexus block (BPB) for upper extremity surgery provides superior analgesia, but this advantage is limited by the pharmacological duration of local anesthetics. Buprenorphine and Dexmedetomidine are used as adjuvants with local anesthetics in supraclavicular brachial plexus block to prolong and improve the quality of intraoperative anesthesia and post operative analgesia. Our study aimed to compare the effect of the addition of Buprenorphine versus Dexmedetomidine to Lignocaine with Adrenaline in supraclavicular brachial plexus block for forearm surgeries.

Methods: A total of 60 adult patients of ASA grade 1 or 2 scheduled for forearm surgeries under supraclavicular brachial plexus block were included in the study. Patients were randomly allocated into one of the two groups. Each group consisted of 30 patients. Group A patients received 7mg/kg of 1.5% Lignocaine with Adrenaline +3µg/kg of Buprenorphine. Group B patients received 7mg/kg of 1.5% Lignocaine with Adrenaline+1µg/kg of Dexmedetomidine. Onset and duration of sensory and motor blockade and duration of post operative analgesia were assessed.

Results: Mean time of onset of sensory block was 11.00 ± 1.64 min in patients of group A and 13.76 ± 1.77 min in patients of group B which was statistically significant with a p value <0.0001. Mean time of onset of motor block was 13.36 ± 1.95 min in group A and 16.06 ± 1.99 min in group B which was statistically significant with a p value<0.0001. Mean duration of sensory block was 442.00 ± 33.05 min in group A and 299.00 ± 17.68 min in group B which was also statistically significant with a p value<0.0001. Mean duration of motor block was 381.33 ± 34.91 min in group A and 241.66 ± 18.01 min in group B which was statistically significant with a p value<0.0001. Mean duration of post operative analgesia was 452.33 ± 32.45 min in group A and 309.33 ± 18.18 min in group B which was also statistically significant with a p value<0.0001. No side effects were noted in both groups.

Conclusion: From our study we concluded that Buprenorphine when compared to Dexmedetomidine shortens the onset time of sensory and motor blockade and increases the duration of sensory and motor block, as well as duration of post operative analgesia when used as an adjuvant with Lignocaine with Adrenaline in supraclavicular brachial plexus block.

INTRODUCTION

Upper limb surgeries are mostly performed under regional blocks such as brachial plexus block. Regional blocks not only provide intraoperative anaesthesia but also extend analgesia in post operative period. Among the various approaches for brachial plexus block, supraclavicular approach is routinely used all over the world for surgeries of upper limb because of the anatomical ease of blocking nerve roots at this level of brachial plexus[1] .

Many drugs have been tried as additives with local anesthetics to prolong and improve the quality of intraoperative anesthesia and postoperative analgesia[2]. Opioids are added to local anaesthetics in supraclavicular brachial plexus block to prolong duration of postoperative analgesia. Buprenorphine is a lipophilic opioid with high molecular weight, high affinity for µ receptors, longer duration of action, easily available and cost effective[3].

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α_2 adrenergic receptor agonists have been successfully utilized in various anaesthetic techniques due to its hemodynamic stabilizing properties, sedative,analgesic and sympatholytic effects[4]. Dexmedetomidine, an α_2 agonist in clinically effective doses lack respiratory depression but maintains its analgesic properties that may make it a safe adjuvant with local anaesthetics[5].

Although the effect of both Buprenorphine and Dexmedetomidine when used as adjuvants with local anesthetics on the quality of block have been studied individually, a parallel comparison between the two drugs has not arrived at a clear consensus as to which adjuvant has a better efficacy. Also many of the previous studies evaluated the effect of these adjuvants on long acting local anesthetics like bupivacaine. Since bupivacaine itself is long acting, doubts existed whether the addition of adjuvants would prolong the actions of shorter and intermediate acting local anaesthetics.

So the aim of our study was to compare the effect of the addition of buprenorphine versus dexmedetomidine to intermediate acting local anesthetic lignocaine with adrenaline in supraclavicular brachial plexus block.

METHODOLOGY

After Ethical Committee clearance, this prospective study was conducted on 60 ASA physical status I and 2 patients of either sex, aged between 18 and 60 years, undergoing various forearm surgeries under supraclavicular brachial plexus block in Medical college Hospital, Government Medical college, Thrissur.

Patients with peripheral neuropathies, coagulation disorders, local infections at site of injection, history of seizure, pregnancy, patients on beta blockers and patients with known allergy to local anaesthetics were excluded from the study. Patients were randomly divided into two groups; each group included 30 patients. Those who received 7mg/kg of 1.5% lignocaine with adrenaline (1:200000)+ 3 µg/kg of buprenorphine were in group A.

Those who received 7 mg/kg of 1.5% lignocaine with adrenaline (1:2 00000) +1µg/kg of dexmedetomidine were in group B.

After satisfying inclusion and exclusion criteria, a thorough preoperative evaluation was performed. The patients were briefed about the supraclavicular block to be performed, its advantages over general anesthesia, and also about assosciated complications. A written informed consent in the local language was obtained from patient and relatives.

All patients were familiarized with the use of visual analogue scale scoring system. All patients were kept fasting for 6 hours prior to surgery.

Baseline (before start of procedure) pulse rate, blood pressure, respiratory rate, peripheral oxygen saturation were recorded. Intravenous access was secured with 18G cannula and iv fluid Ringer Lactate started. Monitors werre attached before the procedure for recording of non invasive blood pressure, heart rate, ECG and SpO_2.

Under aseptic precautions brachial plexus block was performed by supraclavicular approach (classical approach).[2]

The vital parameters (pulse rate, non invasive blood pressure, respiratory rate) were monitored every 2 minute for first 30 minutes, and then every half hour till 8 hours and then every 1 hour till patient complaints of pain equivalent to VAS score of 4.The following parameters were noted: onset of sensory blockade, onset of motor blockade, duration of sensory and motor block, duration of postoperative analgesia.

Adverse events such as hypotension, bradycardia, hypoxaemia and perioperative nausea and vomiting were recorded.
Sensory blockade was assessed by loss of sensation to pin prick over the C5-T1 dermatomes using a three point scale.[6]
0-Normal sensation
1-loss of sensation of pin prick (analgesia)
2-loss of sensation of touch (anesthesia)
Sensory onset time is defined as the time interval between the end of local anesthetic administration and establishment of score 2 on three point scale on all nerve territories. Duration of sensory blockade is defined as the time interval between the end of local anesthetic administration and complete resolution of anesthesia (score 0 on three point scale on all nerve areas).
Motor block was assessed using modified Bromage scale[7]
0-normal motor function with full flexion and extension of elbow, wrist and fingers.
1-decreased motor strength with ability to move fingers only.
2-complete motor blockade with inability to move fingers.

Complete motor block is defined as the absence of voluntary movements in hand and forearm (score 2 on bromage scale). Duration of motor block is defined as the time interval between the end of local anesthetic administration and recovery of complete motor function of hand and forearm (score 0 on bromage scale). Block was considered inadequate, when sensory anesthesia was not achieved within 30 minutes and such patients were excluded from the study.

Duration of analgesia is defined as the time interval between supraclavicular brachial plexus block administration and onset of pain, that is VAS score >4.

Visual analog scale- on a scale of 0-10, the patient is asked to quantify postoperative pain.

0-no pain, 10-maximum/worst pain. Injection diclofenac sodium 75 mg im will be administered after a test dose if VAS score reaches 4.

Statistical Analysis

Data was entered into Microsoft Excel and analysed using Epi info Version 7. Mean ± standard deviation was used to evaluate onset and duration of sensory and motor blockade and duration of post operative analgesia and t test was used for comparison between groups.

RESULTS

There were no statistically significant differences in the demographic profile of patients of either of the group in terms of age, weight and male to female ratio thus implying that the groups are comparable with respect to age, weight and gender. (Table 1).

Table 1 Demographic Variables

	GROUP	N	MEAN	P value
Age	A	30	36.56 ± 7.18	.15
	B	30	40.26 ± 12.06	
Weight	A	30	54.10 ± 4.07	.26

	B	30	55.13 ± 3.02

		A	B	P value
GENDER	MALE	17	16	.70
	FEMALE	13	14	

Mean time of onset of sensory block was 11.00 ±1.64 min in group A and 13.76 ± 1.77 min in group B. It was observed that patients of group A had an earlier onset of sensory block compared to group B. On applying 't' test to see if this difference between groups was statistically significant, a 'p' value of < 0.0001 was obtained showing that the difference was statistically significant. (Table 2).

Table 2 Onset of Sensory Block

	group	N	Mean	Standard deviation	t value	Degree of freedom	P value
Onset of sensory block	A	30	11	1.64	-6.27	58	<0.0001
	B	30	13.76	1.77			

Mean time of onset of motor block was 13.36 ± 1.95 min in group A and 16.06 ± 1.99 min in group B. It was observed that patients of group A had an earlier onset of motor block compared to group B. On applying 't' test to see if this difference between groups was statistically significant, a 'p' value of < 0.0001 was obtained showing that the difference was statistically significant. (Table 3).

Table 3 Onset of Motor Block

	Group	N	Mean	Standard deviation	t value	Degree of freedom	P value
Onset of motor block	A	30	13.36	1.95	-5.29	58	<0.0001
	B	30	16.06	1.99			

Mean duration of sensory block was 442.00 ± 33.05 min in group A and 299.00 ± 17.68 min in group B. Statistical analysis showed that duration of sensory block was significantly longer in group A compared to group B with a p value<0.0001.(Table 4).

Table 4 Duration of Sensory Block

		N	Mean	Standard deviation	t value	Degree of freedom	P value
Duration of sensory block	Group A	30	442	33.05	20.89	58	<0.0001
	B	30	299	17.68			

Mean duration of motor block was 381.33 ± 34.91min in group A and 241.66 ± 18.01 min in group B. Statistical analysis showed that duration of motor block was significantly longer in group A compared to group B with a p value<0.0001. (Table 5).

Table 5 Duration of Motor Block

	Group	N	Mean	Standard deviation	t value	Degree of freedom	P value
Duration of motor block	A	30	381.33	34.91	19.41	58	<0.0001
	B	30	241.67	18.02			

Mean duration of post operative analgesia was 452.33 ± 32.45 min in group A and 309.33 ± 18.18 min in group B. Statistical analysis showed that duration of post operative analgesia was significantly longer in group A compared to group B with a p value<0.0001.(Table 6).

No side effects were noted in both groups in our study.

Table 6 Duration of Post Operative Analgesia

	Group	N	Mean	Standard deviation	t value	Degree of freedom	P value
Duration of post operative analgesia	A	30	452.33	32.45	21.06	58	<0.0001
	B	30	309.33	18.18			

DISCUSSION

Upper limb surgeries are mostly performed under brachial plexus block (BPB) which avoids the unwanted effects of anesthetic drugs, stress of laryngoscopy and tracheal intubation, and also extend analgesia in the postoperative period without any systemic side effects such as nausea, vomiting, and respiratory depression.[8]Supraclavicular approach for brachial plexus block gives the most effective block for all portion of upper extremity.[9,10,11] Carlo *et al.*[12] found that subclavian perivascular approach consistently provides an effective block for the upper limb.

At the site of injection, the plexus is reduced to its smallest components, and the sheath is reduced to its smallest volume, which explains the success (98.8%) obtained with it. Brown [13] also found that supraclavicular brachial plexus block provides anesthesia of the entire upper limb in the most consistent, time efficient manner.

Peripheral nerve blocks with local anaesthetics provide excellent operating conditions with good muscle relaxation but the duration of analgesia is rarely maintained for more than 2-3 hours even with the longest acting local anaesthetics (Bupivacaine, Ropivacaine and levo-bupivacaine). Anesthesia providers have addressed this limitation by adding adjunctive drugs to local anesthetics to prolong duration and enhance quality of regional blocks. However, no known single source identifies those adjuvants that are best at prolonging the duration of single injection peripheral nerve blocks and extending the time to first analgesia for patients undergoing orthopedic surgery. Buprenorphine and Dexmedetomidine are two commonly used adjuvants with local anesthetics.

Doses of lignocaine, buprenorphine and Dexmedetomidine used

The dose of lidocaine used in our study is the maximum recommended dose of lidocaine with adrenaline.[14] 1.5% lignocaine with adrenaline have been successfully used in axillary brachial plexus block in various studies [15] with adequate anaesthesia during intraoperative period.

In the majority of the studies with buprenorphine as a local anesthetic (LA) adjuvant, either a fixed dose of 300 µg or 3 µg/kg has been used.[16,17,18,19]. Hence we used Buprenorphine at a dose of 3 µg/kg

The dose selection of Dexmedetomidine was based on previous studies where dexmedetomidine 1 µg/kg and clonidine 1 µg/kg were used in Bier's block as an adjuvant to lignocaine [20] and in supraclavicular block as an adjuvant to 0.25% bupivacaine.[21]

A study by Aman thakur etal[22] also concluded that 1 µg/kg dexmedetomidine has better therapeutic profile as compared to 0.5 µg/kg without any significant side effects, as an adjuvant to lignocaine with adrenaline in axillary brachial plexus block.

In our study addition of buprenorphine to local anesthetic significantly prolonged the duration of sensory and motor blockade and duration of post operative analgesia when compared to Dexmedetomidine Many researchers have observed similar prolongation of duration in sensory and motor block with Buprenorphine similar to the results of our study [23,24,25,26,27]

From 2001 onwards, eight studies [7,16,17,18,24,28,29] have reported significantly long duration of analgesia using buprenorphine in brachial plexus block in our study addition of buprenorphine shortened the onset of sensory and motor block when compared to Dexmedetomidine. This is in contrast to previous studies [17,30] where Buprenorphine has no effect on onset of sensory and motor block. This needs further evaluation in future.

Buprenorphine is a highly lipophilic, partial μ-opioid receptor agonist with analgesic properties. It is postulated that μ-receptors are located on the peripheral nerve endings, and because of its high lipophilic properties, buprenorphine is more likely to access these receptors.[30] When used as an adjuvant, buprenorphine stimulates these peripheral selective opioid receptors, produces analgesia, and dramatically increases the duration of action of local anesthetics in peripheral nerve blocks.

Use of adjuvants like Buprenorphine and Dexmedetomidine in peripheral nerve block reduces its systemic side effects like respiratory depression, hemodynamic changes, nausea and vomiting[2,21] which were reflected in our study that none of the patient in our study had major side effects or complication during the study period.

CONCLUSION

From our study "effect of addition of Buprenorphine versus Dexmedetomidine to Lignocaine with Adrenaline in supraclavicular brachial plexus block, we concluded that Buprenorphine when compared to Dexmedetomidine shortens the onset time of sensory and motor blockade when used as an adjuvant with Lignocaine with Adrenaline in supraclavicular brachial plexus block.

Buprenorphine when compared to Dexmedetomidine also increases the duration of sensory and motor block as well as duration of post operative analgesia when used as an adjuvant with Lignocaine with Adrenaline in supraclavicular brachial plexus block.

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