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ASSOCIATION DEXMEDETOMIDINE AND DEXAMETHASONE AS AN ADJUVANT TO LEVOBUPIVACAINE FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN PATIENTS UNDERGOING UPPER LIMB SURGERIES.

Anaesthesiology

Dr. Amit Kumar MD Anaesthesia Assistant professor MGM Medical College.

Dr. Arun Kumar PGT anaesthesia Mgm medical college.

Dr. Debarshi Jana * Young Scientist Institute of Post-Graduate Medical Education and Research, West Bengal, India. *Corresponding Author

ABSTRACT

Introduction: Brachial plexus block has evolved into an excellent substitute to general anaesthesia for upper limb surgeries. By curtailing the stress response and using minimal anaesthetic drugs it provides intraoperative analgesia along with prolonged postoperative pain-relief.[1] Varied avenues of brachial plexus blockade exist namely interscalene, supraclavicular, infraclavicular and axillary approach. With swift onset of dense anaesthesia of upper limb, supraclavicular brachial plexus block (SCBP) block is considered as the 'spinal of the arm.

Objective: To conduct a comparative evaluation between Dexmedetomidine and Dexamethasone as an adjuvant to Levobupivacaine for supraclavicular brachial plexus block inpatients undergoing upper limb surgeries.

Material and Methods: This is a prospective randomized controlled intervention study was Patients undergoing elective upper limb surgeries under supraclavicular brachial plexus block at orthopaedic surgery rooms of MGM Medical College From March 2019 to August 2020 Patients aged between 20-60 years of either sexes. Patients belonging to ASA Grade I and ASA Grade II and Patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block in included in this study.

Result: The mean Onset of sensory block (mean± s.d.) of patients was higher in Group-C [13.2333± 1.6333 Mins] compared to Group-S patients [11.2000± 1.1265(Min)] which was statistically significant ($p<0.0001$). the mean Duration of Sensory Block (mean± s.d.) of patients was higher in Group-S [753.5667± 5.2172 (Min)] compared to Group-C patients [718.2333± 25.7504 (Min)] which was statistically significant ($p<0.0001$). the mean Duration of Motor Block (mean± s.d.) of patients was higher in Group-S [708.5667± 4.2644 (Min)] compared to Group-C patients [682.3667± 20.0095 (Min)] which was statistically significant ($p<0.0001$).

Conclusion: The difference of mean Fingers 0 ($p=0.6311$), Fingers 5 ($p=0.8860$), Fingers 10 ($p=1.0000$), Fingers 15 ($p=1.0000$), Fingers 20 ($p=1.0000$), Fingers 25 ($p=0.5936$) and Fingers 30 ($p=0.8469$) with both Groups were not statistically significant. Bromage Score 0 ($p=0.8469$), Bromage Score 5 ($p=0.8355$), Bromage Score 10 ($p=0.5693$), Bromage Score 15 ($p=0.5671$), Bromage Score 20 ($p=0.5671$), Bromage Score 25 ($p=0.6973$) and Bromage Score 30 ($p=0.7176$) with both Groups were not statistically significant.

KEYWORDS

Dexmedetomidine, Dexamethasone, supraclavicular brachial plexus block, Levobupivacaine, sensory block and Motor Block.

INTRODUCTION

Peripheral nerve block has taken patient care in anaesthesia to a whole new level. One can extend patient care in the form of extended postoperative analgesia, ensure compliance of patient with physiotherapy and early mobilization of patient with stable haemodynamic variables. Various studies have shown that dexmedetomidine prolongs the duration of sensory and motor block and provide a very good analgesia when used as an adjuvant to local anaesthetics for nerve blocks. The anaesthetic and the analgesic requirement are reduced substantially because of its analgesics properties and augmentation of local anaesthetics (LA) effects as they cause hyperpolarization of nerve tissues by altering transmembrane potential and ion conductance at locus ceruleus in brain stem. Steroids have powerful anti-inflammatory as well as analgesic property. Perineurally injected steroids is reported to influence postoperative analgesia. Dexamethasone microspheres have been found to prolong the block duration in animal and human studies and adding methyl prednisolone to local anaesthetic increase the duration of brachial plexus block. Brachial plexus block is one of the easiest, safest and most commonly performed peripheral nerve blocks in day to day practice of anaesthesia. We chose supraclavicular approach for BPB as the narrowest part of plexus is located there and anaesthesia will be rapid, dense and predictable for the entire upper limb.

Brachial plexus block has evolved into an excellent substitute to general anaesthesia for upper limb surgeries. By curtailing the stress response and using minimal anaesthetic drugs it provides intraoperative analgesia along with prolonged postoperative pain-relief.[1] Varied avenues of brachial plexus blockade exist namely interscalene, supraclavicular, infraclavicular and axillary approach. With swift onset of dense anaesthesia of upper limb, supraclavicular brachial plexus block (SCBP) block is considered as the 'spinal of the arm.

Ultrasound facilitates the deposition of drug at the apt place and augments block success. The brachial plexus at supraclavicular regions is compact and shallow (20-30 mm deep) and the nerve visibility is remarkable.[2]

Consistent efforts have been made to enhance the outcomes of the block by adding myriad adjuncts to local anaesthetics (Las). Dexamethasone as adjuvant to perineural local anaesthetics augments peripheral nerve block analgesia.[3] Dexmedetomidine, an alpha-adrenergic agonist when mixed with LAs for brachial plexus block facilitates better anaesthesia and analgesia.[4] The chase for quintessential adjuvant with most benefits and minimal side-effects continues.

Results of these studies are discordant and call for more direct comparison between the two adjuncts. The primary outcomes studied were onset and duration of sensory and motor block. Secondary outcomes included duration of analgesia, total analgesic consumption in 24 h postoperatively, quality of block and complications.[5,6]

To conduct a comparative evaluation between Dexmedetomidine and Dexamethasone as an adjuvant to Levobupivacaine for supraclavicular brachial plexus block inpatients undergoing upper limb surgeries

METHODOLOGY

A) Study Setting And Timelines- The study is to be conducted in MGM Medical College which is a rural based tertiary care hospital and medical college. Timeframe of the study is about one and half years from acceptance of synopsis.

Study period: From March 2019 to August 2020.

i) Preparatory Phase- 1 month
ii) Case Recruitment- 6 months
iii) Data collection- 10 months
iv) Data Entry and Analysis- 7 months
v) Report Writing- 1 month

Group S: Dexmedetomidine group (study group)- Patients were received Inj. 0.25% Levobupivacaine 2mg/kg body weight + Inj. Dexmedetomidine 1mcg/kg body weight + Distilled water (total volume 30-40ml)

Group C: Dexamethasone group (control group)- Patients were

received Inj. 0.25% Levobupivacaine 2mg/kg + Inj. Dexamethasone 0.1mg/kg body weight + Distilled water (total volume 30-40ml)

H) Inclusion / Exclusion Criteria:
Following criteria to be adopted for selecting patients :

Inclusion Criteria
- Patients aged between 20-60 years of either sexes.
- Patients belonging to ASA Grade I and ASA Grade II.
- Patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block.

Exclusion Criteria
- Unwilling patients.
- ASA class 3, 4 and 5.
- Infection at the site of injection.
- Presence of coagulopathies.
- Hypersensitivity to any of bupivacaine, dexamethasone or dexmedetomidine.

Statistical Analysis:
For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS 24.0. and GraphPad Prism version 5. A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short for Pearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. p-value ≤ 0.05 was considered for statistically significant.

RESULT & DISCUSSION
This prospective randomized controlled intervention study (superiority trial) was conducted in BSMCH which is a rural based tertiary care hospital and medical college from March 2020 to August 2021.

The proposed study was to conducted in the orthopaedic surgery operating rooms under the aegis of Department of Anaesthesiology, Bankura Sammilani Medical College and Hospital, Bankura.

Patients were selected after thorough pre-anaesthetic assessment and investigations. 60 patients were divided into two groups, Group S and Group C with 30 cases in each group by matching patient's age, sex, Mallampati score and ASA grading (I or II).

One group was the study group (Dexmedetomidine group) and another was the control group (Dexamethasone group).

Group S: Dexmedetomidine group (study group)- Patients were received Inj. 0.25% Levobupivacaine 2mg/kg body weight + Inj. Dexmedetomidine 1mcg/kg body weight + Distilled water (total volume 30-40ml)

Group C: Dexamethasone group (control group)- Patients were received Inj. 0.25% Levobupivacaine 2mg/kg + Inj. Dexamethasone 0.1mg/kg body weight + Distilled water (total volume 30-40ml)

Patients aged between 20-60 years of either sexes, Patients belonging to ASA Grade I and ASA Grade II and Patients scheduled for elective upper limb surgeries under supraclavicular brachial plexus block were included in this study.

In our study, In Group-C, 17 (56.7%) patients had ASA 1 and 13 (43.3%) patients had ASA 2. In Group-S, 17 (56.7%) patients had ASA 1 and 13 (43.3%) patients had ASA 2. It was not statistically significant (p=2.7767).

Our study showed that, In Group-C, the mean Weight in Kg (mean± s.d.) of patients was 65.8933± 4.2152 and In Group-S, the mean Weight in Kg (mean± s.d.) of patients was 65.5600± 4.5229 which was not statistically significant (p=0.7688).

Lee MJ et al [7] (2016) showed that fifty-one ASA physical status I–II patients with elective forearm and hand surgery under axillary brachial plexus blocks were randomly allocated to receive 20 ml of 0.5% ropivacaine with 2 ml of isotonic saline (C group, n = 17), 20 ml of 0.5% ropivacaine with 2 ml (10 mg) of dexamethasone (D group, n = 17) or g) of dexmedetomidine (DM group, n = 17). The duration of the sensory block was extended in group D and group DX compared with group C ($P < 0.05$), but there was no significant difference between group D and group DX. However, there were no significant differences in onset time in all three groups. g were equally effective in extending the Dexamethasone 10 mg and dexmedetomidine 100 duration of ropivacaine in ultrasound-guided axillary BPB with nerve stimulation. However, neither drug has significantly effects the onset time.

Singh N et al [8] (2020) observed that Group 1 (n = 20) received 1 μg/kg of dexmedetomidine, and group 2 (n = 20) received 8 mg of dexamethasone in addition to ropivacaine, while group 3 (n = 20) received only ropivacaine. Onset of sensory and motor block was faster in group 1 (13.5 ± 4.1 and 17.0 ± 4.1 min) and group 2 (15.6 ± 3.6 and 18.5 ± 3.7 min) as compared to group 3 (20.1 ± 5.3 and 24.9 ± 5.6 min; $P < 0.001$). Block duration was significantly longer in group 1 and group 2 than in group 3. Duration of analgesia was prolonged in group 1 and 2 (1218.0 ± 224.6 and 1128.0 ± 207.5 min, respectively) as compared to group 3 (768.0 ± 273.7 min; $P < 0.001$). Twenty-four hours analgesic consumption postoperatively was reduced in the two study groups. Both dexmedetomidine and dexamethasone when used as adjuvants to ropivacaine for SCBP block, block onset time, and prolong' block duration.

Vorobeichik L et al [9] (2017) found that dexmedetomidine prolonged sensory block (at least 57%, $P < 0.0001$), motor block (at least 58%, $P < 0.0001$), and analgesia (at least 63%, $P < 0.0001$) duration. Dexmedetomidine expedited onset for both sensory (at least 40%, $P < 0.0001$) and motor (at least 39%, $P < 0.0001$) blocks. Dexmedetomidine also reduced postoperative oral morphine consumption by 10.2mg [-15.3, -5.2] ($P < 0.0001$), improved pain control, and enhanced satisfaction. A 50-60μg dexmedetomidine dose maximized sensory block duration while minimizing haemodynamic side-effects. No patients experienced any neurologic sequelae. Evidence quality for sensory block was high according to the GRADE system.New evidence now indicates that perineural dexmedetomidine improves BPB onset, quality, and analgesia. However, these benefits should be weighed against increased risks of motor block prolongation and transient bradycardia and hypotension.

Abdallah FW et al [10] (2013) found that sensory block duration was prolonged by 150 min [95% confidence interval (CI): 96, 205, P,0.00001] with intrathecal dexmedetomidine. Perineural dexmedetomidine used in BP block may prolong the mean duration of sensory block by 284 min (95% CI: 1, 566, P¼0.05), but this difference did not reach statistical significance.

We observed that, the mean Onset of sensory block (mean± s.d.) of patients was higher in Group-C [13.2333± 1.6333 Mins] compared to Group-S patients [11.2000± 1.1265(Min)] which was statistically significant ($p<0.0001$).

We also found that, the mean Duration of Sensory Block (mean± s.d.) of patients was higher in Group-S [753.5667± 5.2172 (Min)] compared to Group-C patients [718.2333± 25.7504 (Min)] which was statistically significant ($p<0.0001$).

Nema N et al [11] (2019) found that Group DM (n = 30), to receive 15 ml of 0.5% bupivacaine and 15 ml of 2% lignocaine with Adr + 1 ml of Dexmedetomidine (50mcg) + 1ml distilled water, making a total of 32 ml and another Group DX (n = 25), to receive 15 ml of 0.5% bupivacaine and 15 ml of 2% lignocaine with Adr. + 2ml of Dexamethasone (8 mg). The time of onset of sensory and motor block was significantly less in group DM as compared to group DX ($P < 0.05$). The duration of the sensory and motor block as well as duration of post operative analgesia was significantly more in group DM as compared with group DX ($P<0.05$), but there was no statistically significant difference between both the groups with respect to the heart rate, mean arterial pressure and spo2.Dexmedetomidine 50 mg was more effective than dexamethasone 8 mg in extending the duration of supraclavicular brachial plexus block and prolonging the duration of post operative analgesia and it also significantly decreases the onset time of block.

Abdallah FW et al [10] (2013) found that motor block duration and time to first analgesic request were prolonged for both intrathecal and BP block. Dexmedetomidine produced reversible bradycardia in 7% of BP block patients, but no effect on the incidence of hypotension. No

patients experienced respiratory depression. Dexmedetomidine is a potential LA adjuvant that can exhibit a facilitatory effect when administered intrathecally as part of spinal anaesthesia or peripherally as part of a BP block. However, there are presently insufficient safety data to support perineural dexmedetomidine use in the clinical setting.
Our study showed that, the mean Onset of motor block (mean± s.d.) of patients was higher in Group-C [15.9333± 1.5742 (Min)] compared to Group-S patients [14.2667± 1.0807 (Min)] and this was statistically significant (p<0.0001).

Also the mean Duration of Motor Block (mean± s.d.) of patients was higher in Group-S [708.5667± 4.2644 (Min)] compared to Group-C patients [682.3667± 20.0095 (Min)] which was statistically significant (p<0.0001).

Table: Association between ASA: Group

GROUP					
ASA	**Group-C**	**Group-S**	**TOTAL**	**Chi-square value**	**p-value**
1	17	17	34	0.0000	2.7767
Row %	50.0	50.0	100.0		
Col %	56.7	56.7	56.7		
2	13	13	26		
Row %	50.0	50.0	100.0		
Col %	43.3	43.3	43.3		
TOTAL	30	30	60		
Row %	50.0	50.0	100.0		
Col %	100.0	100.0	100.0		

Table: Distribution of mean Onset of sensory block (Min), Onset of motor block (Min), Duration of Sensory Block (Min) and Duration of Motor Block (Min): Group

Onset of sensory block (Min)	Group-C	30	13.2333	1.6333	10.0000	15.0000	13.0000	<0.0001
	Group-S	30	11.2000	1.1265	10.0000	13.0000	11.0000	
Onset of motor block (Min)	Group-C	30	15.9333	1.5742	13.0000	18.0000	16.0000	<0.0001
	Group-S	30	14.2667	1.0807	13.0000	16.0000	14.0000	
Duration of Sensory Block (Min)	Group-C	30	718.2333	25.7504	680.0000	760.0000	708.5000	<0.0001
	Group-S	30	753.5667	5.2172	745.0000	760.0000	754.0000	
Duration of Motor Block (Min)	Group-C	30	682.3667	20.0095	640.0000	712.0000	677.0000	<0.0001
	Group-S	30	708.5667	4.2644	701.0000	715.0000	709.0000	

CONCLUSION

Onset of sensory block was higher in Group-C patients compared to Group-S patients which was statistically significant (p<0.0001). Duration of Sensory Block was significantly higher in Group-S compared to Group-C patients.

The mean Onset of motor block was higher in Group-C patients compared to Group-S patients and this was statistically significant (p<0.0001). Also the Duration of Motor Block (mean± s.d.) of patients was high in Group-S patients compared to Group-C patients which was statistically significant (p<0.0001).

Present study showed that, the difference of mean Median nerve 0 (p=0.1975), Median nerve 5 (p=0.8673), Median nerve 10 (p=0.7585), Median Nerve 15 (p=0.7585), Median Nerve 20 (p=0.7334), Median Nerve 25 (p=0.8589) and Median Nerve 30 (p=0.3773) with both Groups were statistically significant.

It was found that, the difference of mean Ulnar Nerve 0 (p=0.3773), Ulnar Nerve 5 (p=0.8680), Ulnar Nerve 10 (p=0.3249), Ulnar Nerve 15 (p=0.9503), Ulnar Nerve 20 (p=0.9503), Ulnar Nerve 25 (p=0.5026) and Ulnar Nerve 30 (p=0.4426) with both Groups were not statistically significant.

Our study showed that, the difference of mean Radial Nerve 0 (p=0.7637), Radial Nerve 5 (p=0.6386), Radial Nerve 10 (p=0.7473), Radial Nerve 15 (p=0.7473), Radial Nerve 20 (p=0.6171), Radial Nerve 25 (p=0.6171) and Radial Nerve 30 (p=0.9058) with both Groups was not statistically significant.

We found that, the difference of mean Musculocutan Eous Nerve 0 (p=0.9058), Musculocutan Eous Nerve 5 (p=0.3858), Musculocutan Eous Nerve 10 (p=0.3858), Musculocutan Eous Nerve 15 (p=0.3491), Musculocutan Eous Nerve 20 (p=0.8164), Musculocutan Eous Nerve 25 (p=0.4795) and Musculocutan Eous Nerve 30 (p=0.4795) with both Groups were not statistically significant.

Present study showed that, the difference of mean Elbow 0 (p=0.8547), Elbow 5 (p=0.7762), Elbow 10 (p=0.5799), Elbow 15 (p=0.7183), Elbow 20 (p=0.4167), Elbow 25 (p=0.4167) and Elbow 30 (p=0.5964) with both Groups were not statistically significant.

It was found that, the difference of mean Wrist 0 (p=0.8095), Wrist 5 (p=0.1965), Wrist 10 (p=0.3358), Wrist 15 (p=0.6623), Wrist 20 (p=0.9040), Wrist 25 (p=0.4657) and Wrist 30 (p=0.4657) with both Groups were not statistically significant.

In our study, the difference of mean Fingers 0 (p=0.6311), Fingers 5 (p=0.8860), Fingers 10 (p=1.0000), Fingers 15 (p=1.0000), Fingers 20 (p=1.0000), Fingers 25 (p=0.5936) and Fingers 30 (p=0.8469) with both Groups were not statistically significant.

We also found that, Bromage Score 0 (p=0.8469), Bromage Score 5 (p=0.8355), Bromage Score 10 (p=0.5693), Bromage Score 15 (p=0.5671), Bromage Score 20 (p=0.5671), Bromage Score 25 (p=0.6973) and Bromage Score 30 (p=0.7176) with both Groups were not statistically significant.

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