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Comparison of effect of addition of dexamethasone to bupivacaine for supraclavicular brachial plexus block, on incidence and duration of radial nerve palsy due to surgical manipulation and recovery period, in patients posted for middle and lower end fracture humerus

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Abstract

Objective: To compare the effect of addition of dexamethasone to Bupivacaine, on incidence and duration of radial nerve palsy due to surgical manipulation and recovery period, for supraclavicular brachial plexus block in patient scheduled for middle and lower end fracture humerus surgery.

Methodology: Present study is going to be a prospective randomized double blind study, to be conducted on 120 patients, (60 cases and 60 control groups), of ASA grade I and II, aged between 18 to 60 years, with no history of hypersensitivity to local anesthetics, no bleeding disorders, with no pre-existing peripheral neuropathy, also excluding pregnant and lactating women, which will be scheduled for upper limb surgery of fracture humerus of middle and lower end and will be divided into two Group of 60 each. Group D1 recieves LA 0.5% bupivacaine 12 ml plus lignocaine adrenaline 12 ml plus dexamethasone 0.1mg/kg diluted with normal saline up to 6ml total volume 30 ml and group D2 recieves LA 0.5% bupivacaine 12 ml plus lignocaine adrenaline 12 ml plus diluted with normal saline up to 6ml total volume 30 ml. Intra op monitoring will be done for the onset and duration of sensory and motor block, duration of analgesia, hemodynamic parameters, post op. monitoring will be done for the duration of sensory and motor block and any incidence of radial nerve palsy and follow up for recovery period. (Randomization will be done by computer generated slips randomly given to the patients selected for study. Either patients nor doctor know who is receiving what treatment.)

Result: Onset time of sensory and motor block were earlier and duration of analgesia were longer in Group D2 than in GroupD1 ($p<0.001$) and also found reduction in number of rescue analgesic doses consumption in 24 hours in GroupD2 than in GroupD1, incidence of radial nerve palsy was significantly reduced in Group D2($P<0.001$) after surgical manipulation.

Keywords: dexamethasone, supraclavicular brachial plexus block, analgesia

Introduction

Patients undergoing orthopedic surgery often report postoperative pain that is intense and difficult to control. Adequate postoperative pain relief is one of the most important factor for a favorable surgical outcome. Keeping these concerns in focus and based on patient characteristics, the anesthesiologist can choose from a range of anesthesia techniques such as local, neuraxial (spinal or epidural) or general anesthesia. The supraclavicular brachial plexus block is one of the most commonly performed upper limb brachial plexus block to provide anesthesia below the mid arm surgeries. Various studies have investigated the role of novel analgesic adjunct to brachial plexus block for post-operative analgesia, the goal of which is to reduce the onset time, prolong the analgesic effect without the disadvantage of systemic side effects or prolonged motor blockade and also allow for the reduction in the total dose of local anesthetic. The search for the ideal additive continues, and led us to the novel dexamethasone which has analgesic, perioperative cardiovascular stabilizing effects and reduction in anesthetic requirements.

Material and Methods

The study was conducted in department of anesthesiology of VCSGGIMS&R hospital uttrakhand on 120 patients of American Society of Anesthesiologist (ASA) Grade I and II, patients of either sex aged 18- 60 years, undergoing lower end and mid arm fracture humerus orthopaedic surgeries in supraclavicular brachial plexus block. The patients were divided in two groups of 60 patients each and randomly assigned using computer generated random numbers to one of thefollowing groups:

Group D1: Bupivacaine 0.5% (12 cc) + Lignocaine ADR (12cc) diluted in 6cc normal saline, total volume 30cc.

Group D2: Bupivacaine 0.5% (12cc) + Lignocaine ADR (12cc) + dexamethasone 1µg/kg diluted in 6cc normal saline, total volume 30cc.

Both, patient & investigator performing the study and observing the result were blinded to the test drug by giving serial numbers to the patients and serial numbers were decoded in the end. All the observations were made by the same observer.

Inclusion criteria
- Patients of either sex, aged between 18-60 years
- Patients with ASA grade I and II physical status
- lower end and mid arm fracture humerus surgeries

Exclusion criteria
- History of hypersensitivity to local anesthetic drugs
- Patients steroid therapy
- Bleeding disorders
- Pregnant and lactating women
- Pre- existing peripheral neuropathy
- History of significant systemic disease

All patients were premedicated with tablet alprazolam 0.5 mg orally a night before surgery.

Investigations
Hb, bleeding time, clotting time, serum urea and creatinine, blood sugar, ECG and chest X-ray posteroanterior view depending on age and associated comorbidities.

Resuscitation equipment
The anesthesia machine, emergency oxygen source pipe line oxygen supply, working laryngoscope appropriate size endotracheal tubes and connectors, working suction apparatus with a suction catheter, or pharyngeal airways, iv fluids, anesthetic agents and resuscitation drugs were checked and kept ready.

Procedure
On operation table, after patient's identification, monitor was attached and oxygen saturation (SpO_2), noninvasive blood pressure, respiratory rate and ECG were recorded. Intravenous line was started with ringer lactate and midazolam 0.02mg/kg was given intravenously, before procedure. Starting time of procedure was recorded and then depending upon the group, block was carried out and end point of procedure was noted.
The patient was kept supine with head slightly elevated away from the site to be blocked. Part was prepared for the block to be performed with iodine solution. A sonoscape Micromax-HFL linear probe was used for conducting the block in every case. The probe was then placed in the coronal oblique plane in the supraclavicular fossa. The subclavian artery, vein, and the brachial plexus were visualized. The brachial plexus and the surrounding structures were scanned and plexus was identified super lateral to the subclavian artery.
Skin was anesthetized at the proposed site of entry with 1% lignocaine (1-2mL) and a 20G, 50 mm needle was connected to a 10cm extension line and primed with the drug. Once the needle reached the plexus, after negative aspiration, drug was injected and the spread of the drug was observed.
Sensory block was assessed by the pin prick method. Assessment of sensory block was done at every minute after completion of drug injection in the dermatomes corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous nerve till complete sensory blockade. Sensory onset was considered when there was a dull sensation to pin prick along the distribution of any of the above-mentioned nerves.
Sensory block was graded as
Grade 0: Sharp pin prick felt
Grade 1: Analgesia and dull sensation felt
Grade 2: Anesthesia and no sensation felt.

Assessment of motor block was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when Grade 1 motor blockade was achieved. Motor blockade was determined as per modified Bromage scale for upper extremities on a 3-point scale [5].
Motor block was graded as:
Grade 0: Normal motor function with full flexion and extension of forearm, wrist and fingers
Grade 1: Decreased motor strength with ability to move the fingers only
Grade 2: Complete motor block with inability to move the fingers

The block was considered incomplete/partial when any of the segments supplied by median, radial, ulnar and musculocutaneous nerve was not having analgesia even after 30 min of drug injection. These patients were supplemented with intravenous fentanyl (1µg/ kg) and midazolam (0.02 mg/kg). When more than one nerve remains unaffected, it was considered a failed block. In this case, general anesthesia was given in traoperatively and patient was excluded from the study. Patients were monitored for hemodynamic variables such as heart rate, blood pressure and oxygen saturation every 5 min after the block for 30 min then every 15 min till surgery ended. Sedation of patients was assessed by the Ramsay Sedation Score. At the end of the procedure, quality of operative conditions were assessed according to the following numeric scale: Grade 4: (Excellent) No complaints by patient Grade 3: (Good) Minor complaint with no need for the supplemental analgesics
Grade 2: (Moderate) Complaint that required supplemental analgesia
Grade 1: (Unsuccessful) Patient given general anesthesia Assessment of blood loss was done and fluids were administered as per the loss. The intra- and post-operative assessment was done by an anesthesiologist who was unaware of the drug used.

All patients were observed for any side-effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma, local anesthetic toxicity and post-block neuropathy in the intra-operative and post operative periods. The duration of sensory block was defined as the time interval between onset of the sensory block and the complete resolution of anesthesia on all nerves. The duration of motor block was defined as the time interval between the onset of motor block and the complete recovery of motor function of the hand and forearm.
Duration of analgesia was observed i.e. time between end of drug administration in the brachial block and first rescue analgesic dose administered. Post-operative pain was assessed by visual analogue scale which ranges from 1-10. Patients were assessed for duration of analgesia till the score of 5 on visual analogue scale. The rescue analgesia was given in the form of inj. diclofenac sodium (1.5 mg/kg) intramuscularly at the visual analogue Scale of 5 and the time of administration was noted. The data obtained was tabulated and statistically analyzed using Chi-Square test, student t test was applied and the results thus obtained were

presented in the light of statistical and clinical significance.

Observations

The present study was conducted in a double blind randomized controlled manner on 120 patients of both the sexes belonging to ASA grade I and II, between the age group of 18-60 years undergoing midarm and lower end fracture humerus orthopaedic surgery under supraclavicular brachial plexus block. Patients were randomly divided into two groups: GroupD1 and GroupD2. Mean age (in years) in groupD1 was 37.66 ±10.90, and in group D2 was 36.21 ± 11.52. p-Value was 0.631 which was not significant statistically (p-value > 0.05). Mean weight (in Kg) in group D1 was 62.70 ± 7.79, in group D2 was 63.33 ±7.66. p-Value was 0.752 which was not statistically significant (p-value > 0.05). The ratio of male versus female was 18:12 in group D1 and 24:6 in group D2. p-value was 0.573 which was not statistically significant (p-value> 0.05). Both the groups were comparable in age, weight and sex distribution.

Table 1: Baseline Parameters

Parameter	Mean ± S.D		p-value
	Group C	Group D	
HR (bpm)	84.76±14.27	87.68±11.07	0.368
MAP (mmHg)	93.33±8.15	93.16±7.52	0.432
SpO2	95.96±1.94	95.56±1.91	0.698

Baseline mean HR(beats per minute) and mean arterial pressure(mmHg) in group D1 and D2 was 84.76±14.27, 87.68± 11.07 and 93.33±8.15, 93.16±7.52 respectively which was not statistically significant (p-value >0.05). Similarly baselines mean SpO2 in both groups was 95.96±1.94 and 95.56±1.91 respectively which was statistically insignificant (p-value >0.05). The baseline parameters were found to be comparable and the differences were statistically insignificant (p-value > 0.05). (Table 1) There was also no statistically significant difference between the vital signs (HR, NIBP and SpO2) in both the groups intraoperatively.

Table 2: Comparison of blockade and analgesia between two groups

Variables	GroupD1	GroupD2	p-Value
Onset of sensory block (min)	3.44±0.68	2.20±0.75	<0.0001
Onset of motor block (min)	7.40±0.87	5.75±1.21	<0.001
Duration of sensory block (min)	766.96±29.0	899.50±30.15	<0.001
Duration of motor block (min)	800.29±28.63	1003.17±37.40	<0.001
Duration of analgesia (min)	870.73±32.22	1050.62±43.84	<0.001

The onset of sensory and motor blockade was earlier and duration of analgesia and sensory motor blockade was longer in Group D2 as compared to Group D1 (statistically highly significant, p < 0.001) as shown in table 2.

Table 3

Group	Grade 1	Grade 2	Grade 3	Grade 4
D1	0	0	19	11
D2	0	0	16	14

Table 4: Block quality grade

Group	Block quality grade	p- value
Group D1	3.40 ± 0.50	0.78
Group D2	3.47 ± 0.50	

The grade of block quality was 3.40±0.50 in group D1 and 3.47±0.51 in group D2 in a scale of grade 1 to 4 where grade 4 was complete analgesia and no complaint intraoperatively. The difference in two study groups was found to be statistically insignificant. (Table III)

Table 5: Comparison of rescue analgesia between two groups

	Groups	N	Mean	SD	P-Value
Rescue analgesia (No. of diclofenac inj.)	D1	30	2.10	0.583	<0.0001
	D2	30	1.45	0.465	

Injection diclofenac aqueous solution in dose of 1.5mg/kg was given IV for rescue analgesia till 24 hours from the start of surgery. Total number of diclofenac injections were recorded. The mean value of injection diclofenac used for first 24 hours post-operatively was 2.10±.583 injections in group D1 and 1.45±.465 injections in group D2. (Table IV) Patients of groupD2 had significant prolongation of post operative analgesia and their demand of rescue analgesia was also less compared to groupD2 and these values were found to be statistically significant with p value of <0.0001.

Table 6: Comparison of Side Effects between two groups

Side effects	GroupD1	GroupD2
Nausea/vomiting	1(3.3%)	1(3.3%)
Dryness of mouth	nil	nil
Hematoma	nil	nil
Pneumothorax	nil	nil
LA toxicity	nil	nil

Table 7: Radial nerve palsy incidence

Duration	24 Hour	48 Hour	72 Hour	4 Days	5 Days	6 Days	1 Week	2 Week	3 Week	4 Week	5 Week	6 Week	7 Week	8 Week	P-Value
D1	26	24	24	24	21	21	20	20	20	16	15	11	11	11	<0.0001
D2	18	17	12	12	10	10	04	03	02	02	02	02	02	02	

Discussion

In our prospective randomized, double blinded comparative study demonstrate that adding 1 µg/kg dexamethasone to 0.5% Bupivacaine and lignocaine adrenaline fasten the onset of sensory and motor block and prolonged the duration of postoperative analgesia in supraclavicular block and reduce the incidence of radial nerve palsy due to surgical manipulation.

There was no significant change in hemodynamic parameters throughout the study period with both the doses. With the use of dexamethasone as adjuvant to Bupivacaine and lignocaine adr causes faster onset of action of LA, rapid onset of both sensory and motor blockade, prolonged postoperative analgesia. Both of these drugs have been widely used by several researchers for brachial plexus block in different doses with different local anesthetic agents. We found that onset of sensory and motor block was earlier in Group D2 than in Group D1 and the difference was statistically significant (p < 0.001). We also found that none of studies were done of dexamethasone as adjunct to

bupivacaine and lignocaine adrenaline in brachial plexus block for avoiding radial nerve palsy due to surgical manipulation in past. In present study adding dexamethasone resulted in faster onset of sensory and motor blockade were comparable to other studies. Duration of sensory and motor block and analgesia were more prolonged in GroupD2 as compared to GroupD1 ($p < 0.001$) which were highly significant, also consumption of rescue analgesic is reduced. These results were comparable with other studies [11-13].

Both groups showed hemodynamic stability, with maximum fall of mean HR 6.7% at 20 min in Group D1 and 10% at 30 min in GroupD2 which were comparable. These results were consistent with other studies [13, 14].

In our study we observed fall in saturation in both groups which was easily managed by administering oxygen via mask at 4-5 L/min and we observed no significant episodes of hypoxemia like earlier studies [14].

So keeping the results of present study in view, we recommend that dexamethasone in a dose of 1 µg/kg can be safely and effectively used as an adjuvant in brachial plexus block for reducing the incidence of radial nerve palsy in post op cases due to surgical manipulation in fracture humerus surgeries.

Conclusion

Addition of dexamethasone (1µg/kg) with 0.5% bupivacaine and lignocaine adrenaline 2% in brachial plexus block resulted in faster onset, prolonged duration of sensorimotor blockade and provided prolonged analgesia in postoperative period with less hemodynamic alterations, with reduced incidence of radial nerve palsy due to surgical manipulation in lower end and mid arm fracture humerus surgeries when compared with 0.5% bupivacaine and lignocaine adrenaline 2%.

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