Original Article

Efficacy Of Systemic Or Perineural Dexamethasone As An Adjunct To Ultrasound Guided Supraclavicular Block

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DOI: 10.47750/pnr.2022.13.S05.90

Abstract

Background: Regional anaesthesia (RA) techniques have traditionally been utilized for surgical anaesthesia and post-operative pain control. Post-operative analgesia from an epidural or a peripheral nerve block can benefit the patients with better recovery and more satisfaction. Innumerable additives have been tried in nerve blocks with variable results. We wished to evaluate the use of addition of dexamethasone with local anaesthetics and compare the efficacy with simultaneous administration of systemic dexamethasone in brachial plexus blocks.

Methods: Ninety-seven patients posted for upper limb surgeries were divided randomly into three groups to receive ultrasound guided supraclavicular brachial plexus block with bupivacaine saline combination(A) or dexamethasone bupivacaine combination(B) or a systemic dexamethasone(C) with bupivacaine alone in the plexus site. The onset and duration of sensory and motor blocks were noted**.** ANOVA, Chi square tests and intent to analyses were done according to the need and a p value of less than 0.05 was considered significant**.**

Results: The variables like mean age, weight, duration of surgery were similar between the groups. The onset and duration of sensory and motor blocks were similar with addition of dexamethasone either in plexus(perineural) or systemic. Onset (A, B, C -17 vs 12 vs 12 in minutes) duration of sensory anaesthesia (414 vs 857 vs 838 minutes) But patients in both the dexamethasone groups showed significant shortening of action in onset and prolonged duration than saline group. ($p < 0.001$), There were no significant side effects.

Conclusion: Systemic dexamethasone had a similar effect on the onset and duration of both the sensory and motor actions in supraclavicular brachial plexus blocks as perineural dexamethasone. Dexamethasone usage, both systemic and perineural, reduces cumulative postoperative analgesic usage in the first 24 hours. Either of the two techniques outperformed the control group, which received only normal saline. There were no significant negative side effects.

Key words: anaesthesia, regional, nerve block, brachial plexus, additive, dexamethasone, analgesia

INTRODUCTION:

The brachial plexus is a complex network of nerves that runs from the neck to the axilla and provides motor and sensory fibres to the upper extremities. Knowing the intricacies of the brachial plexus' formation remains a key component of effective regional anaesthesia. The plexus is most densely packed at the point of the supraclavicular fossa. The supraclavicular brachial plexus approach has a high rate of success which would include anaesthesia of the ulnar and musculocutaneous nerves, that could be missed with the interscalene and axillary approaches, respectively. Often anaesthesiologists, have been hesitant to perform this supraclavicular approach because of the close proximity of the pleura. The use of ultrasound guidance techniques not only reduces the risk of pneumothorax but also allows for a more precise diagnosis. It also decreases onset and allows a lesser dose of local anaesthetic drug[1]. Innumerable additives have been tried with variable success like opioids, midazolam, clonidine, steroids, dexmedetomidine[2]. The ideal drug which shortens onset with prolonged post operative analgesia being safe to the nerves is still being researched. Corticosteroids have potent anti-inflammatory qualities and are used to treat pain after surgery. Several recent publications and studies show that corticosteroids outperform non-corticosteroids in terms of analgesic effect. Corticosteroids are increasingly being recommended as the analgesic of choice for patients undergoing surgery. However, the safety and efficacy of corticosteroids are still debatable[3]. With the addition of steroids, to conventional peripheral nerve blocks in children,

they can be discharged home after potentially traumatic orthopaedic surgery with safe, low-cost night-time pain relief. Quality improvement[4] benefits include: a) high levels of parental and patient contentment with analgesia b) less family disturbances c) reduced necessity for inpatient care, potentially saving the money. Research work[5] have been done extensively for the addition of dexamethasone in supraclavicular brachial plexus block which has shown prolonging the duration of block. Hence in this study, we wished to compare the effect of systemic and perineural dexamethasone on the effects of anaesthesia in supraclavicular approach to brachial plexus. We aimed to compare the efficacy of Systemic or Perineural Dexamethasone as an adjunct to ultrasound guided Supraclavicular block in terms of Onset of sensory block and motor blockade, Peak effect of sensory block and motor blockade, duration of sensory block and motor blockade, postoperative pain and analgesic requirement and postoperative patient satisfaction

METHODS:

Study primer;

The study was done in a tertiary care centre in South India in accordance with declaration of Helsinki. The sample were selected from the patients admitted and posted for upper limb surgeries in the institution. The ethical committee approved the study (GMKMC & H- 4341/IEC/01/2017-54. Informed consent was taken from the study participants.

Inclusion Criteria

Patients posted for upper extremity elective surgeries with American Society of Anesthesiologists physical status class I-II in the age group of 18-60 years with a BMI < 35 kg/m2

Exclusion Criteria

Patient refusal, pregnancy, surgical procedure duration of 180 minutes or longer, Severe respiratory disease, Chest or shoulder deformities on the operating side, Pre-existing neurological deficit or neuropathy, Allergy to local anesthetics or dexamethasone, Local skin infection, coagulopathy and bleeding diathesis formed the exclusion criteria.

Randomisation and blinding:

The randomisation was done by Sequentially Numbered Opaque Sealed Envelope technique. The participants, investigators, performers, surgeons, nurses and Statistician – all will be blinded to each other with regard to the drug solutions administered. The sample size was divided into three groups. The group allocation is shown in Table 1

Table 1 showing group allocation as three groups A ,B and C

Group	A	B	C
Block drugs	24 ml of 0.5% bupivacaine+6ml distilled water	24ml of 0.5% bupivacaine+6ml distilled water	24 ml of 0.5% bupivacaine+4ml distilled water+2ML (8mg) of Dexamethasone
Iv drugs	10ml Saline	10ml (8ml of saline +2ml(8mg) of Dexamethasone	10ml Saline

Study design:

Sample size was calculated assuming the mean duration of sensory block in group 1 as 263.33 with a standard deviation of 43 and in group 2 as 234.44 with a standard deviation of 38.76 as per the earlier study. The other parameters considered for sample size calculation were 80% power of study and 5% alpha error. As per the above-mentioned calculation, the required sample size was 30**, i**n each group. To account for nonparticipation rate of about 10%, another 3 subjects will be added to the sample. Hence the final required sample size is 33 subjects in each of the study groups. Procedures were explained in detail and written consent were obtained. The procedure was carried out in the preparation room or in the theatre where facilities for resuscitation available. A senior experienced anaesthesiologist administered the ultrasound guided supraclavicular block with the drugs loaded by another investigator. Routine monitoring included ECG, Pulse oximetry, NIBP and temperature.

Outcome measures:

The duration of sensory blockade was the primary outcome measure while the onset of sensory block , onset and duration of motor blockade with postoperative analgesic duration were the secondary outcome measures. The measurement methodology is described in tables below. All the four nerves (Radial, median, ulnar and the musculocutaneous) were tested.

Table 2 describing scores of sensory loss.

SCORE	SENSATIONS
0	Normal sensation
1	Dull sensation to pin prick
2	No sensation to pin prick

Table 4 describing scores of motor involvement

SCORE	MOTOR MOVEMNT
0	Normal movements
1	Paresis
2	No movement

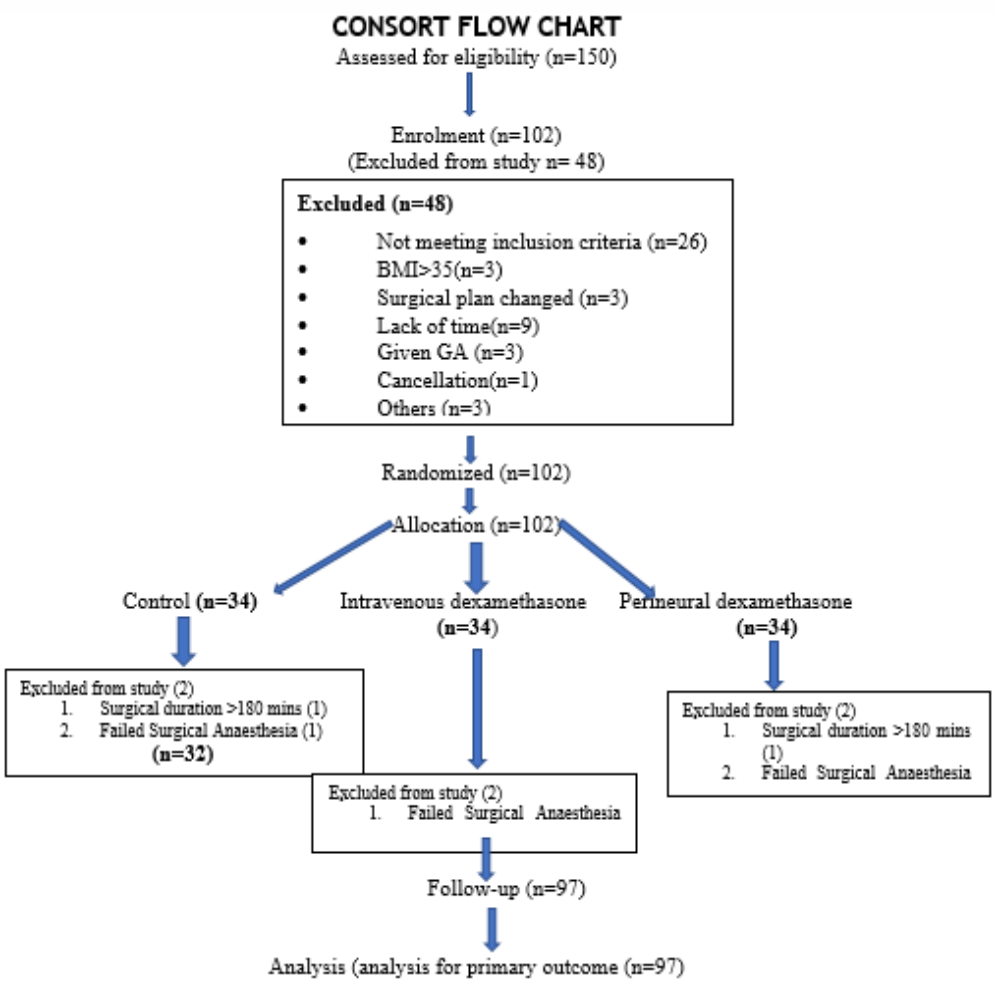
Cumulative score of 14 and above in 30 minutes is considered as block success. Score less than 14 was recorded as block failure and will be excluded from analysis. Duration of analgesia was the time between sensory onset and time when patient feels pain, Duration of motor block was time between motor onset and time when patient flexes and extends the elbow and wrist with normal power. All the ninety-seven patients received oral paracetamol 500mg every six hours as baseline postoperative analgesic for 24 hours, Inj. Tramadol 100 mg was given intramuscularly if Visual Analogue Scale [VAS] ≥4) during the postoperative period. The pain scores were explained to participants. The cumulative requirement of opioid during first 24 hours was recorded in number (shots) of intramuscular injections. Other complications if any were recorded.

Statistical analyses:

Shapiro- wilk test was also conducted to assess normal distribution. For normally distributed the quantitative parameters the mean values were compared between study groups using ANOVA (>2 groups). Categorical outcomes were compared between study groups using Chi square test. (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). A p value of less than 0.05 was considered significant. An intention to treat analyses was not significant as less than 5 % participants dropped out of the study after randomization.

RESULTS:

Ninety-seven patients completed the study (see consort flow diagram)



The variables like mean age, weight, duration of surgery were similar between the groups.

Table 5 showing demographic data

	Group A	Group B	Group C	P values Avs B	P values A Vs C	P values BA Vs C
Age (years) Mean ± SD	42.76± 11.62	43.68± 11.62	42.32± 13.63	0.761	0.88	0.652
Weight (kg) Mean ± SD	67.09± 5.28	66.97± 4.86	67.1 ± 5.1	0.924	1	0.924
BMI Mean ± SD	25.64 ± 1.58	25.49 ± 1.63	25.45 ± 1.61	0.698	0.615	0.908
Duration – surgery (Minutes) Mean ± SD	156.09 ± 18.01	154.42 ± 17.19	153.12 ± 17.08	0.7	0.9	0.5

The differences between onset, duration of sensory and motor blocks are tabled below.

Table 6 showing outcome variables and differences with p values

	Group A	Group B	Group C	P values A Vs B	P values B A vs C	P values B Vs C
Onset sensory(min) Mean ± SD	17.06 ± 2.08	12.15 ± 2.81	12.64 ± 2.22	**0.001**	**0.001**	0.413
Duration – sensory (min) Mean ± SD	414.61 ± 70.71	857.67 ± 82.64	838.03 ± 113.91	< **0.001**	< **0.001**	0.34
Onset motor(min) Mean ± SD	17.61 ± 3.58	14.42 ± 3.51	15.06 ± 2.61	< **0.001**	**0.002**	0.429
Duration – motor (min) Mean ± SD	364.02±115.1	716.36 ± 106.38	660 ± 137.31	< **0.001**	< **0.001**	0.06

The onset of sensory and motor effects was significantly less with the addition of dexamethasone either locally(perineural) or with systemic use than the control group with saline alone. There was no difference between the groups which used dexamethasone (either perineural or systemic) The mean 24-hour analgesic shots used in 24 hours was 2.16 ± 0.73 in group A, it was 0.27 ± 0.45 in group B and it was 0.48 ± 0.62 in group C. The mean difference of 24 analgesics used in 24 hours (1.89) in AVs B was statistically significant (P value <0.001), in A Vs C (1.67) was statistically significant (P value <0.001) and in B Vs C (0.21) was statistically not significant (P value 0.161). The side effects were around 10 % and spread over all the groups.

Table 7 with incidence of complications.

Complications	**Frequency**	**Percentages**
Nausea	4	4.1%
Shivering	4	4.1%
Vomiting	1	1.0%
No Complications	88	90.7%

DISCUSSION:

Supraclavicular approach to brachial plexus is one of the commonly used techniques to effectively block all the component nerves without much difficulty in visualising or problem of spared nerves[6,7,] There are innumerable indications other than breast and upper limb surgeries to administer the block[8,9] The addition of perineural dexamethasone to local anesthetic solutions significantly reduced postoperative pain in brachial plexus block patients without rising risks. On the other hand, Perineural adjuvant dexamethasone, delayed the onset of sensory and motor block and prolonged the duration of motor block. Dexamethasone doses as low as 4 to 5 mg were as effective as higher doses (8 - 10 mg) [10] but our results slightly differed in the onset also. Another study[11] concluded that intravenous and perineural dexamethasone both prolong the duration of analgesia in supraclavicular block. Perineural dexamethasone, on the other hand, caused earlier onset of motor and sensory blockade. This differs from our results that we had earlier onset even with systemic dexamethasone. In a standard single-injection supraclavicular brachial plexus block with long-acting local anaesthetic, intravenous dexamethasone appears to be as efficacious as perineural dexamethasone in extending the duration of analgesia. Our results coincide with Abdallah et al[12] in that the addition of dexamethasone either systemic or perineural prolongs duration

in a similar way. On the contrary Veena et [13]al have described that perineural dexamethasone with Levobupivacaine was superior to intravenous dexamethasone which goes against our findings. When used in conjunction with brachial plexus blocks[14], perineural dexamethasone enhances postoperative pain outcomes. There were no reports of long-term nerve damage caused by perineural administration of the drug. This fact was not studied in our work regarding long term follow up of patients and nerve injuries. Perineural dexamethasone[15], when compared to intravenous dexamethasone, increased the average interscalene block duration by a minor fraction that might or might not be clinically relevant, regardless of dose. However, regardless of administration route, the difference in mean block durations between 8 mg and 4 mg of dexamethasone was highly unlikely to be clinically significant. But we had both shortened onset and increased duration of both sensory and motor blocks with minimal side effects. The increased rescue analgesic need was also similar to other findings. The limitations of the study were 1. Ours is a smaller single centre study 2. We did not differentiate the types of nociception.3. we did not vary the dosage of the steroid.

CONCLUSION:

To summarise, systemic dexamethasone had a similar effect on the onset and duration of sensory and motor action in supraclavicular brachial plexus blocks as perineural dexamethasone. Dexamethasone, both systemic and perineural, reduces cumulative postoperative analgesic usage in the first 24 hours. Either of the two techniques outperformed the control group, which received only normal saline. There were no negative side effects.

Conflict of interest – NIL for all authors

Ethical issues – approval – Yes

Patient consent – Yes

Contributions: MA and MR designed the study, MP data collection, GS statistical analyses, SPS manuscript preparation and communication

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