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Comparative evaluation of dexamethasone and clonidine as an adjuvant to ropivacaine in supraclavicular block

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Abstract---Background/Aim: Enhancing the intensity of block by using adjuvant is the mainstay now a days in various regional block for surgery. Our primary objective was to compare the dexamethasone and clonidine as adjuvant to ropivacaine in supraclavicular block. Supraclavicular brachial plexus block provides excellent perioperative analgesia in upper extremity surgeries. Various adjuvants can be added to local anesthetics to enhance the effect of block. The main objective in the management of postoperative pain is minimizing the dose of analgesic to reduce side effects and provide adequate analgesia, shorten hospital stay, reduce hospital cost, and increase patient satisfaction. Methodology: One hundred twenty patients going for elective upper limb surgery of ASA grade I & ASA II in the age group 18 – 60 years were divided in the two groups of 60 each. Groups 1 were given Ropivacaine 0.5% 30 ml with 8 mg Dexamethasone, and Groups II were given Ropivacaine 0.5% 30 ml with 75 mcg Clonidine for supraclavicular block using peripheral nerve stimulator. Onset of sensory and motor block, duration of motor block, duration of analgesia, number of rescue analgesia, sedation score, post-operative pain and adverse effects were observed. Results: We found faster onset of sensory and motor block in ropivacaine – clonidine group (group 2) 14 min and 17 min than Ropivacaine – dexamethasone grp (group1) 17 min and 21 min respectively. P value of onset of sensory block is 0.003 and motor block is 0.000 while there is significant prolongation of motor block in group 1 (360 min), p value 0.106 NS than in group 2 (343 min) and significant prolongation of duration of analgesia in group1 (503 min), p value 0.000 than in group 2 (413

min). The number of rescue analgesic was found less in group 1 than group 2, p value less than 0.05. Sedation score was found more in group 1 than group 2, p value 0.595NS. Conclusion: The conclusion of study showed that dexamethasone prolong the duration of analgesia and motor block with no adverse effect, while faster onset of sensory and motor block was seen with clonidine.

Keywords--- dexamethasone, ropivacaine, supraclavicular block.

Introduction

Peripheral neural blockade enables site-specific, long-lasting, and effective anesthesia and analgesia. It is suitable for many surgical patients and can improve analgesia.^[1] Peripheral nerve blocks now a days can be used alone as the sole “surgical” anesthesia, they not only provide intraoperative anesthesia but also avoid the unwanted side effect of general anesthesia and providing prolonged postoperative analgesia.^[2] The main objective in the management of postoperative pain is minimizing the dose of analgesic to lessen side effect and providing adequate analgesia, shortened hospital stay, reduce hospital cost, and increase patient satisfaction.^[3]

The supraclavicular block is called the “spinal anesthesia of the upper extremity” because of its effective application for upper extremity surgery.^[4] The supraclavicular blockade is associated with a rapid onset of anesthesia and a high success rate and, the use of peripheral nerve stimulator was started which allowed better localization of the nerve, plexus.^[6] Peripheral nerve blocks are cost-effective anesthetic techniques used to provide good quality anesthesia and analgesia while avoiding tracheal stress response of general anesthesia.^[7] Various local anesthetic agents like lidocaine bupivacaine ropivacaine are used in brachial plexus block for upper limb surgery.

For prolongation of anesthesia various adjuvants drugs are mixed with local anesthetic drugs. Still the challenge remains with anesthesiologists to prolong the duration of analgesia & minimize the adverse effect. Several additives have been studied in efforts to prolong duration of analgesia, including the α_2 -agonist clonidine and the glucocorticoid dexamethasone. Both of these additives cause meaningful prolongations of blocks more than others, as well significant prolongation of sensory block and post-operative analgesia.^[9] Ropivacaine is long acting local regional anesthetic drug and it is less lipophilic than bupivacaine and less like penetrate large myelinated motor fiber resulting relatively reduced motor blockade. It is less toxic to cardiac system and nervous system as compare to other local anesthetic.^[10]

Many studies shown that Dexamethasone added to local anesthetic prolong the analgesia. Dexamethasone is very potent and highly selective glucocorticoids and prolong the duration of anesthesia when added to local anesthetic in supraclavicular block.^[11] As adjuvant Clonidine is also commonly used in regional block. Clonidine when added to local anesthetic, fasten the onset of block, and prolong the duration of brachial plexus block.^[12]

Aim and Objective

The aim of study Dexamethasone and Clonidine as an adjuvant to ropivacaine in supraclavicular block is to compare and evaluate.

1. The onset of sensory block.
2. The onset and duration of motor block.
3. The total duration of analgesia
4. Total no of analgesic injection needed in 24 hrs.
5. Level of sedation
6. Hemodynamic stability
7. Adverse effect

Material and Methods

Methodology

The present study “**Comparative evaluation of Dexamethasone and Clonidine as an adjuvant to Ropivacaine in supraclavicular block**” was carried out in Department of anesthesiology Index medical college hospital and Research Centre, Indore M P after approval of institutional ethical committee in 120 patients of ASA I & ASA II posted for elective upper limb surgery from Apr 2017 – Jun2018.

Inclusion criteria

- 1) Patients belonging to age group 18 – 60 years.
- 2) 120 patients of ASA grade I & ASA II undergoing elective operative procedure for upper limb surgery.
- 3) Weight 40 – 70 kg.

Exclusion Criteria

- 1) Unwilling patients.
- 2) Known hypersensitivity to local anesthetic agent.
- 3) Known contraindication to supraclavicular block.
- 4) Skin infection at the site of block.
- 5) Pregnancy.
- 6) Bleeding disorder.

Pre anesthetic evaluation of these patients by detailed history, complete general and systemic examination and routine investigation. After taking written & informed consent, explained about the procedure & VAS scale. patient will be randomly divided in to two groups of 60 each.

Group

120 patients were randomly divided in to 2 groups

- 1) Group RC - 30 ml 0.5% Ropivacaine + 0.5 ml (75mcg) Clonidine + 1.5 ml Normal saline.(Total volume 32ml)
- 2) Group RD - 30 ml 0.5% Ropivacaine + 2ml (8 mg) Dexamethasone. (Total volume 32ml)

Materials & Equipment:

- 1) Multi parameter monitor
- 2) Nerve locator (vygon)
- 3) Injection Ropivacaine 0.5% 30 ml.
- 4) Clonidine vial (150mcg)
- 5) Dexamethasone vial (8mg)
- 6) Peripheral nerve stimulator

Technique

On arrival in the operation room, baseline heart rate blood pressure oxygen saturation will be recorded. Five lead ECG were connected.

Patients were placed in supine position with head turn to contralateral side and arms extended. Under all aseptic precaution the midclavicular point, external jugular vein is palpated.

The supraclavicular plexus block was performed by the classic approach using a single nerve stimulator (Plexygon, VYGON) technique. The injection site was infiltrated with 1 ml of lidocaine 2% subcutaneously. Brachial plexus location was achieved by using a nerve locator and connected to a 22 G, 50-mm long stimulating needle. The location end point was a distal motor response (flexion or extension at interphalangeal joints, wrist or elbow) with an output lower than 0.5 mA ($t=0.3\text{ms}$; $f = 2\text{ Hz}$). During injection negative aspiration was performed every 5 ml to avoid intravascular inject

Observation:

Pulse rate, systolic blood pressure, diastolic blood pressure, oxygen saturation, mean blood pressure continuously monitored by multipara monitor throughout the operative procedure. Recording of hemodynamics vital were noted at 5, 10, 15, 30, 60, 90, 120, 180, 300, 420, 540 min.

Definitions Of The Term

Sensory block:

Sensory block of each nerve is was confirmed by the spirit soaked cotton method. The assessment was done in the dermatomes areas corresponding to the all four nerves (median nerve, radial nerve, ulnar nerve, and musculocutaneous nerve).

Duration of sensory block:

Sensory block duration was defined as the time from injection of local anesthetic mixture to complete recovery from cold sensation as tested by spirit soaked swab in all dermatomes of the brachial plexus.

Motor block:

Motor block is defined as time from injection of drug to complete motor block. Motor block is assessed by modified Bromage scale for upper extremities.

Grade 0 – normal motor function with full flexion and extension of elbow wrist and fingers.

Grade 1 – decreased motor strength with ability to move the fingers only.

Grade 2 – complete motor block with inability to move the fingers.

Duration of motor block:

Motor block duration was described as the time from injection of local anesthetic to complete recovery of motor function in all nerve dermatomes.

Assessment of postoperative pain:

Postoperative pain was described by visual analogue score scale. VAS consist of 10 cm horizontal scale with gradation marked as 0 means no pain and 10 means very severe pain.

VAS scale; medscape.com > article > VAS^[14]

0	No pain
1 – 3	Mild pain
4 -6	Moderate pain
7 – 10	Severe pain

Sedation score; www.sedationconsulting.com ^[15]

Sedation is assessed by Ramsay sedation scale.

Score	Description	Response
1	Awake	Anxious or restless both
2	Awake	Cooperative oriented
3	Awake	Respond to command only
4	Asleep	Brisk response to stimulus
5	Asleep	Sluggish response to stimulus
6	Asleep	No response to stimulus

Duration of analgesia:

Defined as time interval from completion of local anesthetic administration until first need of rescue analgesia in the form of injection Diclofenac ,and amount of Diclofenac consumed in 24 hrs.

Adverse effect:

Watch for any adverse effect such as nausea, vomiting, hypotension, bradycardia, tachycardia, hematoma, seizure, confusion, respiratory distress.

Observations and Results

Table No. 1: Comparison of mean age between the two groups

Group	No.	Mean $\pm$ SD	't' value	P value
Ropivacaine + Dexamethasone	60	34.13 $\pm$ 13.64	-1.019, df=118	0.310, NS
Ropivacaine + Clonidine	60	36.77 $\pm$ 14.65		

Unpaired 't' test applied. P value = 0.310, Not significant

The difference was found to be statistically not significant ($p > 0.05$), showing a comparable mean age between the two groups.

Table No.2: Comparison of sex between the groups

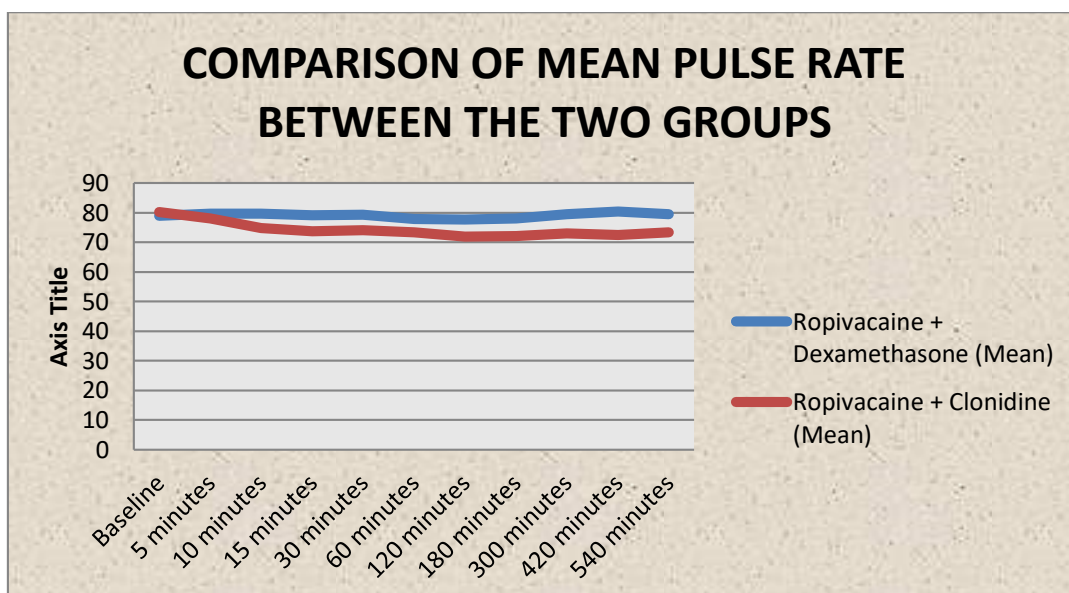
Sex	Ropivacaine + Dexamethasone		Ropivacaine + Clonidine	
	No.	%	No.	%
Female	24	40.0	24	40.0
Male	36	60.0	36	60.0
Total	60	100.0	60	100.0

Pearson Chi-square value = 0.000, df=1, P value = 1.000, Not Significant

The above table shows the comparison of sex between the two groups. There was no statistically significant association seen between sex and the groups ($p>0.05$), showing that groups are independent of the sex.

Hemodynamics parameter

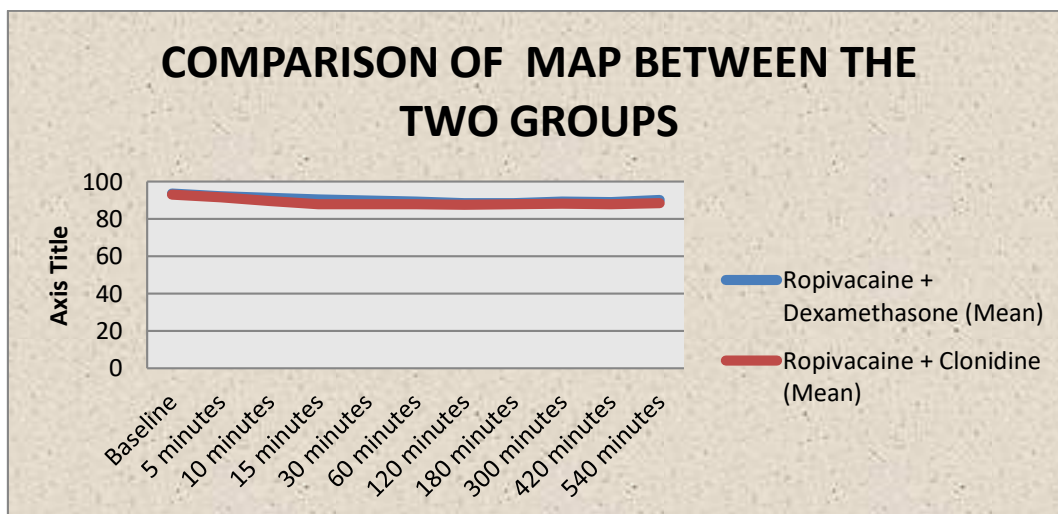
Graph No.1: Comparison of mean pulse rate between the two groups at different time intervals



Graph: Line diagram showing comparison of mean pulse rate between the two groups

The mean pulse rate was comparable at baseline and at 5 minutes ($p>0.05$) between the two groups, while it was significantly higher in the ropivacaine + dexamethasone group ($p<0.05$) at all the other time intervals.

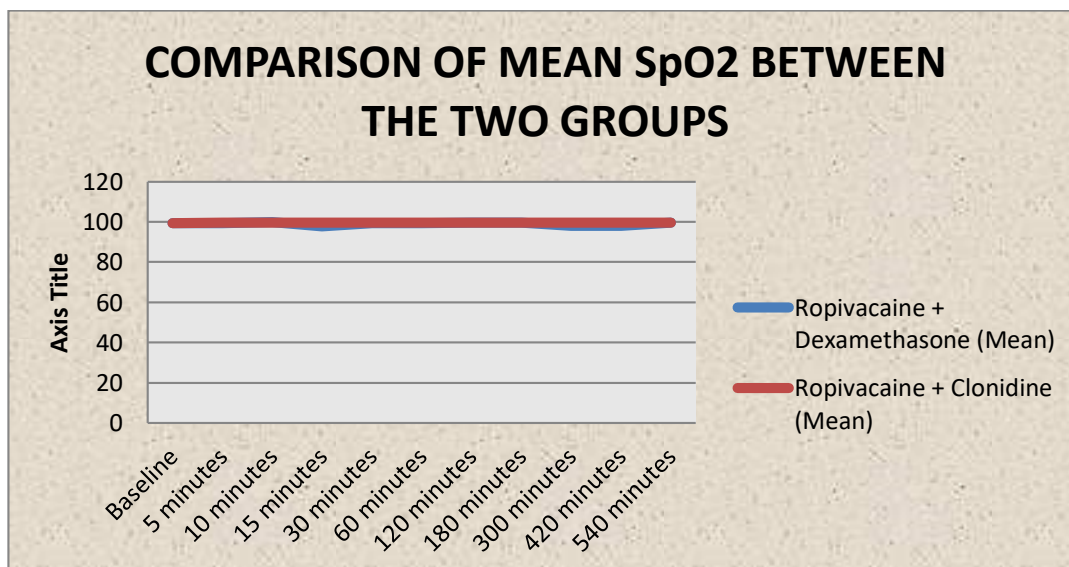
Graph No. 2: Comparison of MAP (mean arterial pressure) between the two groups at different time intervals



Graph : Line diagram showing comparison of MAP between the two groups

There was no statistically significant difference seen in the mean MAP between the two groups at all the time intervals ($p > 0.05$), showing a comparable mean MAP between the two groups throughout the study period

Graph No. 3: Comparison of mean SpO₂ between the two groups at different time intervals



Graph: Line diagram showing comparison of mean SpO₂ between the two groups

Though there was a statistically significant difference between the two groups at few of the time intervals, but the mean SpO₂ in both the groups was within the clinically acceptable range throughout the study period.

Table No. 3: Comparison of mean onset of motor block between the two groups

Group	No.	Mean $\pm$ SD	't' value	P value
Ropivacaine + Dexamethasone	60	21.92 $\pm$ 2.81	9.480, df=118	0.000*
Ropivacaine + Clonidine	60	17.32 $\pm$ 2.50		

Unpaired 't' test applied. P value = 0.000, Significant

The above table shows the comparison of mean onset of motor block between the two groups. In the Ropivacaine + Dexamethasone group, the mean onset of motor block was 21.92 $\pm$ 2.81 while in the ropivacaine + clonidine group it was 17.32 $\pm$ 2.50. The difference was found to be statistically significant ($p < 0.05$), showing a higher mean onset of motor block in the ropivacaine + dexamethasone group.

Table No. 4: Comparison of mean duration of motor block between the two groups

Group	No.	Mean $\pm$ SD	't' value	P value
Ropivacaine + Dexamethasone	60	360.42 $\pm$ 52.78	1.627, df=118	0.106, NS
Ropivacaine + Clonidine	60	343.42 $\pm$ 61.39		

Unpaired 't' test applied. P value = 0.106, Not Significant

The above table shows the comparison of mean duration of motor block between the two groups. In the Ropivacaine + Dexamethasone group, the mean duration of motor block was 360.42 $\pm$ 52.78 while in the ropivacaine + clonidine group it was 343.42 $\pm$ 61.39. The difference was found to be statistically significant ($p < 0.05$), showing a higher mean duration of motor block in the ropivacaine + dexamethasone group

Table no 5: Comparison of mean onset of sensory block between the two groups

Group	No.	Mean $\pm$ SD	't' value	P value
Ropivacaine + Dexamethasone	60	17.05 $\pm$ 4.77	3.080, df=118	0.003*
Ropivacaine + Clonidine	60	14.75 $\pm$ 3.27		

Unpaired 't' test applied. P value = 0.003, Significant

The above table shows the comparison of mean onset of sensory block between the two groups. In the Ropivacaine + Dexamethasone group, the mean onset of sensory block was 17.05 $\pm$ 4.77 while in the ropivacaine + clonidine group it was 14.75 $\pm$ 3.27. The difference was found to be statistically significant ($p < 0.05$), showing a higher mean onset of sensory block in the ropivacaine + dexamethasone group.

Table No. 6: Comparison of mean duration of analgesia between the two groups

Group	No.	Mean $\pm$ SD	t' value	P value
Ropivacaine + Dexamethasone	60	503.92 $\pm$ 101.64	5.435, df=118	0.000*
Ropivacaine + Clonidine	60	413.50 $\pm$ 79.19		

Unpaired 't' test applied. P value = 0.000, Significant

The above table shows the comparison of mean duration of analgesia between the two groups. In the Ropivacaine + Dexamethasone group, the mean duration of analgesia was 503.92 $\pm$ 101.64 while in the ropivacaine + clonidine group it was 413.50 $\pm$ 79.19. The difference was found to be statistically significant ($p < 0.05$), showing a higher mean duration of analgesia in the ropivacaine + dexamethasone group.

Table No. 7: Comparison of number of diclofenac injections between the groups

Number of Injections	Ropivacaine + Dexamethasone		Ropivacaine + Clonidine	
	No.	%	No.	%
One	10	16.7	1	1.7
Two	42	70.0	26	43.3
Three	8	13.3	33	55.0
Total	60	100.0	60	100.0

Pearson Chi-square value = 26.372, df=2, P value = 0.000*, Significant

The above table shows the comparison of number of diclofenac injections between the two groups. There was a statistically significant association seen between the number of injections and the groups ($p < 0.05$), showing that the groups are dependent on the number of diclofenac injections. RC group required more analgesics.

Table No. 8: Comparison of side effects between the groups

Side Effects	Ropivacaine + Dexamethasone		Ropivacaine + Clonidine	
	No.	%	No.	%
None	60	100.0	47	78.3
Bradycardia	0	0.0	9	15.0
Hypotension	0	0.0	4	6.7
Total	60	100.0	60	100.0

Pearson Chi-square value = 14.579, df=2, P value = 0.001*, Significant

The above table shows the comparison of side effects between the two group. There was a statistically significant association seen between side effects and the groups ($p < 0.05$), showing that groups are dependent on the side effects. All the side effects were seen in Ropivacaine + Clonidine group only.

Discussion

Supraclavicular block provides a rapid, dense, and predictable anesthesia of the entire upper extremity in the most consistent manner of any brachial plexus technique. Ropivacaine is the novel local anesthetic with less cardiovascular and central nervous system toxicity as compared to bupivacaine, addition of various adjuvant has been tried with ropivacaine to enhance the onset and duration of analgesia. Many studies shown that Dexamethasone added to local anesthetic prolong the analgesia. Dexamethasone is very potent and highly selective glucocorticoid and prolong the duration of anesthesia when added to local anesthetic in supraclavicular block.^[4]

The mechanism of analgesia induced by corticosteroids can be due to their anti-inflammatory or immuno-suppressive properties or mainly due to their direct effect on nerve membrane. Perineural vasoconstriction induced by corticosteroids via specific glucocorticoid receptors and modulation of the effects of potassium channels on the cells leads to slower absorption of LA resulting in their prolonged action ⁽⁴⁾

As adjuvant Clonidine is also commonly used in regional block. Clonidine when added to local anesthetic, fasten the onset of block, and prolong the duration of brachial plexus block.^[10] Clonidine is one of the frequently used adjuvants to LAs. It is an α -2 agonist and has anti-hypertensive effect.. Peripheral action of clonidine is less obvious as α -2 receptors are not present on axons of normal peripheral nerves. One mechanism can be that Clonidine blocks conduction of C and A-delta fibers and increases conduction of potassium in *in vitro* neurons causing conduction block. Second, due to the local vasoconstriction caused by clonidine, the vascular uptake of LA from around the neurons is reduced.

Onset of sensory block

Our study demonstrate The onset of sensory block in Group RC was earlier as compared to Group RD. the result of our study show the following study trends. Patil et al ⁽¹⁷⁾ popping et al ⁽²³⁾ study show that adding clonidine to local anesthetic significantly prolong the duration of analgesia. Shah et al ⁽²²⁾ compare dexamethasone and clonidine as an adjuvant in brachial block, there study showed that clonidine is more efficient than dexamethasone in term of success of block.

Onset of motor block

Onset of motor block was also earlier in ropivacaine and clonidine group, our result is consistent with the study of Bernard and Macarie^[15]. Patil et al (2015)^[17]. shah et al compare clonidine and dexamethasone as adjuvant to ropivacaine in supraclavicular block, the sensory and motor block is more successful in clonidine group. Patil et al, Bernard and maccaire used clonidine as adjuvant to ropivacaine, they also showed prolongation of sensory and motor block in clonidine group. But Gupta et al ⁽²¹⁾ study showed variation with our study, this study compare the ropivacaine alone and clonidine as adjuvant to ropivacaine, showed delay in the onset of sensory and motor block.

Duration of motor block

Duration of motor block as compare to ropivacaine clonidine , there is significant prolongation of duration in ropivacaine dexamethasone group the following study also support our study Shah et al (2015)^[22] compare dexamethasone 8 mg and clonidine 150 mcg as adjuvant to lignocaine, the duration of motor clock was prolonged in dexamethasone group. Choi et al (2014)^[19] meta analysis study also support our study in view of prolongation of motor block in dexamethasone . Kumar et al (2014)^[17] also showed prolongation of motor block when dexamethasone was added to bupivacaine. Patil et al found that duration of motor block was prolonged in ropivacaine clonidine group over ropivacaine alone, but this study is not compare two adjacents. Nasir et al⁽²⁴⁾ study compare the dexamethasone (4mg) and clonidine (100 mcg) and showed prolongation of motor block in clonidine group, as compare to our study variation there we used 8 mg dexamethasone and 75 mcg clonidine so variation was due to dose difference.

Duration of analgesia

Duration of analgesia is significantly prolonged in Group RD as compare to Group RC ($p < 0.05$). The result of our study was accordance to following studies, Noss et al⁽²⁰⁾ (2014)^[20] Choi et al (2014)^[19] choi et al study was to compare local anesthetic with dexamethasone , the conclusion of study was perineural administration of dexamethasone prolong block effect without any adverse effect. Nasir et al⁽²⁴⁾ study showed that clonidine 100 mcg prolonged the duration of analgesia, the variation of study may be due to dose of clonidine which is more in these study and dexamethasone dose was less.

Number of rescue analgesia

The overall consumption of analgesic dose is more in clonidine group as compared to dexamethasone group. Many studies support our observation that the duration of analgesia was prolonged in dexamethasone so number of rescue analgesia was less in dexamethasone group and it was statistically significant. Choi et al (2014),^[19] Noss et al (2014)^[20] studied and observe that number of analgesic injection was less in dexamethasone.

Adverse effect

In the dexamethasone group there was no adverse effect seen throughout the study while in clonidine group bradycardia hypotension was seen Sedation in our study was not significant, no variation in sedation was seen in both group. Shah et al also showed the same result while Sinha et al⁽¹⁸⁾ compare dexamethasone and clonidine in urogenital surgeries, here the sedation is more in clonidine. Variation may be due to dose site and age. Hemodynamically dexamethasone is more stable as compared to clonidine group Supraclavicular brachial plexus block provide excellent analgesia during and after upper limb orthopedic surgeries.

Result

The result of study was significant faster onset of sensory and motor block in

ropivacaine clonidine group as compared to dexamethasone group while there is significant prolongation of motor block and duration of analgesia in dexamethasone ropivacaine group. The number of analgesic consumption was less in dexamethasone group and no side effect was seen in dexamethasone ropivacaine group over clonidine in which hypotension bradycardia was seen.

Conclusion

The conclusion of our study is:

1. Dexamethasone as adjuvant clearly prolong the duration of analgesia and motor block in supraclavicular brachial plexus block over clonidine.
2. Dexamethasone also reduces postoperative analgesic requirement.
3. Clonidine fasten the onset of sensory and motor block.
4. Hemodynamically dexamethasone is more stable as compared to clonidine.
5. There is no adverse effect is seen in dexamethasone Ropivacaine group.

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