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A Prospective Randomised Comparative Study for Arthroscopic Shoulder Surgery under Interscalene Block (ISB) with Effect of Ropivacaine 0.5% and Ropivacaine 0.5% with Dexamethasone

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ABSTRACT
One of the basic biological phenomena is pain. According to the International Association for the Study of Pain, pain is an unpleasant emotional and sensory experience connected to tissue damage that has occurred or may occur. Aim of the study is to evaluate the following observations in patients receiving either ropivacaine 0.5% or ropivacaine 0.5% with dexamethasone (8mg) as an adjuvant in interscalene brachial plexus (ISB) block. The study was Prospective randomised observational study. Period of study from March 2020 to February 2021. Department of Anaesthesiology, at Nil Ratan Sircar Medical College and Hospital and total sample size 56. Group R experienced motor blockade for 495.62 min on average, while group RD experienced it for 902.28 min. According to statistical analysis, there is statistical significance ($p<0.0001$). We found that the combination of ropivacaine 0.5% and dexamethasone in ISB appears to provide better pain control and feweropioid need for arthroscopic shoulder surgery than ropivacaine 0.5% alone.

INTRODUCTION

One of the basic biological phenomena is pain. According to the International Association for the Study of Pain, pain is an unpleasant emotional and sensory experience connected to tissue damage that has occurred or may occur. Pain is consistently undervalued and undertreated. The primary function of anesthesia is to reduce pain during surgery.

James Moore promoted neural compression as a practical method for providing surgical anesthesia in 1784 by using mechanistic notions.

In 1855 Gadecke (German) isolated an alkaloid from leaves of coca plant.

Albert Nieemann successfully isolated and identified the alkaloid from Erythroxylon coca leaves in 1860.

A common and extensively used regional nerve block procedure for perioperative anesthesia and analgesia during upper extremity surgery is the brachial plexus block. By using a regional nerve block, the side effects of the anesthetics used during general anesthesia as well as the strain of tracheal intubation and laryngoscopy are avoided.

For shoulder surgery, Interscalene Block (ISB) offers superior anesthesia and analgesia[1]. Post-operative analgesia, however, is insufficient to support prompt mobilization. To extend the duration of peripheral nerve blocks, a number of additives have been investigated, including epinephrine and clonidine[2,3]. Nevertheless, these medicines may have unfavorable side effects.

When dexamethasone is used with short-acting local anesthetics, the effects of peripheral nerve block are prolonged[4]. Recently, we have been employing ropivacaine for single-shot ISB for the shoulder. This offers good anesthesia during surgery but the duration of post-operative analgesia is constrained.

We sought to assess the combined effect of dexamethasone and ropivacaine used in ISB for shoulder procedures since numerous studies have demonstrated that dexamethasone is a safe adjuvant to ropivacaine[5]. The goal of the current study was to examine the use of 0.5% ropivacaine and a combination of 0.5% ropivacaine and 8 mg dexamethasone in ISB for shoulder arthroscopic procedures.

METERIALS AND METHODS

Study design: Prospective randomised observational study.

Period of study: The study will be conducted over 1 year, from March 2020 to February 2021.

Place of study: The study will be conducted under the Department of Anaesthesiology, at Nil Ratan Sircar Medical College and Hospital, in the Operating Room designated for Orthopaedic Surgery.

Sample size: 56

Inclusion criteria:

- Patients belonging to ASA GRADE I, II
- Patient of either sex between the age groups 18-65 years. Patients with shoulder injury or fractured posted for arthroscopic surgery including total shoulder replacement, hemiarthroplasty, rotator cuff repair, labral repair and acromioplasty, Humerus fracture, Clavicle fracture, Other arm surgery that does not involve the medial aspect of the forearm or hand
- Patients that have given written, informed consent to participating in the study

Exclusion criteria:

- Patient not satisfying all inclusion criteria
- Patient having infection over injection site
- Patient refusal
- Known hypersensitivity to test drugs
- Contraindications to ISB
- Patients with thrombocytopenia or coagulopathies
- Patients having BMI >30 kg/m2, mental illness, chronic obstructive pulmonary disease or any respiratory disease, coagulopathy, prior trauma, neuropathy, myopathy and requiring open surgery were excluded from the study

Statistical analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests, which compare the means of independent or unpaired samples, were used to assess differences between groups. Paired t-tests, which account for the correlation between paired observations, offer greater power than unpaired tests. Chi-square tests (χ^2 tests) were employed to evaluate hypotheses where the sampling distribution of the test statistic follows a chi-squared distribution under the null hypothesis; Pearson's chi-squared test is often referred to simply as the chi-squared test. For comparisons of unpaired proportions, either the chi-square test or Fisher's exact test was used, depending on the context. To perform t-tests, the relevant formulae for test statistics, which either exactly follow or closely approximate a t-distribution under the null hypothesis, were applied, with specific degrees of freedom indicated for each test. p-values were determined from Student's t-distribution tables. A $p \leq 0.05$ was considered statistically significant, leading to the rejection of the null hypothesis in favour of the alternative hypothesis.

RESULT AND ANALYSIS

Group A's mean BMI is 24.97, whereas group B's is 24.60. The p-value is 0.288, indicating that there is no statistical significance. With regard to BMI, both groups are comparable. There were five ASA II patients and twenty-five ASA I patients in group R. Within the RD group, 26 patients were classified as ASA I and 4 as ASA II. In terms of ASA status, the statistics are comparable between the two groups and are statistically not significant (p>0.05). In group R, the average start of sensory blocking is 4.35 min, while in group RD, it is 3.98 min. The p value of 0.088 indicates statistical non-significance, according to the analysis. The anesthetic quality in group R is rated at 3 for 26 patients, 2 for 4 patients and at 3 for 29 patients and 2 for 1 patient in group RD. The p value, according to statistical analysis, is 0.161, which is not significant. Group R experienced motor blockade for an average of 495.62 min, while group RD experienced it for 902.28 min. The p-value is less than 0.0001, indicating statistical significance, according to statistical analysis. The mean duration of motor blockade in group R is 495.62 min, in group RD is 902.28 min. Statistical analysis shows the p<0.005, which is statistically significant (Table 1-5).

DISCUSSION

For upper limb procedures, brachial plexus block is a simple and generally safe procedure. Although, lignocaine and ropivacaine together improved operating conditions, analgesia is rarely sustained for longer than eight to ten hours. When steroids are added to local anaesthetics, the duration of analgesia is effectively and significantly extended and the onset of action is accelerated. Steroids are extremely strong immunosuppressive and anti-inflammatory drugs. Steroid injections perineurally have been shown to affect post-operative analgesia. Sciatica and back discomfort were treated with epidural steroids.

While other steroids have been used for this purpose, dexamethasone, a synthetic glucocorticoid derived from 9 alpha, is chosen due to its strong anti-inflammatory properties; it is around 25-30 times more effective than hydrocortisone and lacks mineralocorticoid action. was discovered to be risk-free and free of any possible negative consequences. Pre-operative dexamethasone administration by oral and intravenous methods has been demonstrated in a variety of dental and general surgical procedures to reduce overall pain scores and the need for analgesics during the postoperative period without causing any negative side effects[5].

It is also known that dexamethasone lessens post-operative nausea and vomiting. The anti-inflammatory characteristic of dexamethasone may be the mechanism behind its analgesic and antiemetic effects[6].

Additionally, it has been noted that a tiny quantity of dexamethasone added to local anesthetics increased the length of analgesia following subcutaneous, intercostal, intraarticular and epidurally blocks[7].

In our study mean age in group R is 37.73 and in group RD it is 34.93 both groups are comparable in terms of age.

Number of male patients in group R is 25 and in group RD is 24, number of female patients in group R is 5 and in group RD is 6. Both groups are comparable in terms of sex.

Number of patients with ASA I in group R is 25 and in group RD is 26 number of patients with ASA II in group R is 5 and in group RD is 4. Both groups are comparable in terms of ASA PS status.

Mean value of BMI in group R is 24.97 and in group RD is 24.60 p value is not significant, both groups are comparable in terms of BMI.

Duration of surgery, in both groups are comparable and not statistically significant in group R mean duration of surgery is 152.47 and group RD mean duration of surgery is 153.40.

Hemodynamic parameters like heart rate, systolic BP, diastolic BP, mean arterial BP are comparable in both groups, are statistically insignificant.

In our study, the dexamethasone group experiences the onset of sensory blockage and motor blockade earlier. Our results are consistent with the research that was done by Shrestha *et al.*[8] in 60 patients.

Table 1: Distribution of mean Demographic profile: Group

Group	No	Mean	SD	p-value
R	30	24.97	1.502	0.288
RD	30	24.60	1.214	NS

SD: Standard deviation

Table 2: Distribution of mean. demographic profile ASA: Group

	ASA I		ASA II		
Groups	No.	Percent	No.	Percent	p-value
R	25	83.30	5	16.7	0.718NS
RD	26	86.74	4	13.3	

Table 3: Distribution of mean onset of sensory blockade: Group

Group	No.	Mean	SD	p-value
R	30	4.35	0.86	0.088 NS
RD	30	3.98	0.79	

SD: Standard deviation

Table 4: Distribution of mean quality of anaesthesia: Group

	Quality of anaesthesia						
	1		2		3		
Group	No	Percent	No	Percent	No	Percent	p-value
R	-	-	4	13.3	25	86.7	0.161NS
RD	-	-	1	3.3	29	96.7	

Table 5: Duration of motor blockade: Group

Group	No.	Mean	SD	p-value
R	30	495.62	54.29	<0.0001
RD	30	902.28	76.91	

SD: Standard deviation

In your study, the dexamethasone group (RD) experienced the onset of sensory blockage in an average of 3.98 min and the onset of motor blockade in an average of 5.32 min, compared to the 4.35 and 5.83 min for group R. The potential reason for the early onset of action could be the synergistic effect of dexamethasone and local anesthetics on nerve fiber blockage. Our findings are consistent with a study by Winnie from 1977, who reported that the outside motor fibers are blocked earlier than the sensory fibers, which are located deeper in the plexus at the level of trunk and division[9]. In our investigation, motor blockade occurs earlier than sensory blockade. This result is also consistent with the research that Shrestha *et al*.[10].

Duration of motor and sensory blockade: Our results are consistent with the research done by De Jong *et al*.[11] in that motor blockade regression occurs earlier than sensory regression. In the dexamethasone group, the duration of pain reduction (postoperative analgesia) was significantly longer, a mean of 986.76 min, compared to only 565.27 min in the control group. These results are consistent with Yadav *et al*.[12].

In their study, Mowafegh *et al*.[13] also reported that in 60 patients with lignocaine, dexamethasone increases the length of analgesia in axillary block. Numerous studies have proposed a plausible mechanism of action for dexamethasone in prolonging the sensory blockage. According to Johanson *et al*.[14], steroids have the ability to inhibit nocioceptive C fibers.

In a different investigation, Attardi *et al*.[4] discovered that steroids work via changing the k+ channel, which in turn works in concert with local anesthetics in nerve fibers.

Ahlgren *et al*.[1] discovered in their investigation that the anti-inflammatory properties of steroids mediate the analgesic effect.

According to Seidenari *et al*.[15], steroids have a vasoconstriction effect that is caused by their analgesic prolonging activity, which is comparable to adrenaline's action when combined with local anesthetics.

Additional options include regulation of ectopic neuronal discharge and effect on the corticosteroid receptor in the brain after being absorbed from the peripheral to the systemic circulation[16]. In one study, Sugita *et al*.[17] observed no neurological side effects following about 2000 intrathecal injections of dexamethasone 8 mg in 200 patients to treat post-traumatic visual impairment.

The average duration of motor blockade was 495.62 min in Group R, while in Group RD, it was 902.28 min. Statistical analysis revealed a $p<0.005$, indicating that the difference is statistically significant.

CONCLUSION

We concluded that for arthroscopic shoulder surgery, the combination of Ropivacaine 0.5% and Dexamethasone in ISB seems to offer better pain management and less opioid needs than Ropivacaine 0.5% alone. These findings imply that adding dexamethasone to ISB may improve recovery outcomes and postoperative analgesia.

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