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A COMPARISON OF EFFICACY OF INTRAVENOUS AND PERINEURAL DEXAMETHASONE IN INCREASING THE ANALGESIC DURATION IN SINGLE SHOT SUPRACLAVICULAR BLOCK IN UPPER LIMB SURGERY

Anaesthesiology

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ABSTRACT

AIM- To compare the effects of perineural and intravenous dexamethasone as an adjuvant to Ropivacaine in single shot supraclavicular blocks with Ropivacaine in upper limb surgeries.

MATERIALS AND METHOD- 120 patients of ASA grades I & II, aged 18 to 55 years, scheduled for any elective orthopedic or plastic surgery on upper limb were selected. Patients were given supraclavicular block after elicitation of paresthesia after randomizing them into 3 groups; Group A and B received 30 ml 0.5% ropivacaine + 8 mg dexamethasone perineurally and IV respectively and Group C received 30 ml 0.5% ropivacaine without any adjuvant. All the groups were observed for sensory and motor blockade characteristics and duration of analgesia.

RESULTS- Patients who were administered dexamethasone through either route showed a significantly short period of sensory and motor blockade ($p<0.001$) compared to patients receiving only ropivacaine. The difference in the duration of sensory and motor blockade was also significant ($p<0.001$) with both dexamethasone groups showing longer duration compared to Ropivacaine group. Perineural route was more effective way of decreasing the onset time and increasing the duration of sensory and motor blockade. No post-op complications or residual weakness were reported in any of the patients.

CONCLUSION- Dexamethasone decreased the onset time of sensory and motor blockade and increased the duration of blockade without causing any intraoperative or post operative complications.

KEYWORDS

Ropivacaine, Dexamthasone, Supraclavicular block, Regional Anesthesia.

INTRODUCTION

The development of new delivery techniques, particularly ultrasound guidance and continuous epidural and peripheral nerve catheters has supported the renaissance of regional blockade.

Regional anaesthesia has been increasing in popularity in recent years. It provides a safe and low-cost technique with advantage of early ambulation and prolonged postoperative pain relief. It avoids unwanted effects of anaesthetic drugs used during general anaesthesia, pressure response to laryngoscopy and tracheal intubation.

Brachial plexus block is a versatile and reliable regional anaesthesia technique. It provides a useful alternative to general anaesthesia for upper limb surgery by being safe, decreasing the cost of anaesthetic agents, decreased operation theatre pollution and with an advantage of prolonged post-operative pain relief.

Of various local anaesthetics used for Brachial plexus block, Bupivacaine is the most commonly administered long acting drug but in large doses, it causes cardiac depression and central nervous system toxicity. A newer long acting local anaesthetic drug, Ropivacaine was approved for clinical use in 1996. It has better safety profile compared to Bupivacaine as it has less cardiac depression and central nervous system toxicity; potential clinical advantage during neural blockade when large volumes are used.

Adrenaline, sodium bicarbonate, clonidine, opioids and several other drugs have been used as additives to improve the duration of the block and to enhance postoperative analgesia.

Corticosteroids have been shown to specifically inhibit C-fibre transmission[13]. Dexamethasone has been shown to prolong peripheral nerve and plexus blocks. The addition of 8 mg of dexamethasone extends the duration of analgesia after interscalene block using bupivacaine by up to 22 hours. We chose 8 mg as the dose for perineural injection based on the studies of Choi S et al[14], Williams BA et al[15] and MA R et al[16] and used the same dose intravenously.

AIMS AND OBJECTIVES

The aim of our study was to compare the effects of perineural and intravenous dexamethasone as an adjuvant to Ropivacaine in single shot supraclavicular blocks with Ropivacaine in upper limb surgeries.

Objectives of the Study were to compare the:-

1. Onset and duration of sensory block between Ropivacaine group and adjuvant groups.
2. Onset and duration of motor block between Ropivacaine group and adjuvant groups.
3. Duration of analgesia between the groups.
4. Haemodynamic parameters.
5. Complications.

MATERIALS AND METHODS

This study was carried out after obtaining permission from ethical committee of Jhalawar Medical College and obtaining written informed consent of the patient's relative. We recruited total 120 patients for our prospective randomized controlled study.

Inclusion criteria:

1. Age of patient-18 to 55yrs
2. ASA (American society of anaesthesiologist) grade I or II
3. Weight 50 - 80 kg
4. Admitted for any kind of Orthopaedic or Plastic surgeries on upper limb,

Exclusion criteria:

1. Patient's refusal
2. Allergy to amide group of local anaesthetic agent
3. Contraindication to brachial plexus block
4. Significant neurological disease in upper limb
5. Renal disease and psychiatric history
6. Inability to comply with study assessment
7. Pregnancy and lactation
8. Patient on anticoagulants or having any bleeding disorder
9. Underlying other significant systemic disease

All the patients underwent a pre-anaesthetic check-up before surgery and all the routine and specific investigations were noted. The patients were kept NPO for 6 hours before surgery and prior to operation, patients were explained about the procedure. Standard monitors were applied and patient's baseline parameters like pulse, blood pressure, SpO2 were recorded. Intravenous line was secured and intravenous fluid was started. All patients were given premedication in the form of

Inj. Midazolam 1mg and Inj. Ondansetron (100mcg/kg) intravenously.

Technique

For performing brachial plexus blockade through supraclavicular approach we used Classical technique (Kulenkampff's).

According to the drug administered the patients were randomly allocated to 3 groups :-

1. Group A: Inj. Ropivacaine 0.5% 30cc + perineural Dexamethasone 8mg (RDP)
2. Group B: Inj. Ropivacaine 0.5% 30cc + I.V Dexamethasone 8mg (RDI)
3. Group C: Inj. Ropivacaine 0.5% 30cc (R)

Heart rate, blood pressure, oxygen saturation were recorded before the procedure and at 5, 10, 15, 30, 45, 60, 90, 120 min and then every two hourly postoperatively till the complete wearing off of effect.

Onset of Sensory block was assessed every 2 min by atraumatic pin prick test in the areas innervated by radial, ulnar, and median nerves and compared with the same stimulation on contralateral hand.

Sensory blockade was graded as
Grade 0(no block): normal sensitivity
Grade 1(onset): reduced sensitivity compared with same territory in contralateral upper limb
Grade 2(partial): analgesia or loss of sharp sensation of pinprick
Grade 3(complete): anaesthesia or loss of sensation to touch

Onset time was defined as time from injection of drug to a dull sensation on any of the nerve distribution.

Duration of sensory block was defined as time between the peak effect time and feeling of dull sensation in any of the nerve distribution.

Motor block evaluated by four point scale:
Grade 0: No effect
Grade 1(onset): Decreased movement with loss of strength
Grade 2(partial): Decreased movement with inability to perform movement against resistance
Grade 3(complete): Paralysis

Onset time was considered from time of injection of drug to time when patient felt heaviness on abduction of arm at shoulder.

Duration of motor blockade was defined as time between the onset of peak motor effect and the onset of weaning of motor effect in any of the nerve distribution.

Patients were observed for any systemic side effects like bradycardia, hypotension etc. Intra operative data were recorded every 5 minutes till 15 minutes, then every 15 minutes till 1 hour time, then every 30 minutes till 2 hours, then at every 2 hour interval. Tourniquet inflation and deflation time and duration of surgery were noted.

Intensity of post-operative pain was evaluated using VAS (visual analog scale) with grade 0 (no pain) to 10 (worst pain). Pain score were noted every 5 to 10 minutes initially then hourly till the patient had regained VAS score of 4. Analgesia was considered satisfactory if the score was 3 or less. If score was more than 4, analgesia was judged unsatisfactory and rescue analgesia was administrated and time for need of first analgesia was noted.

Evaluation was stopped when complete wearing off of effect occurred. All three groups were compared for duration of analgesia (time between the end of local anaesthetic administration and the first analgesic request made), duration of sensory block, duration of motor block.

Vital parameters were noted at regular intervals along with pain scored for 16 hrs. All the data were filled up in proforma and were statistically analyzed by applying Z - test for analysis in both groups for various parameters.

The results were considered significant if P value was <0.05 and highly significant if P value was <0.001.

OBSERVATIONS AND RESULTS

After studying 120 cases, the observation and results were summarized in tabulated form. All the patients were divided into three groups with 40 patients in each group (n= 40).

A) Group A: Inj. Ropivacaine 0.5% 30cc + perineural Dexamethasone 8mg (RDP)
B) Group B: Inj. Ropivacaine 0.5% 30cc + I.V Dexamethasone 8mg (RDI)
C) Group C: Inj. Ropivacaine 0.5% 30cc (R)

The populations in all the three groups were comparable demographically and there was no statistically significant difference between the groups.

Table 1: Characteristics of Blockade

Block Characteristics	RDP	RDI	R
Sensory			
Onset (in minutes)	3.42 ± 0.4	4.02 ± 0.67	5.26 ± 0.6
Duration (in hours)	15.49 ± 1.412	14.76 ± 2.22	9.037 ± 1.128
Motor			
Onset (in minutes)	6.06 ± 0.62	7.06 ± 0.77	9.19 ± 1.34
Duration (in hours)	14.443 ± 1.446	13.56 ± 1.695	6.995 ± 1.24
Analgesia			
Duration (in hours)	16.22 ± 0.72	13.22 ± 0.84	9.12 ± 0.50

Above table shows sensory and motor blockade characteristics and duration of analgesia.

Table 2: p value of block characteristics

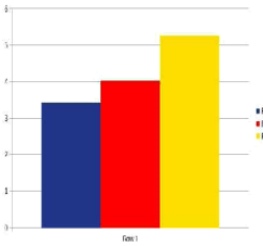
	Between RDP & R	Between RDI & R	Between RDP & RDI
Sensory			
p value of onset	< 0.001	< 0.001	< 0.01
Significance	Highly Significant	Highly Significant	Significant
p value of duration	< 0.001	< 0.001	< 0.05
Significance	Highly Significant	Highly Significant	Significant
Motor			
p value of onset	< 0.001	< 0.001	< 0.01
Significance	Highly Significant	Highly Significant	Significant
p value of duration	< 0.001	< 0.001	< 0.05
Significance	Highly Significant	Highly Significant	Significant
Analgesia			
p value of duration	< 0.001	< 0.001	< 0.001
Significance	Highly Significant	Highly Significant	Highly Significant

Sensory onset time was significantly different in groups RDP and R with P value < 0.001. Same was the case in comparison betweeen groups RDI and R. When both dexamethasone groups were compared it showed p value of <0.01; which was not highly significant as the previous 2 comparative groups but still had a significant statistical difference. Similar result was obtained in the statistical analysis in the case of motor onset time when compared in all three groups.

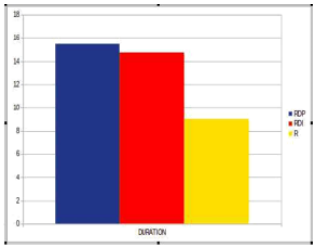
The statistical data when compared for duration of sensory block between both dexamethasone groups (RDP & RDI) and non dexamethasone group ® was highly significant (<0.001). When groups RDP and RDI was compared, they also showed significant difference in the results (p<0.05)

Duration of motor block was longer with Ropivacaine when given after mixing with dexamethasone or by injecting intravenously when as compared to plain ropivacaine.

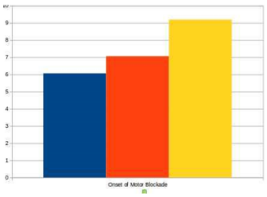
Duration of effective analgesia was significantly longer in group A (RDP) as compared to group C (R) for time of rescue analgesia and was statistically highly significant (P value < 0.001). Similar result was found when p value was calculated between groups RDI and R (p value <0.001) and between groups RDP and RDI. At VAS score ≤ 4, rescue analgesia was given (Inj. Diclofenac 1-2 mg/kg i.v)



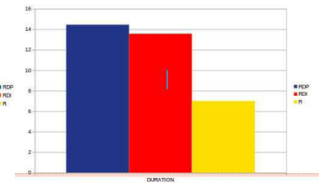
Onset of Sensory Block (In Minutes)



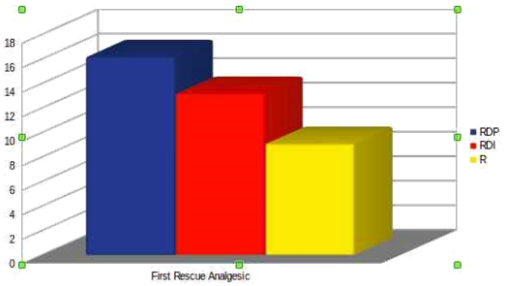
Duration of Sensory Block (In Hours)



Onset of Motor Blockade (In Minutes)

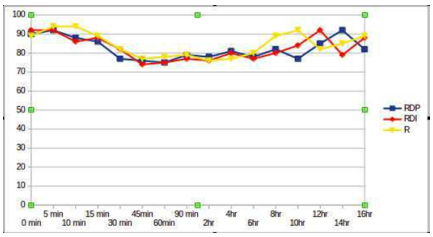


Duration Of Motor Blockade (In Hours)



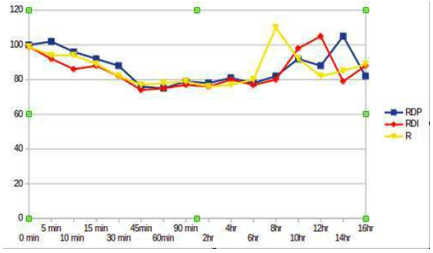
Duration Of Analgesia (In Hours)

GRAPH: MEAN BLOOD PRESSURE CHANGES



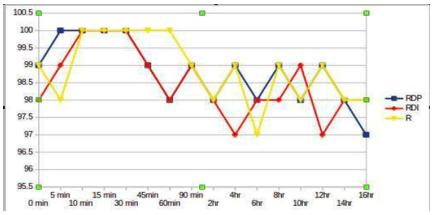
There was no significant difference (p value > 0.05) in the blood pressure calculated p value =0.634.

GRAPH : MEAN HEART RATE CHANGES



There was no significant difference in the heart rate changes (p value > 0.05) calculated p value = 0.082.

GRAPH: OXYGEN SATURATION CHANGES



Oxygen saturation followed the similar trend in all three groups.

DISCUSSION

Regional anaesthesia provides improved satisfaction and cause less cognitive impairment and immune suppression compared to general anesthesia (particularly in elderly patients). Brachial plexus block is a versatile and reliable regional anaesthetic technique and a suitable alternative to general anaesthesia for upper limb surgery. The supraclavicular approach provides the most complete and reliable anaesthesia as it provides anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique.

In our study there was a significant difference in the onset of sensory and motor block between the R group and other two groups (RDP and RDI) using dexamethasone as adjuvants whether perineurally mixed with ropivacaine or injected intravenously alongside performing the supraclavicular block. The mean onset time of sensory block in RDP group was 3.42 ± 0.4 minutes compared to 5.26 ± 0.6 minutes of R group and RDI group had mean onset in 4.02 ± 0.67 minutes. The mean onset time of Motor block in RDP group was 6.06 ± 0.62 minutes compared to the 9.19 ± 1.34 minutes it took in group R and was 7.06 ± 0.77 minutes in RDI group.

Our study showed a very significant ($p<0.01$) decrease in onset of motor blockade and sensory blockade in dexamethasone groups (RDP and RDI) as compared to the ropivacaine group (R). There was significant difference in statistical data (p value < 0.05) between group RDP and RDI suggestive of perineural route to cause a better reduction in onset time of sensory and motor blockade.

Similar significant result (<0.05) was found in the study by **Dr. Feroz Ahmad Dar**, **Dr. Neelofar Jan (2013)**[9] where the sensory onset duration was 14.65±3.31 minutes for dexamethasone group and was 17.5±4.2 minutes for ropivacaine group. In the same study the motor onset time for dexamethasone group and ropivacaine group was 18.01±4.51 minutes and 20.67±3.03 minutes respectively. Contrary to our study; the study conducted by **Ashok Jadon et al**[2] in 2015 did not show significant effect on onset of sensory and motor block (p value > 0.05).

In present study the duration of Sensory block in RDP group was 14.443 +/- 1.446 hours compared to 6.995 +/- 1.24 hours in group R and 13.56 +/- 1.695 hours in RDI group. The result when compared between dexamethasone groups and non dexamethasone was highly significant (p value <0.001).Even while comparing between the perineural route (RDP) and intravenous routes of administration (RDI) the result was highly significant with p value < 0.001. The duration of motor blockade was 15.49 +/- 1.412 hours in RDP group compared to 14.76 +/- 2.2 hours of RDI and 9.037 +/- 1.128 hours in R group. This was highly significant too with p value < 0.001 when calculated between each of the 3 groups.

In the study by **Desmet et al**[4] in 2013 similar result was found where 1405 min and 1275 min for RD and RDiv, respectively. There was a significant difference between the ropivacaine group: 757 min and the dexamethasone groups (P<0.0001).

In the study by **Rahangdale et al**[11] in 2014 suggested a significant increase in duration of motor and sensory blockade (p value =0.008).

There was significant prolongation in the duration of analgesia and requirement of the first analgesic dose in case of RDP group. The first analgesic dose requirement in RDP group was after 16.22+/- 0.72 hours as compared to group R in which the rescue analgesia was needed just after 9.12 +/- 0.5 hours and in RDI group the first dose was required to be administered after 13.22 +/- 0.84 hours. The result was highly significant when statistical data was compared between all 3 groups with yielding a p value of <0.001. Similar results were demonstrated in study by **Abdallah FW et al (2015)**[6] where the duration of analgesia was prolonged in the intravenous group (25 hours [17.6–32.4]) compared with Control (13.2 hours [11.5–15.0]; P< 0.001) but similar to the DexP group (25 hours [19.5–30.5]; P = 1).

In the study by **Ashok Jadon et al**[2] in 2015, the mean duration of analgesia in Group RDP was 1103.72 ± 296.027 min and in Group R it was 551.54 ± 166.92 min (P = 0.0001). Onset of sensory block in Group RDP was 12.24 ± 1.88 min and in Group R was 13.48 ± 1.81 min (P = 0.5170). Onset of motor block in Group RDP was 16.24 ± 2.04 min and in Group R was 17.76 ± 2.21 min (P = 0.2244). They

concluded that Dexamethasone significantly prolonged duration of analgesia of ropivacaine during ISB used for arthroscopic surgeries of shoulder.

INTRA OPERATIVE PULSE RATE AND BLOOD PRESSURE

In present study, the intra operative pulse rate and systolic blood pressure remained stable without any significant fluctuation in all three groups.

COMPLICATIONS

No intra-operative and post-operative complications like pneumothorax, intra arterial or intravascular placement of drug, nausea, vomiting, neurotoxicity or cardiotoxicity were found in any of the 3 groups.

CONCLUSION

To conclude the study, we observed that Dexamethasone as an adjuvant drug increased the motor and sensory durations causing better pain relief in patients and for longer duration when used with Ropivacaine 0.5%. It had an option of being administered through intravenous route as well hence following non-usage as an off label analgesic potentiator. We found that dexamethasone via perineural route to be the better and more potent alternative than the intravenous route as the adjuvant. It decreased the onset time of both motor and sensory blockade as well as led to increase in blockade duration without causing any intra-operative side effects or any post-operative complications like nerve damage. It led to a decrease consumption of post-operative analgesic requirement.

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