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Efficacy of Plain Ropivacaine Versus Combination Ropivacaine for Brachial Plexus Block

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Abstract:

Background*: By the introduction of newer and safer local anaesthetics, regional anaesthesia has taken over as the principal technique for anaesthesia in upper limb surgeries. Supraclavicular and infraclavicular techniques are the most efficient in producing complete anaesthesia of the brachial plexus as the slenderest of the plexus is encountered by these techniques. Several studies have demonstrated Clonidine and Dexmedetomidine as adjuvants to local anaesthetic in brachial plexus block without significant adverse effects. These observations led us to compare between Clonidine and Dexmedetomidine as adjuvants to plain Ropivacaine.*

Objective:*This study was done to know the safety and efficacy of plain ropivacaine versus ropivacaine with clonidine and ropivacaine with dexmedetomidine.*

Materials and Methods: *This study was done at a tertiary care teaching institute in the Department of anaesthesia at GEMS, Srikakulam, Andhra Pradesh, India, from January 2020 to January 2022. 90 patients were included as per the eligibility criteria. They were randomized into three groups R, C, and D, each group containing 30 patients. Age, gender, duration of surgery, onset of sensory and motor blocks, duration of sensory and motor blocks, duration of analgesia, side effects were assessed.*

Results:*There is no significant difference in the mean age and mean duration of surgery among 3 groups of patients. Most of the patients were males. Onset of sensory and motor blocks was quick in group D patients. Duration of sensory and motor blocks was more in group D patients.Most common side effect is nausea/vomiting, which was seen in 5 patients overall.*

Conclusion:*From our study, it is concluded that the addition Dexmedetomidine (1mcg/kg) as an adjuvant to Ropivacaine (0.5%) has the following effects: Faster onset of sensory and motor block than Clonidine, longer duration of sensory and motor block than Clonidine and longer duration of analgesia than Clonidine.*

Key Words: *Clondine, Dexmedetomidine, Efficacy, Safety, Supraclavicular brachial plexus block, Upperlimbsurgeries*

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I. Introduction

Anaesthesia has evolved into a speciality subject over the decades, with many improvements in the methods employed and drugs used to provide anaesthesia with the least complications. General anaesthesia alone is one of the most common methods employed to provide anaesthesia for upper limb surgeries. By the introduction of newer and safer local anaesthetics, regional anaesthesia has taken over as the principal technique for anaesthesia in upper limb surgeries. There are many advantages[1] of brachial plexus block for upper limb surgeries over general anaesthesia, namely a. Adequate analgesia with a decent motor blockade b. Awake patient c. Extended postoperative analgesia d. Early ambulation e. Early resumption of oral feeding f. No Polypharmacy g. No airway manipulation h. Less incidence of postoperative nausea and vomiting (PONV). Various approaches[2], of brachial plexus block, have been used for upper limb surgeries namely a. Interscalene approach b. Supraclavicular approach c. Infraclavicular approach d. Axillary approach. Amongst these approaches, supraclavicular and infraclavicular techniques are the most efficient in producing complete anaesthesia of the brachial plexus as the slenderest of the plexus is encountered by these techniques. The supraclavicular approach is more accessible than the infraclavicular approach as the plexus is more superficial above the clavicle. Local anaesthetics administered in regional nerve blocks also provide post-operative pain relief in many surgeries by blocking signal traffic to the ascending spinothalamic tract. Some drugs may be used as adjuncts to local anaesthetics to lower the dose of each agent and enhance analgesic effectiveness while reducing the dose of each agent and enhance analgesic efficacy while decreasing the incidence of adverse effects. Several studies have demonstrated Clonidine and Dexmedetomidine as adjuvants to local anaesthetic in

brachial plexus block without significant adverse effects.[3-4] These observations led us to compare between Clonidine and Dexmedetomidine as adjuvants to plain Ropivacaine.

Objective: This study was done to know the safety and efficacy of plain ropivacaine versus ropivacaine with clonidine and ropivacaine with dexmedetomidine.

II. Material And Methods

This randomized study was carried out at a tertiary care centre in India from January 2020 to January 2022.
Study Design: InterventionalRandomized single-blinded study
Study Location: This study was done at a tertiary care teaching institute in the Department of anaesthesia at Great Eastern Medical School &Hospital (GEMS), Srikakulam, Andhra Pradesh, India.
Study Duration: January 2020 to January 2022
Sample size: 90 Patients
Sampling procedure: Simple random sampling
Sample size calculation: The sample size was estimated from data of previous studies, using an alpha level of 0.05 and a beta level of 0.95 to establish a desired power of 0.80.[5-7] The minimum sample size came to be 88 overall. Hence, we included 90 patients in our study.
Subjects & selection method: The study population includes patients who were scheduled for various upper limb surgeries at our tertiary care center under supraclavicular brachial plexus block.
Patients of Group R(n=30)received 30ml of 0.5% Ropivacaine and 2ml of normal saline.
Patients in Group C(n=30)received 30ml of 0.5% Ropivacaine and Clonidine (1mcg/kg) + 2ml of normal saline.
Patients in Group D(n=30) received 30ml of 0.5% Ropivacaine and Dexmedetomidine (1mcg/kg) + 2ml normal saline. Group R was the control group.
Group D and Group C are considered study groups.
Eligibility criteria:

Inclusion criteria:
1. Patients aged 40 to 60 years of either sex, scheduled for elective upper limb surgeries under supraclavicular brachial plexus block.
2. Patients who provided informed consent to participate in the study.

Exclusion criteria:
1. Pregnant and lactating women
2. Patients with bleeding abnormalities
3. Patients with allergies to clonidine or dexmedetomidine or ropivacaine
4. Patients with obesity (BMI above $30kg/m^2$.)
5. Patients with a pacemaker
6. Patients suffering from progressive neurological disorders
7. Patients with severe cardiac or hepatic or renal disorders which interfere data collection.
8. Patients with incomplete data.

Methodology:

Intravenous access was obtained in the limb opposite to that undergoing surgery with 18 G cannula. Monitors like ECG monitoring, Pulse oximeter, Noninvasive blood pressure were connected and monitored in all the patients. The baseline blood pressure, heart rate, and oxygen saturation were recorded. After Including patients as per the eligibility criteria, data collection was done. When the nerve response is produced, the anaesthetic solution is injected while the needle is secured in position. Negative aspiration was performed while injecting the drug solution to avoid any intravascular placement. Immediately after injecting the drug, patients were evaluated every 2 minutes, for the assessment of onset of sensory and motor blockade. Assessments were carried out every 2 minutes until the achievement of motor and sensory blocks were attained for 30 minutes. After 30 minutes, if the block was considered to be adequate, surgeons were allowed to apply the tourniquet and start the surgery. If the block was considered to be inadequate for surgery, the patient was given general anaesthesia with endotracheal intubation and these patients were excluded from our study
The data was subjected to statistical analysis and then a conclusion was drawn.

Parameters assessed:
- Age
- Gender
- Duration of surgery.
- Onset of sensory block

- Onset of motor block
- Duration of sensory block
- Duration of motor block
- Duration of analgesia
- Side effects

Statistical analysis
Data was analyzed using Epi info software version 7.2.5. Results were expressed as percentages and mean with standard deviation. ANOVA analysis was used to compare three groups. P value below 0.05 is considered significant.

Ethical considerations:
Ethical committee approval was taken before conducting the study. Informed consent was taken from every patient participated in the study.

III. Results

The current study included 90 patients scheduled for upper limb surgeries.

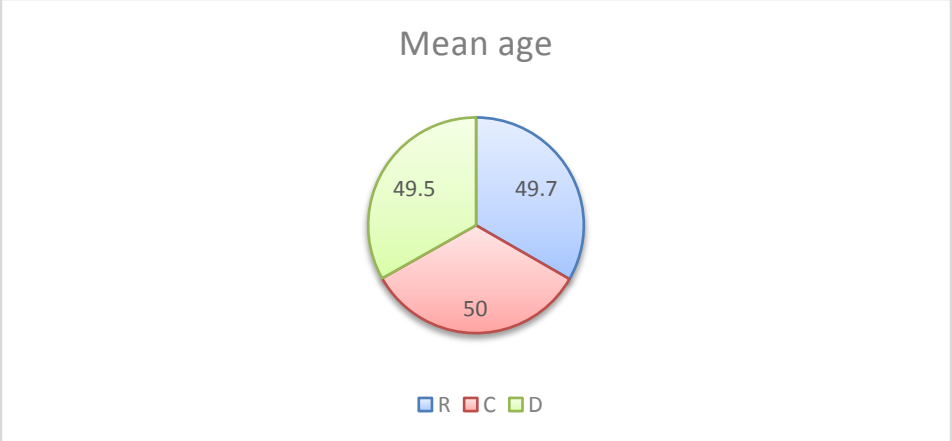
Gender:
Most of the patients were males in our study.

Table 1 shows gender distribution of patients in each group

	No of patients		
Gender	Group R	C	D
Male	24	24	18
Females	6	6	12

Age:
There is no significant difference in the mean age of patients in three groups(p=0.69).

Graph 1: Shows mean age of patients in 3 groups



Duration of surgery:
There is no significant difference in the duration of surgery between 3 groups, as per students t test(p=0.46).
Table 2 shows duration of surgery in three groups:

Table 2 shows duration of surgery

Groups	Mean duration of surgery(min)	P value
R	101.87 + 8.02	0.46
C	106.6 + 10.94	
D	110.77 + 10.22	

Onset of sensory andmotor blocks:
There is significant difference in the onset of sensory and motor blocks among 3 groups. Onset is quick in group D patients.

Table 3 shows onset of sensory and motor blocks

Groups	Mean onset of sensory block(min)	P value
R	14.2+2.72	0.001
C	11.77+1.92	
D	10.2+1.69	
Groups	**Mean onset of motor block(min)**	**P value**
R	18.13 + 1.74	0.001
C	13.53 + 1.89	
D	11.47 + 1.33	

Duration of sensory and motor blocks:

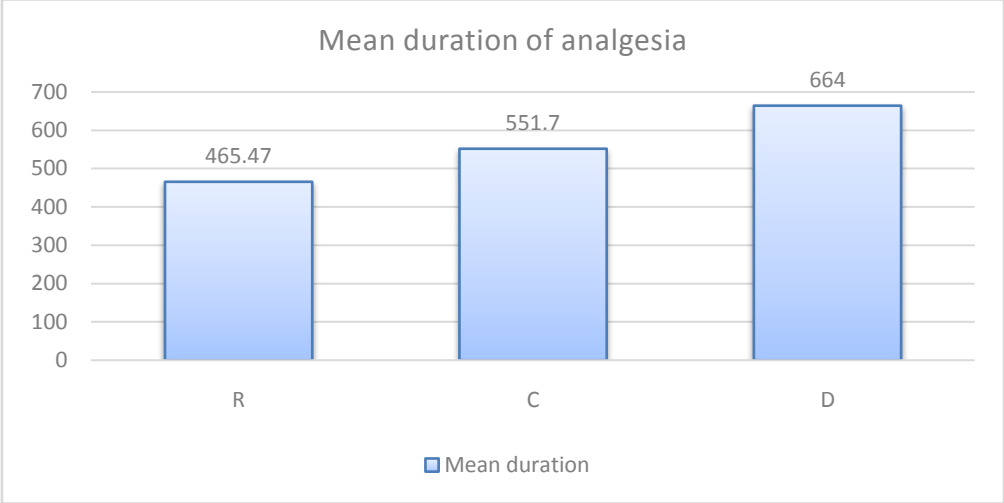
There is significant difference in the onset of sensory and motor blocks among 3 groups. Mean duration is morein group D patients.

Table 4 shows duration of sensory and motor blocks

Groups	Mean duration of sensory block(min)	P value
R	369.6 + 11.91	0.001
C	580.47 + 19.23	
D	635.53 + 14.48	
Groups	**Mean duration of motor block(min)**	**P value**
R	337.9 + 9.36	0.001
C	531.5 + 13.87	
D	531.5 + 13.87	

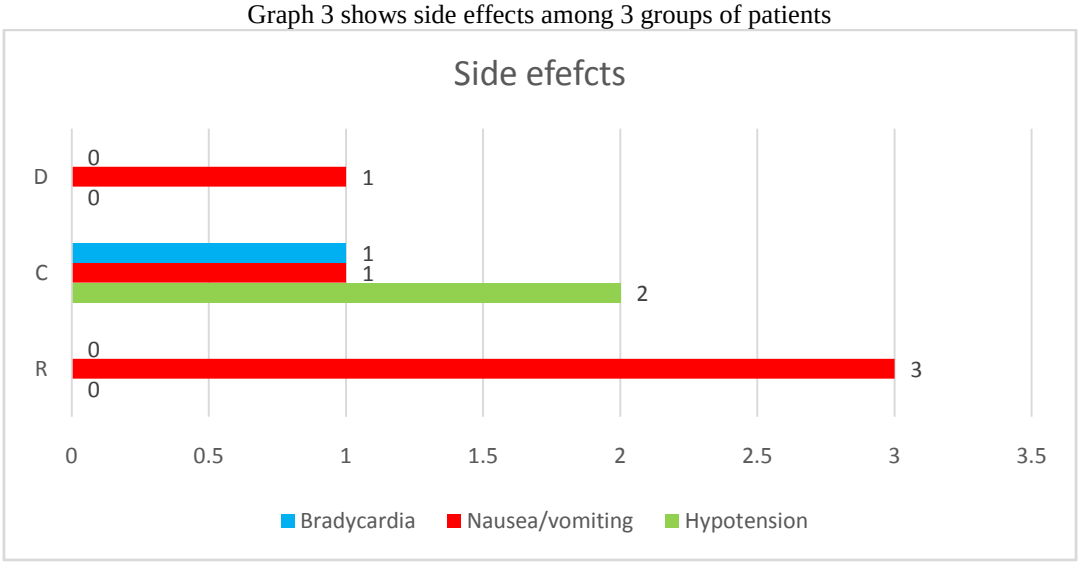
Duration of analgesia:
There is significant difference in the duration of analgesiaamong patients of 3 groups. Mean duration is more in group D patients.(p=0.001)

Graph 2 shows mean duration of analgesia



Side effects:
Nausea/vomiting was seen in 5 patients overall. Hypotension was seen in 2 patients.

Graph 3 shows side effects among 3 groups of patients



IV. Discussion

The current study was done on 90 patients scheduled for upper limb surgeries. There is no significant difference in the mean age and mean duration of surgery among 3 groups of patients. Most of the patients were males. Onset of sensory and motor blocks was quick in group D patients. Duration of sensory and motor blocks was more in group D patients. Most common side effect is nausea/vomiting, which was seen in 5 patients overall.

The acceptance of regional anaesthesiawas limited by two main factors inherent in the local anaesthetic agents available for use, namely slow onset time and short duration of action. Out of the local anaesthetic agents available.

The onset time of sensory block in study group is earlier compared to control group is supported by the study done by **Daniel M. Popping**[8]. He identified that early onset of sensory block time with an onset time of Clonidine 12.8 min. In controls, the average onset of the time of sensory block was 15 min. There is statistically significant difference, similar toour study. These findings were also similar to the study done by **Obayah G.han**[9]**.**

The motor onset time is earlier in the dexmedetomidine group and clonidine groups compared to the control group, in our study, which is similar to the study conducted by **Susmitha chakraborthy**[10], who reported earlier onset of the motor blockade in study group compared to the control group.

The duration of sensory blockade was more in dexmedetomidine and clonidine(study) groups compared to the controlgroup, which is statistically significant in our study.**El Saied et al**[11], in his study, found that the duration of sensory block was longer in the study (clonidine) group compared to placebo group, similar to our study.

In our study, the duration of motor block is longer in dexmedetomidine and clonidine group was more compared to the control group. In the study done byEl Saied[11], the duration of motor block was 552+/-35min in control group, but in the clonidine group, the duration of the block was 721+/-38min, and the difference is statistically significant, similar to our study.

Duration of analgesia was more in study group compared to control group in our study, similar to the study of **Esmaoqla et al.**[12]

The efficacy of perineural dexmedetomidine when added as adjuvant to ropivacaine for sciatic nerve blocks was established previously in rats.[13-14]Some studies showed thatmore duration of sensory blockade can be achieved by just adding dexmedetomidine to local anesthetics like bupivacaine and levobupivacaine, respectively.[15]

Limitations of this study:

1. Small sample size
2. Hemodynamic parameters were not assessed

V. Conclusion

From our study, it is concluded that the addition Dexmedetomidine (1mcg/kg) as an adjuvant to Ropivacaine (0.5%) has the following effects: Faster onset of sensory and motor block than Clonidine, longer duration of sensory and motor block than Clonidine and longer duration of analgesia than Clonidine.

The study is self-sponsored. There were no conflicts of interest.

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