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COMPARISON OF DEXMEDETOMIDINE AND MIDAZOLAM AS AN ADJUVANT TO LOCAL ANAESTHETIC SOLUTION IN ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

Anaesthesiology

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ABSTRACT

Objective: Present study was conducted with intent to compare effects of addition of dexmedetomidine and midazolam as an adjuvant to local anaesthetic mixture in supraclavicular brachial plexus block.

Material and methods: Three groups of 20 patients each.

Control Group (Group-NS) 12.5 ml of 0.5% levobupivacaine + 12.5 ml of 2% lignocaine with adrenaline (1 in 200000) + 2.5 ml normal saline,

study Group I (Group-DEX) 12.5 ml of 0.5% levobupivacaine + 12.5 ml of 2% lignocaine with adrenaline (1 in 200000) + 50 µg dexmedetomidine in 2.5 ml normal saline

study Group II (Group-MID) 12.5 ml of 0.5% levobupivacaine + 12.5 ml of 2% lignocaine with adrenaline (1 in 200000) + 2.5 mg preservative free midazolam.

Results: Onset and duration of sensory and motor block were comparable in test groups but were statistically significant when compared to control group. Sedation and satisfaction was greatest with midazolam followed by dexmedetomidine.

KEYWORDS

supraclavicular , dexmedetomidine, midazolam, levobupivacaine

INTRODUCTION: 'The greatest evil is physical pain' rightly said by Saint Augustine, the Christian theologian and philosopher. Postoperative pain has many detrimental effects on the body. Regional nerve blocks are based on interruption of transmission of pain impulses anywhere along the course of the nerve. The brachial plexus is a somatic nerve plexus formed by intercommunications among the ventral rami (roots) of the lower 4 cervical nerves (C5 - C8) and the first thoracic nerve (T1). Supraclavicular approach of brachial plexus block was first described by Kulenkampff[4] in 1911. Introduction of USG in regional anaesthesia has offered advantage of less complications and increased success rate.

AIMS AND OBJECTIVES: To study and compare the effects of addition of midazolam and dexmedetomidine as an adjuvant to local anaesthetic solution of levobupivacaine and lignocaine with adrenaline in supraclavicular brachial plexus block with respect to: Onset and duration of sensory and motor block, the time of demand for first rescue analgesic, total analgesic requirement in 24 hrs postoperatively and side effects, if any.

MATERIAL AND METHODS: After approval of Institutional Research and Ethical Committee a prospective randomized double blinded control study was carried out in ASA I and ASA II patients posted for unilateral upper limb surgery at IGMC Shimla. Patients were randomly allocated into three groups of 20 patients each. All the groups received 12.5 ml of 0.5% levobupivacaine and 12.5 ml of 2% lignocaine with adrenaline (1 in 200000). In addition Control Group (Group-NS) received 2.5 ml normal saline, study Group I (Group-DEX) received 50 µg dexmedetomidine in 2.5 ml normal saline to make total volume of 27.5 ml, study Group II (Group-MID) received 2.5 mg preservative free midazolam. The anaesthetist prepared the local anaesthetic solution according to the group allocated to the patient and the syringe was coded. But another anaesthetist who performed the ultrasound guided supraclavicular brachial plexus block and recorded the parameters blinded to the contents of the syringe injected the solution for the block. Syringes were decoded after completion of study period of 24 hrs, when all the parameters were recorded.

Exclusion criteria:- Patient refusal, non cooperative patients, ASA grade 3 & 4,history of peripheral neuropathy, pregnant women, coagulative disordes, drug allergy, Cutaneous infection at the site of injection, psychiatric disease, history of substance abuse.

Patients were kept nil per orally for at least 6 hrs. In the operation theatre, all patients were connected to monitors and baseline vital data (mean arterial pressure, heart rate, pulse oximetry and respiratory rate) were recorded. Intravenous line was secured and intravenous fluid was started in the contralateral arm. Injection fentanyl 50 µg slow i.v. was given to all the patients before performing the supraclavicular brachial plexus block. Patients were kept in supine position with head turned to the contralateral side. A wedge was placed under the shoulder to make the supraclavicular area prominent. Under aseptic precautions, the probe was placed in the supraclavicular fossa in a coronal-oblique plane and the pulsating hypo-echoic subclavian artery was identified, lying above the hyperechoic first rib. While maintaining the view of the artery, the probe will then be angled until both the first rib and the pleura are also seen simultaneously. The brachial plexus was identified as a collection of hypo-echoic oval structures lateral and superficial to the artery. The needle was inserted in-plane into the perineural sheath. After a careful negative aspiration the drug mixture was injected and spread of local anaesthetic solution was ensured along the neural bundle. Oxygen was supplemented through venturimask. Then, following parameters were studied in the operating room:-

1. Onset of sensory block: The onset of sensory block was defined as the time taken from the end of injection of local anaesthetic solution to no pin prick sensation felt with blunt 22g sterile needle in the distribution of all of the major sensory nerves of the limb at 2, 5, 10, and 15 min.

2. Duration of sensory block: The duration of sensory block was assessed postoperatively every 30 min according to pin prick sensation felt or not in each of the major peripheral nerve distribution. The time when the pin prick sensation was felt was considered to be the time of cessation of sensory block. Patient was shifted and postoperative analgesia was managed with injection diclofenac sodium 75 mg i.m. when VAS score of the patient is greater than 5. Time of demand for first rescue analgesia was documented. Total analgesic requirement of the patient in 24 hrs postoperatively was documented.

3. Onset of motor block: The onset of motor block was defined as the time taken from the end of injection of local anaesthetic solution to the inability of the patient to flex his/her elbow and wrist against the gravity. Motor block was assessed at 0, 2, 5, 10 and 15 min. The motor blockade was graded according to Modified Bromage Scale for upper limb.

4. Duration of motor block: The duration of motor block was assessed postoperatively every hour by asking patients to flex his/her elbow and wrist against the gravity. Ability to raise either elbow or wrist against the gravity was documented as the time for cessation of motor block.

5. Haemodynamic monitoring: HR, MAP, RR and SPO_2 were monitored in each group at every 5 min during the surgery and were documented at 0, 5, 10, 15, 30, 60, 90 and 120 min.

6. Sedation scoring: Sedation score was assessed by using the Modified Observer's Assessment of Alertness/Sedation Scale (MOAAS) for 5 hrs after supraclavicular brachial plexus block.

7. Satisfaction Scores: The satisfaction level after the surgery was evaluated as good (1), intermediate (2) and worse (3).

8. Management of unsuccessful block: Patients with failure of block and partial block was administered general anaesthesia and were excluded from the study. Incidence of failure of the block was documented.

9. Statistical analysis: The data obtained was tabulated and statistically analyzed using appropriate tests (ANOVA, students t-test, Mann-Whitney Test) and the results thus obtained were presented in the light of statistical and clinical significance.

Observations: Demographic Data: The mean age in group DEX was 36.30 ± 12.46 years, in group MID was 41.30 ± 17.10 years and in group NS was 32.10 ± 11.30 years which was not significant statistically (p value > 0.05). In group DEX ratio of male to female was 15:5, in group MID ratio was 11:9 and in group NS the ratio was 13:7

Sensory assessment: as shown in table 1, the results of onset of sensory block were statistically significant when study groups were compared to control group (p value < 0.001), but the results were not statistically significant (p value > 0.05) when study groups were compared to each other. Also, the results of duration of sensory block were statistically very significant when study groups were compared to control group (p value < 0.001), but the results were not statistically significant (p value > 0.05) when study groups were compared to each other.

Table 1: Onset and Duration of Sensory Block

		DEX		MID		NS		p value		
		Mean	SD	Mean	SD	Mean	SD	DEX vs MID	DEX vs NS	MID vs NS
Sensory	Onset (min)	5.40	2.64	6.30	2.97	12.50	2.56	0.554	<0.001	<0.001
	Duration (hrs)	13.78	1.41	13.63	3.00	6.75	0.59	0.979	<0.001	<0.001

*p value :> 0.05 is not significant, < 0.05 is significant, < 0.001 is highly significant

Motor Assessment: As shown in table 2, The result of mean time of onset of motor block was statistically very significant when study groups were compared to control group (p value < 0.001), but the results were not statistically significant (p value > 0.05) when study groups were compared to each other. Also, the result of duration of motor block was statistically very significant when study groups were compared to control group (p value < 0.001), but the results were not statistically significant (p value > 0.05) when study groups were compared to each other.

Table 2: Onset and Duration of Motor Block

		DEX		MID		NS		p value		
		Mean	SD	Mean	SD	Mean	SD	DEX vs MID	DEX vs NS	MID vs NS
Motor	Onset (min)	4.30	2.43	5.70	2.88	10.50	3.20	0.28	<0.001	<0.001
	Duration (hrs)	9.13	2.28	9.48	3.63	4.80	0.95	0.91	<0.001	<0.001

*p- value : >0.05 is not significant, <0.05 is significant, <0.001 is highly significant

Haemodynamic monitoring: HR was monitored in each group at every 5 min during the surgery and was documented at 0, 5, 10, 15, 30, 60, 90 and 120 mins. Haemodynamic parameters were comparable between three groups.

Sedation Score: Results were statistically significant when scores were compared between group MID and group DEX at 10 min, 30 min, 1 hr, 2hr, sedation scores being higher in Group MID. Between group DEX and group NS at 10 min, 30 min and 1 hr, sedation scores were found to be higher in Group DEX. Between group MID and group NS at 10 min, 30 min, 1 hr, 2 hr and 3 hr. with more pronounced sedation in group MID.

Table 3: Sedation Scores (comparison after Mann-Whitney Test in three groups)

Timeline	MID vs DEX	DEX vs NS	MID vs NS
	p value*	p value*	p value*
0 min	0.681	0.075	0.057
10 min	<0.001	<0.001	<0.001
30 min	<0.001	<0.001	<0.001
1 hr	0.002	<0.001	<0.001
2hr	<0.001	0.081	<0.001
3 hr	0.101	0.317	0.018
5 hr	0.317	1	0.317

*p value :> 0.05 is not significant, < 0.05 is significant, < 0.001 is highly significant

Satisfaction Score: Patients were most satisfied in group MID with average score of 2.7 ,in group DEX average satisfaction score was 2.3 whereas in group NS score was 1.9.

Rescue Analgesia: The mean duration of time of demand for first dose of rescue analgesia in group DEX was 16.80 ± 0.84 hrs, in group MID was 17.40 ± 1.43 hrs and in group NS was 9.33 ± 1.89 hrs. The result was not statistically significant between the test groups but the results between test groups and control group statistically significant (p value <0.05).

Mean dose of diclofenac sodium required in 24 hours postoperatively for group DEX was 75 + 0.00 mg, for group MID was 75 + 0.00 mg and for group NS was 112.50 ± 38.47 mg. The result was not statistically significant between the test groups but was statistically very significant between the test groups and the control group.

Table 4: Rescue Analgesia

	DEX	MID	NS
Number of patients receiving one dose	5	6	10
Number of patients receiving two doses	0	0	10

DISCUSSION: Upper limb surgeries are increasingly being performed under regional anaesthesia with rapid onset but unable to provide long post operative analgesia with local anesthetic alone. Thus we planned a study comparing dexmedetomidine with midazolam as an adjuvant to LA in supraclavicular brachial plexus block. In our study, the effects of addition of dexmedetomidine on onset and duration of sensory block were comparable to various studies. In a study conducted by Biswas et al[2] and Aggarwal et al[3] authors concluded that dexmedetomidine when added to bupivacaine for supraclavicular block significantly prolongs the duration of sensory blockade. Dixit et al[4] demonstrated that the onset of the block was faster and duration was prolonged with addition of dexmedetomidine as an adjuvant to local anaesthetics.

The results of study conducted by Laiq et al[5] have shown that addition of midazolam to bupivacaine in supraclavicular brachial plexus block shortens the onset and prolongs the duration of sensory block.. Our study has also demonstrated similar effects as seen by Dalvi et al[6]. Harshavardhana[7] in his study concluded that there were no significant differences in haemodynamic parameters when dexmedetomidine was compared to clonidine. Dash et al[8] and Laiq et al[5] in their study did not find any significant changes in haemodynamic parameters on addition of midazolam. Haemodynamic parameters were comparable in all the groups in our study.

We also found that sedation was more pronounced in group receiving midazolam followed by dexmedetomidine and least or no sedation in

control group. Dixit et al[4], Agrawal et al[9] and Meena et al[10] in their study also demonstrated that dexmedetomidine produced sedation when used in supraclavicular block. Jabro et al[11], Laiq et al[5] and El-Baradey et al[12] demonstrated that sedation scores were greater in patients who received midazolam as an adjuvant to local anaesthetics in supraclavicular block.

Results similar to our study were found by Gandhi et al[13] and Kaygusuz et al[14] in their studies which showed that dexmedetomidine increases the duration of analgesia. Efficacy of addition of midazolam in prolongation of duration of analgesia has been demonstrated by studies conducted by Raghu et al[15], Shaikh et al[16] and Nalwaya et al[17]. Therefore, both dexmedetomidine and midazolam increase the duration of demand for first recue analgesic and also decreased the total dose of rescue analgesic consumed.

CONCLUSION: In our study, we found comparable faster onset, increased duration of sensory and motor block and increased duration of analgesia on addition of dexmedetomidine and midazolam to a mixture of local anaesthetics without any untoward side effects in USG guided supraclavicular brachial plexus block. Patients were most satisfied with addition of midazolam. Hence both dexmedetomidine and midazolam can be safely used as an adjuvant to local anaesthetic mixture. The main limitation of our study was small sample size and the study was done in ASA I and II patients so the effects of addition of dexmedetomidine and midazolam to local anaesthetic mixture could not be assessed in ASA III and IV patients.

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