ORIGINAL RESEARCH PAPER

Anaesthesiology

KEY WORDS: Supraclavicular Brachial plexus Block, Ropivacaine, Dexamethasone.

COMPARATIVE STUDY OF ROPIVACAINE ALONE VERSUS ROPIVACAINE WITH DEXAMETHASONE AS AN ADJUVANT IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

Dr. Deba Gopal Pathak Professor, Department of Anaesthesiology and Critical Care, Silchar Medical College and Hospital.

Dr. Aparajita Dutta* PG Trainee, Department of Anaesthesiology and Critical Care, Silchar Medical College and Hospital. *Corresponding Author

Dr. Abhijit Das Asstt. Professor, Department of Anaesthesiology and Critical Care, Silchar Medical College and Hospital.

ABSTRACT

Brachial plexus block provide a useful alternative to general anaesthesia for upper limb surgeries. Ropivacaine is one of the most frequently used local anaesthetic which has longer duration of action but has drawbacks of delayed onset and patchy analgesia. Dexamethasone is very potent glucocorticoid with very good anti-inflammatory and analgesic activity. A prospective, randomised double blinded study was undertaken in patients posted for upper limb surgeries under supraclavicular block. 80 patients with ASA class I and II were randomly grouped into two groups. Group R received 28ml ropivacaine 0.5% and 2ml normal saline and Group RD received combination of 28ml ropivacaine 0.5% and 2ml/8mg dexamethasone. 30ml solution is used for a single shot blockade of supraclavicular brachial plexus. Combination of ropivacaine 0.5% and dexamethasone 8mg has significantly hasten onset and duration of sensory and motor blockade and prolonged duration of analgesia.

INTRODUCTION

Patients seek medical care and therapy for a variety of reasons, the most common of which are pain and suffering from pain and this has been continuing for ages. With the evolution of the concept of pain, various agents treating painful conditions are also developed.

Various regional anaesthesia procedures had emerged to provide relief in the perioperative phase, based on knowledge of the anatomy of various nerve structures and acquaintance with the pharmacology of anaesthetic medications. Brachial Plexus block is a good alternative to general anaesthesia for upper limb surgery. This type of anaesthesia mainly helps to achieve ideal operating conditions by producing muscular relaxation, maintaining stable intraoperative hemodynamic condition, sympathetic block and also reducing postoperative pain, vasospasm and oedema. This also avoids the unwanted effects of general anaesthetic drugs used during general anaesthesia and the stress of upper airway instrumentation.

Local anaesthetics are membrane-stabilizing drugs that work by restricting sodium inflow through voltage-gated sodium channels, preventing action potential production. Local anaesthetics administered for regional nerve blocks are utilized in providing postoperative pain relief in many surgical procedures by blocking signal traffic to the dorsal horn. Various local anaesthetics alone or in combination with different adjuvants have been tried to prolong the duration of postoperative analgesia for a long time. Bupivacaine is a well-established long-acting regional anaesthetic, which like all amide anaesthetics has been associated with cardiotoxicity. Ropivacaine is a long-acting regional anaesthetic that is structurally related to bupivacaine. It is an S(-) enantiomer, unlike bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles.

Significant prolongation of brachial plexus analgesia is ideally accomplished with the placement of the continuous catheter. For moderate prolongation of analgesia, various adjuvant drugs can be admixed with a local anaesthetic. Therefore, investigators have tried mixing local anaesthetic with adjuvant drugs to prolong anaesthesia with a nerve block. Adjuvants including epinephrine, clonidine, opioids, ketamine and midazolam have met with limited success. The steroids have been shown to reduce inflammation and also have shown analgesic effects. The pain relief after administration of steroids is due to the reduction of inflammation by inhibition of Phospholipase A2 and also blocks the transmission in nociceptive C – fibres to reduce the pain. Dexamethasone is a very potent and highly selective glucocorticoid. Basically, it is used as an anti-inflammatory and immunosuppressant.

METHODS

A randomised double-blinded prospective study was conducted in eighty (80) patients ranging in age from 18 to 60 years, with physical status ASA I and II, who were undergoing elective upper limb surgeries lasting more than 60 minutes under supraclavicular brachial plexus block. The study was conducted at SILCHAR MEDICAL COLLEGE AND HOSPITAL in Silchar, Assam, from June 1st, 2020 to May 31st, 2021. Patients who were allergic to local anaesthetic and dexamethasone, Patients with a history of a bleeding disorder, uncontrolled diabetes mellitus, hypertension pre-existing peripheral neuropathy, renal and liver disease, patients with ASA grade III and IV and Patients with a local infection at the site of puncture for supraclavicular brachial plexus block were excluded from the study.

After receiving approval from the Institutional Ethical Committee and written informed consent from the patients (study subjects), all the patients were divided randomly into two groups i.e., Group R (n = 40) Patients in this group received 28 millilitres (mL) of 0.5% Ropivacaine + 2mL saline. Group RD (n = 40):Patients in this group received 28 millilitres (mL) of 0.5% Ropivacaine + 2ml or 8mg Inj. Dexamethasone. (Ropivacaine 0.75% ampoule was used. 20 mL of this was diluted to 30 mL with 10 mL of 0.9% normal saline to make it 0.5%).

On the day before surgery, all of the patients who were chosen for the study were thoroughly assessed. A thorough examination was performed during the pre-anaesthetic evaluation, which included proper history taking, examination of various systems, including the surface anatomy where the block was to be administered, and meticulous airway assessment prior to surgery. The planned anaesthetic procedure for surgery, as well as the procedure for developing paraesthesia, were also thoroughly explained to the patients, and attempts were made to alleviate their anxiety. Signed informed permission was acquired, and pre-

anaesthetic preparation was completed, including overnight fasting and the administration of oral Alprazolam 0.5 mg to all patients the night before surgery. Routine laboratory examinations were conducted which included a complete haemogram, random blood sugar, routine urine examination if required, ECG and a chest X-ray.

In the pre-operative room, the patient's height weight will be noted and an intravenous line will be secured with an 18G cannula on the unaffected arm. The patient will be connected to a standard monitor and baseline E.C.G. (Electrocardiography), NIBP (Non-invasive blood pressure) and SpO2 (Oxygen saturation) will be recorded. The patient will be premeditated 30 minutes before surgery with Inj. Ranitidine 100mg IV, Inj. Ondansetron 4mg IV, Inj. Midazolam 1mg IV stat. The site of injection will be shaved and disinfected.

The injection site will be infiltrated with 1 ml of lignocaine 2% subcutaneously and after that supraclavicular brachial plexus block will be performed following appropriate landmarks, and neural localization will be achieved by using a nerve locator connected to a 22G, 50mm long stimulating needle. The location endpoint will be a distal motor response with an output lower than 0.5mA in the median nerve region. Following negative aspiration, 30ml of the local anaesthetic alone and in combination with the adjuvant will be injected as per the groups.

The onset of the sensory block will be assessed with pinprick sensation: Grade 0: Sharp pain felt Grade 1: Analgesia, the dull sensation felt Grade 2: Anesthesia, no sensation felt. Assessment of motor blockade will be carried out by modified Bromage scale: Grade 0: Normal motor function with full flexion and extension of the elbow, wrist and fingers Grade 1: Decreased motor strength with the ability to move the fingers only Grade 2: Complete motor block with an inability to move the fingers (6). Sensory and motor block along with monitoring vitals was determined at 5 minutes up to 24hrs. Any hypersensitivity reaction for the drugs, evidence of pneumothorax and other adverse events were also monitored.

RESULTS

Descriptive statistical analysis was carried out in the study. Results on continuous measurements were presented as Mean SD and results on categorical measurements are presented in number (%) Proportions were compared using *Chi-squares test* of significance. The *student's t-test* was used to determine whether there was a statistical difference between study groups in the parameters measured.

In the above tests, the "p" value of less than 0.05 was accepted as indicating statistical significance. Data analysis was carried out using Microsoft Word and Excel was used to generate graphs, tables etc.

The minimum age recorded in our study was 18 and the maximum age was 60 years. The mean age of patients in group R was 35.41 ± 11.01 years while the mean age of patients in group RD was 35.08 ± 12.53 years. The mean weight of patients in group R was 58.95 ± 8.75 kgs and in group RD, it was 59.23 ± 10.04 kgs. In group R, 75% of patients were male and the remaining were female.

In group RD also 75% of cases were male and 25% were female. The difference between them was comparable in both groups. Out of 40 patients in group R, 33 were ASA grade I and 7 were ASA grade II. In the group RD, 32 were ASA grade I and 8 were ASA grade II. The total duration of surgery was also comparable in both groups with mean duration in group R (83.46 ± 15.82) min and group RD being (86.50 ± 15.78) min and these differences were statistically not significant.

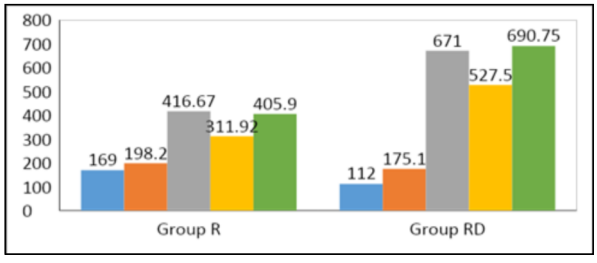
Table - 1 Comparison Of Demographic Parameters, ASA Status And Duration Of Surgery.

Demographic parameters	Group R (n=40) Mean ± SD	Group RD (n =40) Mean ± SD	P value
Age(yrs)	35.41 ± 11.01	35.08 ± 12.53	0.86
Weight(kg)	58.95 ± 8.75	59.23 ± 10.04	0.89
Sex	Male=30(75%) Female=10(25%	Male=30 (75%) Female=10(25%)	1
ASA status(I/II)	33/7	32/8	≈1

In Group R, the mean of onset of sensory blockade was 16.90 ± 1.52 min and 11.20 ± 1.47 min in Group RD . The mean of onset of motor blockade was 19.82 ± 1.38 min in group R and 17.51 ± 1.30 min in group RD and both of the values are statistically highly significant. The mean of the duration of motor blockade was also longer in group RD (527.50 ± 29.22) min compared to Group R (311.92 ± 29.10) min, duration of sensory Blockage was also longer in group RD (671.00 ± 31.29) min compared to Group R (416.17 ± 39.70) min and this difference was also statistically significant. The Mean duration of analgesia was also prolonged in Group RD (690.75 ± 24.64) min in comparison to group R (405.90 ± 47.65) min and this was also highly statistically significant.

Table - 2 Comparison Of Onset & Duration Of Sensory And Motor Blockage And Analgesia

Parameters (in Min)	Group R Mean ± SD	Group RD Mean ± SD	P value
Duration of Surgery	83.5 ± 15.8	86.50 ± 15.78	0.77
Onset of Sensory Block	16.90 ± 1.52	11.20 ± 1.47	0.000
Onset of Motor Block	19.82 ± 1.38	17.51 ± 1.30	0.000
Duration of Sensory Block	416.17 ± 39.70	671.00 ± 31.29	0.000
Duration of Motor Block	311.92 ± 29.10	527.50 ± 29.22	0.000
Duration of Analgesia	405.90 ± 47.65	690.75 ± 24.64	0.000



(Y-axis – figures are in minutes)

Figure 1: Data Analysis Chart.

DISCUSSION

Peripheral nerve blocks can be used not just for prophylactic analgesia, but also for postoperative pain control. Peripheral nerve blocks offer many benefits over other anaesthetic techniques in a certain population of patients like those with pulmonary complications and in certain specific clinical settings, that may contribute to faster and safer pain relief, increase patient satisfaction, early ambulation, reduce hospital stay, and decrease overall healthcare cost. The technique involves the injection of the anaesthetic in the vicinity of a specific nerve or a bundle of nerves to block the pain sensation of a specific portion of the body The usual indications for supraclavicular brachial plexus block are surgeries of the distal third of the arm, forearm and hand.

A regional technique should always be considered whenever the general condition of the patient is poor or the patient is not adequately prepared. Nerve blocks with long-acting local anaesthetics like ropivacaine or bupivacaine are beneficial for better postoperative pain therapy, but the duration of the block remains insufficient to avoid the postoperative use of opioids or NSAIDs. Alternatively, perineural catheters placed in situ can be used to prolong the duration of analgesia, however, the insertion of perineural catheters are time-consuming, costly, possibly more painful for the patient, has possibilities of higher complications (e.g. infection, dislodgment), and needs more postoperative care. So, to improve the quality of the block and to prolong the duration of postoperative analgesia, various adjuvants have been added to local anaesthetics. Adjuvants not only improve the quality of the block but also improve the duration of analgesia which decreases the need for postoperative analgesics (both NSAIDs and opioids) and continuous perineural catheters.

Dexamethasone, a glucocorticoid, exerts its effects by changes in cell function induced by glucocorticoid receptor activation. The mechanism involved for the extended analgesic effect of dexamethasone is attributed to their action locally on nociceptive C-fibers to increase the activity of inhibitory potassium channels, thus decreasing their activity and has emerged as an effective corticosteroid when combined with ropivacaine. Many studies have successfully demonstrated dexamethasone's efficacy as an adjuvant.

In the present study, the onset of sensory and motor blockade was earlier in a study group of dexamethasone comparison to the control group and which is statistically significant. This observation corresponded to the findings of Dar, et. al. which was done in a double-blind fashion, 30 ml of 0.5 per cent ropivacaine was mixed with 2 ml of isotonic sodium chloride solution and in another group, 30 ml of 0.5 per cent ropivacaine was mixed with 2 ml (8 mg) of dexamethasone. The duration of the motor block and sensory block was highly significant in the present study, which was also reported in similar studies by Cummings et al.

In our study, it is shown that an addition of Dexamethasone 8mg an adjuvant to Ropivacaine 0.5% in Supraclavicular brachial plexus block speed up the onset of sensory and motor blockade also prolongs the duration thus providing better analgesia. In our study we found that in Group RD addition of Dexamethasone as an adjuvant with 0.5% Ropivacaine significantly accelerated the onset of sensory and motor block, prolonged the duration of sensory and motor block, and increased the duration of analgesia, resulting in a longer pain-free period post-operatively. Its use was not associated with any side effects such as haemodynamic variation, nausea, vomiting, respiratory depression, systemic toxicity, inflammation of the puncture site or nerve lesion, or pruritus.

CONCLUSION

Combination of Ropivacaine 0.5% and Dexamethasone 8mg in supraclavicular brachial plexus block for upper limb surgery has significantly hastened onset and duration of sensory and motor blockade and prolonged duration of analgesia, without producing haemodynamic variation, nausea, vomiting, respiratory depression, systemic toxicity, inflammation of the puncture site or nerve lesion, or pruritus.

REFERENCES:

[1] Gebhart G. F., Ballantyne, J. C., Fishman, S. M., Rathmell, J. P., (2019), "Intellectual Milestones in Our Understanding and Treatment of Pain." Bonica's Management of Pain. 5th edition, Philadelphia: Wolters Kluwer Health, 195-211.

[2] Hurley, R. W., Murphy, J. D., Wu, C. L., Miller, R. D., Cohen, N. H., Eriksson, L. I., Fleisher, L. A., Wiener-Kronish, J. P., Young, W. L., (2015), "Acute Postoperative Pain." Miller's Anesthesia. 8th edition. Elsevier Saunders, 2974-2998.

[3] Mishra, A. K., Afza, I. M., Mookerjee, S. S., Bandyopadhyay, K. H., Paul, A., (2013), "Pre-emptive analgesia: Recent trends and evidences." Indian Journal of Pain, 27, 114-120.

[4] Krishna Prasad, G. V., Khanna, S., Jaishree. S. V., (2020), "Review of adjuvants to local anaesthetics in peripheral nerve blocks: Current and future trends." Saudi Journal of Anesthesia, 14, 77-84.

[5] Chen, B. S., Peng, H., Wu, S. N., (2009), "Dexmedetomidine, an α2-adrenergic agonist, inhibits neuronal delayed-rectifier potassium current and sodium current." British Journal of Anesthesia, 103(2), 244–254.

[6] Khemka, V., Jadeja, P. D., (2017), "Comparative Study of Ropivacaine with Dexmedetomidine versus Ropivacaine Alone in Supraclavicular Brachial Plexus Block for Upper Limb Surgery." International Journal of Scientific Studies, 5(6), 74-80.

[7] Krishna, S. S., Chnadra, G. P., Chaitnya, K. C., (2017), "Comparative study of ropivacaine alone versus ropivacaine with dexamethasone in supraclavicular brachial plexus block." International Surgery Journal, 4, 3879-3883.

[8] Dar, F. A., Najar, M. R., Jan, N., (2013), "Effect of addition of dexamethasone to ropivacaine in supraclavicular brachial plexus block." Indian Journal of Pain, 27, 165-169.

[9] Kumar, S., Palaria, U., Sinha, A. K., Punera, D. C., Pandey, V., (2014), "Comparative evaluation of ropivacaine and ropivacaine with dexamethasone in supraclavicular brachial plexus block for postoperative analgesia." Anesthesia Essays and Researches, 8, 202-208.

[10] Biradar, P. A., Kaimar, P., Gopalakrishna, K., (2013), "Effect of dexamethasone added to lidocaine in supraclavicular brachial plexus block: A prospective, randomised, double-blind study." Indian Journal of Anaesthesia, 57, 180-184.

[11] Cummings, K. C., Napierkowski, D. E., Parra-Sanchez, I., Kurz, A., Dalton, J. E., Brems, J. J., et al., (2011), "Effect of Dexamethasone on duration of interscalene nerve blocks with ropivacaine or bupivacaine." British Journal of Anaesthesia, 107(3), 446-453.

[12] Golwala, M. P., Swadia, V. N., Dhimar, A. A., Sridhar, N. V., (2009), "Pain relief by Dexamethasone as an adjuvant to local anaesthetics in supraclavicular brachial plexus block." Journal of Anaesthesia clinical Pharmacology, 25(3), 285-288.

[13] Casati, A., Faneli, G., Aldegheri, G., Berti, M., Colnaghi, E., Cedrati, V., et al., (1999), "Interscalene brachial plexus anaesthesia with 0.5%, o.75% or 1% Ropivacaine: a double-blind comparison with 2% mepivacaine." British Journal of Anesthesia, 83, 872-875.

[14] Parrington, S. J., O'donnell, D., Chan, V. W., Brown-Sherves, D., Subramnyam, R., Qu, M., et al., (2010), "Dexamethasone added to mepivacaine prolongs the duration of analgesia after supraclavicular brachial plexus blockade." Regional Anesthesia Pain Medicine, 35(5), 422-426.