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Original Research Article

A Clinical Comparison between 0.5% Levobupivacaine and 0.5% Levobupivacaine with Dexamethasone 8mg Combination under USG Guided Brachial Plexus Block by Supraclavicular Approach

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Abstract

Regional anaesthesia has been preferred over general anaesthesia in many orthopaedic surgeries due to lack of associated complications in regional blocks. Increasing the duration of local anaesthetic action can obtain the desired effect of prolongation of the postoperative patient comfort. Many adjuvants to local anaesthetics such as epinephrine, clonidine, opioids, dexmedetomidine and also neostigmine have been tried. Recently, dexamethasone has been found to prolong postoperative analgesia, reducing the requirement of the local anaesthetic and also the side effect profile. Hence our study was conducted to analyse the efficacy of dexamethasone as an adjuvant drug to levobupivacaine. After institutional ethical committee approval, CTRI registration and patient consent, a double blinded randomised controlled study was conducted in 50 patients aged 18-65 years of ASA I&II undergoing upper limb surgeries distal to mid-humeral level over a period of 1year. The mean duration of post-operative analgesia in Group D was 1022.2±62.67 minutes and in Group S was 777.40±34.19 minutes (p<0.001). The mean total dose of rescue analgesics required was more in Group S when compared to Group D in the first 24hrs. The onset of sensory and motor block was faster in Group D when compared to Group S. The mean duration of sensory and motor block was significantly longer in Group D than Group S. The addition of dexamethasone to levobupivacaine in SCBP blockade was associated with faster onset as well as prolonged duration of sensory and motor block, prolonged duration of post-operative analgesia and required less rescue analgesics.

Keywords: Levobupivacaine, dexamethasone, brachial plexus block, analgesia

Introduction

Among the different modalities of anaesthetising an individual for either the surgical procedure or the pain management, regional anaesthesia is one among those procedures consisting of infiltrating a peripheral nerve with an anaesthetic drug and blocking the

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transmission in order to avoid or relieve pain [1].

Usually general anaesthesia was preferred for the upper extremities' procedures in older times. Now the evolutionary aspects led to the specific regional blockade, in order to improve the approach and reduce the incidence of adverse effects. General anaesthesia differs from the regional one as it does not affect patient's consciousness level [2]. Most important advantages of regional over general anaesthesia are, it avoids the airway manipulation, polypharmacy, side effect profile of systemic drugs, provides postoperative analgesia, faster recovery time and early ambulation. Regional anaesthesia can also be used in conjunction with general anaesthesia, post-procedural and often for many acute and chronic pain conditions too [3].

Brachial plexus block (BPB) is a popular and widely employed regional nerve block technique for anaesthesia and postoperative analgesia for surgeries of the upper extremities. The brachial block was first introduced by Sir William Hallstead in the year 1884. Then Kulenkampff modified the procedure and successfully performed the first percutaneous supraclavicular brachial plexus block among 1000 patients in the year 1911 [4, 5].

Most of the evidence has suggested multiple approaches to blocking the brachial plexus, dependent on the block indication, surgery or procedure being performed, patient-specific body habitus, medical comorbidities and individual anatomy variations [6].

Based on the anatomical course of the brachial plexus, it can be blocked at multiple sites for varying effects. An anesthesiologist must be well trained with multiple approaches given variant patient [7]. The common approaches are Interscalene, Supraclavicular, Infraclavicular: Traditional and Retrograde approach (RAPTIR) and Axillary.

Supraclavicular BPB is ideal for procedures of the upper limb from the mid-humeral level down to the hand. This is considered the "Spinal of the arm" [8]. BPB is beneficial for the patients with cardio-respiratory comorbidities as it minimizes the stress response with minimal need for other anaesthetic drugs [9]. Classical approaches for these blocks are all blind techniques which depend on the sensory paraesthesia or a muscle contraction due to stimulation of that particular nerve. Because of this, multiple needle attempts are needed to elicit sensory paraesthesia or to obtain muscle twitch response. This itself will lead to pain, neurological injury and the most serious adverse effect, pneumothorax.10 Hence, the ultrasound-guided approach for the brachial plexus block is gaining importance in order to increase the success rates and also to reduce the incidence of complications.

Local anaesthetics such as Levobupivacaine and Bupivacaine can be used for supraclavicular brachial plexus blocks to provide good operative conditions. Levobupivacaine is one of the long acting, amide-type local anaesthetic that is the S (−) enantiomer of the racemate bupivacaine. Both provide effective anaesthesia. Compared to bupivacaine, levobupivacaine has a longer duration of action along with lower risk of central nervous system (CNS) and cardiovascular system (CVS). However the duration of analgesia provided by either molecule does not have significant benefit postoperatively. Hence most of the trials are conducted by adding many adjuvant drugs in order to overcome this drawback [11].

Several adjuvants have been evidenced to potentiate the efficacy of brachial plexus block including opioids, midazolam, neostigmine, bicarbonate, hyaluronidase and steroids [12]. Steroids have powerful anti-inflammatory as well as analgesic properties and they also influence the onset and duration of sensory and motor block. They suppress inflammation through inhibition of phospholipase A2. Perineural injection of steroids is reported to influence postoperative analgesia. They relieve pain by reducing inflammation and blocking transmission of nociceptive C-fibres and by suppressing ectopic neuronal discharge [13].

One such steroid molecule that has been tried as an adjuvant for levobupivacaine is dexamethasone and literary search resulted sparse studies.

Dexamethasone is very potent and highly selective glucocorticoid used as an anti-inflammatory and immunosuppressant. Its potency is 40 times that of hydrocortisone. Clinical uses of dexamethasone are for treatment of many inflammatory and autoimmune conditions

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but glucocorticoids are also used to treat patients suffering from neuropathic pain and complex regional pain syndromes (CRPS) [14]. So, steroids have anti-inflammatory as well as analgesic effects.
Many studies have successfully proved the usefulness of dexamethasone as an effective analgesic. It has also been proved in increasing the potency of levobupivacaine when used as an adjuvant in blocking the brachial plexus [15].
Hence this study is designed to know the beneficial effects of addition of dexamethasone to a local anaesthetic in ultrasound guided brachial plexus block by supraclavicular approach.

Methodology

Study design

Prospective, Randomised, Double-blinded, Controlled study.

Study population

50 Patients undergoing upper limb surgeries distal to mid-humeral level.

Study period

1 year.

Source of data

The study was conducted in 50 patients undergoing upper limb surgeries at Hospital, Ballari. Study period was one year. The patients were included in the study by applying the following inclusion and exclusion criteria:

Inclusion criteria

- Patients undergoing upper limb surgeries distal to the mid-humeral level.
- Patients with ASA class 1 and class 2.
- Age 18-65 years.

Exclusion criteria

- Refusal by patients for the block or study.
- Patients with abnormal BT, CT or on anticoagulation therapy, severe anaemia, hypovolemia, shock, septicaemia and h/o seizures.
- Local infection at the site of puncture.
- Allergy to the study drugs.
- History of significant systemic disorders (cardiovascular, respiratory, central nervous system or renal system.

Methods of collection of data

After thorough pre-anaesthetic evaluation and overnight fasting, patients shifted to operation theatre and following monitors are connected. (Pulse oximeter, electrocardiogram, capnograph and non-invasive Blood pressure).
Patients were randomly allocated into 2 groups (Group D and Group S) as per computer generated randomization table. The randomization scheme was generated by using

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https://www.randomizer.org
Allocation concealment was done using sequentially numbered, opaque sealed envelope (SNOSE) technique.
Under all aseptic precautions with the patient in supine position, the affected arm adducted and head turned to the contralateral side, the brachial plexus was visualised by putting the transducer in the supraclavicular fossa behind the middle third of the clavicle.
The plexus either appeared as a cluster of grapes (5-6 hypoechoic circles) or as 3 hypoechoic circles with the hyperechoic outer ring, located lateral and superior to subclavian artery between anterior and middle scalene muscles.
The drug solution, based on group allocation was injected after negative aspiration to avoid accidental intravascular needle puncture and the spread of drug was observed in tissue planes. Distension of the brachial plexus sheath was considered as an indication of correct needle placement.

Group D: Received 25 ml of inj. Levobupivacaine (0.5%) + 2ml of inj. dexamethasone (8mg).

Group S: Received 25 ml of inj. Levobupivacaine (0.5%) + 2ml of normal saline.

Results

Table 1: Frequency distribution of age of the patients in two groups studied

Age in Years	Group D	Group S
<30	7(28%)	7(28%)
30-40	11(44%)	14(56%)
>40	7(28%)	4(16%)
Total	25(100%)	25(100%)
Mean ± SD	36.32±8.70	34.72±8.65

Samples are age matched with P=0.518, student t test

Amongst the twenty five patients recruited in Group D, eleven of them (44%) were aged between thirty years and forty years. Amongst the remaining fourteen of them, seven each were aged below thirty years and above forty years. Amongst the twenty five Group S, seven of them (28%) were aged below thirty years of age, fourteen of them (56%) were aged between thirty to forty years of age and the remaining four of them (16%) were aged above forty years of age. The mean age of Group D was 36.32±8.70 years that of Group S was 34.72±8.65 years. This pattern of distribution of age amongst the two groups was not statistically significant with a p value of 0.518.

Table 2: Comparison of Demographic data in Two Groups of Patients Studied

Variables	Group D (Mean ± SD)	Group S (Mean ± SD)	P Value
Age (Years)	36.32±8.71	34.72±8.66	0.518
Weight (kg)	64.12±8.36	63.72±5.62	0.34
Height (meters)	1.63±0.07	1.63±0.04	0.785
Body Mass Index (kg/m2)	23.26±3.71	23.4±2.29	0.38

The average age of Group D was 36.32±8.71years and that of Group S 34.72±8.66 years. This difference in the mean age between the two groups was not statistically significant. The mean weight of Group D was 64.12±8.36kgs and that of Group S was 63.72±5.62kgs and this

variation in the weight of the two groups was not statistically significant. The average height of the Group D was 1.63±0.07 meters and that of the Group S was 1.63±0.04 meters and this difference in the mean height of the participants was not statistically significant. The mean BMI of Group D was 23.26±3.71 and that of Group S was 23.4±2.29 and this variation in the average BMI was not statistically significant.

Table 3: Comparison of Outcome Variables in Two Groups of Patients Studied

Variables	Group D (Mean ± SD)	Group S (Mean ± SD)	P Value
Onset of Sensory Block (min)	6±0.91	12.48±1.48	<0.001
Onset of Motor Block (min)	9.8±0.87	16.72±1.21	<0.001
Duration of Sensory Block (min)	929.2±57.84	704±44.18	<0.001
Duration of Motor block (min)	819.2±45.73	613.8±48.29	<0.001
Duration of Analgesia (min)	1022.2±62.67	777.4±34.19	<0.001
Dose of rescue Analgesia in 24HRS in mg	120±40.82	228±45.83	<0.001

The average time for onset of sensory block was 6±0.91minutes in Group D and that in Group S was 12.48±1.48 minutes. This difference in the average time taken for onset of sensory block was statistically highly significant with a p value of <0.001. The average time for onset of motor block was 9.8±0.87 minutes in the group of Group D and that in Group S was 16.72±1.21minutes. This variation in the mean time for onset of motor block was statistically highly significant with a p value of <0.001. The duration of the sensory block was 929.2±57.84 minutes in Group D and that in Group S was 704±44.18 minutes. This variation in the average duration of the sensory block was statistically highly significant with a p value of <0.001. The duration of the motor block was 819.2±45.73 minutes in the group of Group D that in the group of Group S was 613.8±48.29 minutes and this difference was statistically highly significant with a p value of <0.001. Even the duration of analgesia in our study was significantly higher with p value of <0.001 in Group D, which was 1022.2±62.67 and 777.4±34.19 minutes in Group S. Average dose of rescue analgesic required for the Group D in 24 hrs was 120±40.82mg and that in the Group S group was 228±45.83mg. This higher requirement of rescue analgesics in the group of Group S was statistically highly significant with a p value of <0.001.

Table 4: Duration of surgery (min)-Frequency Distribution of Patients in Two Groups Studies

Duration of surgery	Group D	Group S
Mean ± SD	138.16±31.40	137.20±25.90

P=0.907, Not Significant, Student t Test

The average duration of surgery was 138.16±31.40 minutes in Group D and 137.20±25.9 minutes in group S. However, this difference in the mean duration of surgery was not statistically significant with a p value of 0.907.

The average duration of the surgery in the group of Group D was 138.16±31.40 minutes and that in the Group S group was 137.20±25.90 minutes. This variation in the duration of the surgery between the two groups was not statistically significant with a p value of 0.907.

Table 5: Comparison of NRS in Two Groups of Patients Studied

NRS in hours	Median value in Control	Median value in Cases
2	1	0
4	2	0
6	3	1
12	3	3

24	5	2
IQR	1.5	0.5

The NRS score was 0 till two hours in both the groups. Whereas in the control group, the median NRS score at 2 hours was 1, at four hours it was 2 and NRS 3 at 6th and 12th hour. At 24 hours, NRS was found to be 5 in the control group. In the study group, the score was zero till 4 hours. The median NRS of 1, 3 and 2 was observed at 6, 12 and 24 hours respectively. And the interquartile range (IQR) for the control group was 1.5 and for the case group it was 0.5, three times the less than control group. This implies that the control group did not have better analgesic effect and there was a need for rescue analgesia.

Table 6: Comparison of time for rescue of first analgesia required among the study population

Time in hours	Group D	Group S
< 4 hours	0	0
4 to 8 hours	0	0
8 to 12 hours	0	1 (4%)
12 to 16 hours	2 (8%)	24 (96%)
16 to 20 hours	23 (92%)	0
20 to 24 hours	0	0
Total	25	25

Out of 25 patients in each group, 23/25 (92%) patients in group D required first rescue analgesic between 16 to 20 hours and hardly 2 (8%) between 12 to 16 hours. (24) 96% required first rescue analgesia between 12 to 16 hours itself and only 1 patient (4%) required before 12 hours. This difference was both clinically and statistically significant.
None of the study participants in either group had any complications in our study.

Discussion

In our study, the average time for onset of sensory block was significantly (<0.001) lesser in Group D compared to group S, which was 6±0.91minutes and 12.48±1.48minutes respectively. Similar results were observed by Shende SY *et al.* [16], the onset time in dexamethasone group was significantly sooner (7.3±1.69 minutes) when compared to the saline group (13.66±1.76 minutes) and was statistically highly significant (p<0.0001). In a similar study by Baloda *et al.* [17], the mean time of onset of sensory blockade was 8.1667 minutes in the dexamethasone group and 10.20 minutes in the control group comparable to our results.
The mean duration of the sensory block in our study was 929.2±57.84 and 704±44.18 minutes in Group D and Group S respectively. Baloda R *et al.* [17] also reported similar mean duration of sensory blockade of 923±12.9 minutes in the dexamethasone group and 657.2±8.38 minutes in the Group S. Whereas the duration of the sensory block in Shende SY *et al.* 16 was observed to be longer in group D with mean duration of 772±12.8 minutes and 361±42.1 minutes in group S (p <0.0001), which is lesser than our study and can be attributed to the combination of LAs used in their study. In a study by Vieira PA *et al.* [17], they found that the dexamethasone group had significantly prolonged the median sensory block of about 1457 min versus 833 min in the bupivacaine alone group with the p value <0.0001, which is almost similar to our findings.
The average time for onset of motor block in the present study was 9.8±0.87 and 16.72±1.21 minutes in group D and group S. In Shende SY *et al.* [16], the onset of motor blockade in group D was significantly sooner by attaining the block at 3.93±0.96 min and in group S 18.66±2.05 min which can be attributed to the use of lignocaine in their study. Mean onset of motor blockade in Baloda R *et al.* [17] was 13.76 minutes in Group D and 15.033 minutes in

Group S, comparatively higher than our findings which can be attributed to the paraesthesia technique used in their study.

We observed an average duration of a motor block of 819.2±45.73 minutes in Group D and 613.8±48.29 minutes in Group S which was highly significant (p<0.001).Similarly Baloda R *et al*. [17] reported the mean duration of motor block being significantly higher in the dexamethasone group than with NS (798.83±15.010 versus 540±7.428, p<0.01). The mean duration of the motor block was longer in group D for 654.33±82.48 minutes and 292.6±56.25 minutes in group S (p<0.001) in Shende SY *et al*. [16] which is again lesser compared to our study. Choi *et al*. [19] also observed prolonged motor blockade in Group D and Group S (1102 vs. 664 min) respectively. A similar study by Vieira PA *et al*. [18] the motor block duration was significantly prolonged (1374 min) in the dexamethasone bupivacaine combination when compared to bupivacaine-only group (827min) and their results are almost similar to our study.

Mathew R *et al*. [20] who compared IV versus perineural dexamethasone for supraclavicular brachial block found that though the duration of analgesia was similar in both groups (P = 0.104) the time to onset of sensory block in Group DP was significantly faster than that of Group DI requiring 10.20 ± 1.443 min and 11.60 ± 1.443 respectively, with a P 0.001. Time to onset of motor block in Group DP was 1.443 respectively, with a P 0.001. Time to onset of motor block in Group DP was 13.92 ± 1.754 min and in Group DI, 14.96 ± 1.274 min. This also showed a significant difference with p 0.02.

The duration of analgesia in Group D was 1022.2±62.67 minutes and that in Group S was 777.4±34.19 minutes in our study. This variation in the duration of analgesia was statistically highly significant with a p value of <0.001. Our study results are in concurrence with that of Choi S *et al*. [19] in which duration of analgesia in Group D was 1306 min vs. Group S 730 min. In Shende SY *et al*. [16] Group D 815 Min vs. Group S 393 min which establishes the effectiveness of Dexamethasone in enhancing the analgesic action.

The median NRS score at two hours, four hours, six hours, 12 hour and 24 hours was 1,2,3,3 and 5 respectively in the control group. In the study group, the median NRS score was zero till 4 hours and 1, 3 and 2 at 6, 12 and 24 hours respectively and the interquartile range (IQR) for the control group was 1.5 and for the case group it was 0.5, three times less than the control group. Hence the study group had better analgesic scores at all timelines. This was both clinically and statistically significant. Our study correlates well with the analgesic scores as observed by Shende SY *et al*. [16] and Baloda *et al*. [17].

Conclusion

Using dexamethasone 8mg as an adjuvant to the local anaesthetic levobupivacaine for ultrasound-guided supraclavicular block significantly reduces the onset of sensory and motor block. It also significantly increases the duration of both sensory and motor block and duration of analgesia. Dexamethasone with levobupivacaine for the supraclavicular brachial block also reduces the amount of rescue analgesic required postoperatively with improved NRS score of pain and without any complications/side effects.

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