Comparison of Dexamethasone and Dexmedetomidine as Adjuvants to Bupivacaine in Prolonging the Duration of Single Injection Supraclavicular Brachial Plexus Block

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Background:
Brachial plexus block, both single shot and continuous, has been in use to provide anaesthesia and analgesia for upper limb surgeries. With the introduction of newer adjuvants and safer techniques of doing the procedure, single injection supraclavicular brachial plexus block is emerging as one of the preferred modalities of perioperative anaesthesia and analgesia for upper limb surgeries in many centres(1). To prolong the duration of nerve block the dose and volume of the local anaesthetic (LA) can be increased, but at the risk of LA toxicity. Catheter-based nerve blocks with continuous infusion can extend the duration of block to postoperative period, but they involve considerable skill and additional cost. There is also a risk of infection (2). Adjuvants to the nerve block can prolong the duration of the block without the aforementioned risks.

Addition of adjuvants to peripheral nerve blocks to extend the duration of anaesthesia and analgesia would also help in decreasing the untoward side effects such as nausea, vomiting, constipation and respiratory depression caused by intravenous opioids; that would otherwise have to be used to provide adequate postoperative analgesia.

Many studies have been done using adjuvants like dexamethasone, clonidine, opioids and a few on dexmedetomidine. However, there has been no study comparing dexamethasone and dexmedetomidine as adjuvant to bupivacaine in supraclavicular brachial plexus block. By knowing and comparing how much each adjuvant prolongs the duration and onset of block, we can choose an appropriate adjuvant based on the surgical duration.

This is a randomized double-blinded controlled trial, conducted in JIPMER from January 2015 to May 2016. The institute research monitoring and ethics committees approved the study protocol.

Aims and Objectives:
To compare the efficacy of dexamethasone and dexmedetomidine in prolonging the duration of supraclavicular brachial plexus block.
To compare the onset of sensory and motor block.
To compare morphine requirement after the request of first analgesic.
To compare intraoperative fentanyl requirement.
To compare NRS scores between the three groups.
Methodology:

After informed consent, ninety patients between the age group 18 and 75 years belonging to ASA 1 and 2 class, who were posted for upper limb surgeries were included in the study.

Once the patient was positioned, under aseptic precautions using both ultrasound and nerve stimulator, the brachial plexus was identified in supraclavicular region using Pajunk 100mm stimulating needle. At 0.5 mA current strength, a test dose of 0.2ml of the study drug was injected and when the response was abolished, rest of the study drug was injected superior and inferior to the brachial plexus. Pregnant patients, presence of pre-existing neuropathy involving the surgical limb, systemic use of corticosteroids for 2 weeks or longer within 6 months of surgery, known allergy to bupivacaine, dexmedetomidine or dexamethasone, coagulopathy and diabetic patients were excluded.

They were randomly assigned into three groups. Each patient received 25ml of 0.5% bupivacaine along with 2ml of 8mg dexamethasone in A group; 1μg/kg of dexmedetomidine (2ml) in M group and 2ml of normal saline in C group. Total volume injected was 27 ml.

Onset and duration of sensory block were noted. Patients were started on PCA morphine for 24 hours after the first analgesic request. NRS scores were noted every 4 hours and total morphine consumption was also noted.

Statistical Analysis:

29 in each group was arrived at using "n master" software considering 45 min difference between each group with respect to motor block with 5% level of significance and 80% power. It was rounded off to 30 keeping failed blocks and dropouts in mind.

SPSS 19 version was used for all statistical analysis in this study. Normality of distribution of data was determined using Kolmogorov-Smirnov tests of normality. Chi square test was used for analysis of ASA and gender. Age and weight were expressed as mean ± SD.

Parametric variables like onset and duration of sensory and motor block, intraoperative fentanyl consumption and morphine consumption after request of first analgesic were analysed using One Way ANOVA. Post Hoc Bonferroni test was done for comparison within and between groups. Variables were expressed as mean Â± SD (standard deviation).

Non parametric variables like NRS scores were analysed using Kruskal Wallis test and were expressed as median with IQR (inter quartile range). All statistical analysis was carried out at 5% level of significance and p value of <0.05 was considered significant.

Results and conclusion:

Ninety patients were randomized, of which 86 were studied and analysed. Four patients were excluded from the study due to inadequate block/ block failure. Twenty eight patients being in dexamethasone group, 29 patients each in dexmedetomidine and control group. The mean onset of sensory block in dexamethasone group(D) was 9.11 Â± 3.34 mins whereas that in dexmedetomidine (M) and control groups (C) were 8.45 Â± 3.01 mins and 9.14 Â± 3.29mins. The mean onset of motor block of dexamethasone group was 15.71Â± 3.78 mins whereas that of dexmedetomidine and control group was 13.79 Â± 3.44 mins and 22.07 Â± 34.42 mins. There was
no significant difference in the onset of motor block (p>0.36) or sensory block (p=1) among the three groups.

The duration of motor block was significantly prolonged in dexamethasone group when compared to dexmedetomidine group by 415.3 mins (SE= 37.29 p=0.00). The mean duration of motor block in D group 1303.93 Â± 233.71 mins and that in M group was 888.62 Â± 57.92mins. The mean of C group was 503.45 Â± 51.98mins. Hence dexmedetomidine prolonged motor block by 385.1(p=0.00) mins when compared to control group.

Duration of sensory block determined by the time to requisition of first analgesic in the postoperative period was 1619.29 Â± 235.49 mins in D group, 1084.14 Â± 207.58 mins in M group and 646.90 Â± 62.39 mins in C group. Hence duration of sensory block was significantly prolonged in the dexamethasone group when compared to both dexmedetomidine group by 535.14 mins (SE=48.77 ;P=0.00) and control group by 972.38 mins (SE=48.77; p=0.00). The mean difference between M group and C group was 437.24 mins which is also statistically and clinically significant (SE=48.34 ; p=0.00)

There was no significant difference between the three groups in terms of the total consumption of fentanyl in intraoperative period (p=1.00)

Postoperative morphine requirement during the first 24 hours after analgesic request was less in both dexmedetomidine group (mean 10.83 Â± 3.24 mg) and dexamethasone group (mean 13.32 Â± 3.89mg) when compared to control group (mean 15.66 Â± 4.60 mg). D group was having statistically significant difference in total morphine consumption over C group (p=0.00). There was no statistically significant difference in consumption of morphine between dexmedetomidine group and Dexamethasone group (p=0.059) or between dexamethasone and control group(p=0.086).

Postoperative NRS score monitored during the 24 hours after the requisition of first analgesic did not show any clinical significant difference in both the dexamethasone and dexmedetomidine group over the control group.

It was seen that both adjuvants significantly prolonged the duration of both sensory and motor block when compared to the control group but the prolongation was significantly more with dexamethasone as compared to dexmedetomidine. Both adjuvants reduced the morphine consumption after the request of first analgesic when compared to the control group with statistically significant difference between the dexmedetomidine group and the control group. No patient had developed hemodynamic instability. One patient in the control group developed Hornerâ€™s syndrome postoperatively, which is a rare but reported complication, its incidence being 2% (30).

We conclude that both dexamethasone and dexmedetomidine significantly prolong the duration of single injection supraclavicular brachial plexus block but prolongation was significantly more with dexamethasone when compared to dexmedetomidine. Hence, dexamethasone as an adjuvant would be a wise option when surgery is expected to be long. Dexmedetomidine at a dose of 1Î¼g/kg is safe and did not cause any adverse hemodynamic changes.

Limitations:

Dexmedetomidine causes sedation when given intravenously. Its sedative effect when given in peripheral nerve blocks is unknown and hence monitoring of sedation that would have been appropriate in this study, was not done.
The onset of sensory and motor blocks were checked every 5 min. We did not get any significant difference among the three groups in terms of onset of sensory and motor blocks. The onset of block could have been checked more frequently.

In our study, analgesics were started after the patient first requested for them and morphine consumption was noted, 24 hours from then and the time of requisition varied for different patients depending upon the duration of sensory block.

There was no specific NRS score that was assigned beyond which, PCA morphine would be started postoperatively. Patients were started on PCA morphine once they complained of pain and requested for analgesia. Hence, the NRS score at request of first analgesic were relatively high.

References:

