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Comparison of Use of Levobupivacaine with Dexamethasone versus Plain Levobupivacaine in Supraclavicular Brachial Plexus Block for Forearm and Hand Surgeries: A Randomised Control - Double Blinded Study

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Abstract: ***Introduction: Supraclavicular brachial plexus block provide important advantages including excellent pain control, reduced side effect and shortened stay in the post anaesthesia care unit. This study was aimed to compare anesthetic characteristics along with side effects of levobupivacaine and levobupivacaine with dexamethasone in supraclavicular block. Methodology: Sixty patients of ASA I and II scheduled to undergo elective upper limb surgery were randomly divided into two groups, Group A (n=30) patients received Inj. Levobupivacaine 0.5% 20ml + Inj. Normal saline 2ml and Group B (n=30) patients received Inj. Levobupivacaine 0.5% 20ml + Inj. Dexamethasone (8mg) 2ml in supraclavicular block. Anaesthetic characteristics, vitals and side effects were observed intraoperatively and 20hr postoperatively. Results: The onset of sensory and motor block for group B is faster and duration of sensory and motor block is prolonged when compared with group A. The time for duration of analgesia is 642.73 ± 54.09 (min) in group A and 898.37 ± 92.98 (min) in group B. (p<0.001) Thus, duration of analgesia is significantly prolonged in group B when compared with group A. Conclusion: In supraclavicular block total duration of analgesia can be prolonged by addition of dexamethasone to levobupivacaine without increasing significant complications.***

Keywords: supraclavicular block, levobupivacaine, dexamethasone, duration of analgesia

1. Introduction

Peripheral nerve block as an anaesthetic technique plays an important role in modern regional anaesthesia and an integral part of comprehensive anaesthetic care. Most important prerequisites for use of peripheral regional anaesthesia in daily clinical practice are success rate and safety. Regional anaesthesia techniques provide important advantages including excellent pain control, reduced side effect and shortened stay in the post anaesthesia care unit. (1) Supraclavicular approach for brachial plexus block was first described by Kulenkampff in1911, the most commonly used regional anaesthetic technique to provide surgical anaesthesia for upper extremity surgeries because of compact arrangement of the nerve trunks, (2) this does not only provide intra operative anaesthesia but also extend analgesia in the post operative period without major systemic side effects by minimizing stress response and using minimal anaesthetic drug.

Local anesthetic is a drug that causes reversible local anesthesia and a loss of nociception. When it is used on specific nerve pathways (nerve block) then its effects such as analgesia (loss of pain sensation) and paralysis (loss of muscle power) can be achieved. All side effects of bupivacaine overcome by Levobupivacaine which is a long - acting, a pure S - enantiomer of bupivacaine. Hence, various adjuvants such as opioids, clonidine, neostigmine and midazolam, were added to local anaesthetic in brachial plexus block to achieve quick dense and prolonged block but results are either inconclusive or associated with side effects.

Use of steroid as an adjuvant to local anaesthetic drug in brachial plexus block is gaining popularity. Recently, dexamethasone has been studied as an adjuvant to local anaesthetic in peripheral nerve block (3). Steroids have prolonging effects of nerve block by blocking transmission of nociceptive myelinated c - fibers and suppressing ectopic neuronal discharge. They are also thought to alter the function of potassium channels in the excitable cells. Thus,

dexamethasone is selected as an adjuvant to local anaesthetic (levobupivacaine) in this study because it has been reported to prolong duration of action of local anaesthetics with no respiratory depression [4]

This study was aimed to compare anasthestic characteristics, hemodynamic pareameters and associated side effects among levobupivacaine and levobupivacaine with dexamethasone in supraclavicular brachial plexus block for forearm and hand surgeries

2. Materials and Methods

After ethical committee approval and written informed consent from patients and/or attendant. The present study was carried out in 60 orthopaedic patients of American Society of Anaesthesiologist (ASA) grade I and II, between the age of 20 - 60 years, undergoing upper limb surgeries under supraclavicular brachial plexus block in department of anaesthesia in Jhalawar medical college and SRG hospital Jhalawar. Equipments required - Nerve stimulator, 20 ml syringe, Oxygen mask, iv canula, Drip set, NIBP, Pulse oximeter, Drug Levobupivacaine, Dexmamethasone etc. Emergency drugs were kept ready as a protocol & emergency instruments like laryngoscope, Bain's circuit, Suction and ET tube etc.

All patients in this study were subjected to detailed pre anaesthetic evaluation which include: - Present complaints, drug history, past history and hypersensitivity history, any major medical illness and drug history. Previous history of operation and complication occurred. Complete general physical examination, systemic examination and ASA grading were done. All investigations of patients were checked. Routine investigations were done like Hb, BT, CT, urine analysis, LFT, ECG, Chest X - ray and other laboratory investigations done as a protocol of the required procedure. Emergency cases, pregnant or lactating females, patients with known hypersensitivity or contra - indications to study drugs, patients on anti coagulants or with bleeding disorders, patient refusal for block, local infection at injection site, patients having cardio respiratory dysfunction or renal, hepatic or metabolic derangements or history of epilepsy were excluded from this study.

Patients posted for surgery were kept overnight fasting after midnight. Patient's written informed consent and PAC checked. All patients were premedicated with 150mg ranitidine and 8mg ondansetron orally on the morning of surgery. Before the procedure, visual analogue scale (VAS) on 0 - 10 cm was explained to the patient for the assessment of pain where 0 denotes no pain and 10 denotes worst pain. Intravenous access obtained on opposite upper limb. Baseline vital parameter documented. Patient was given i. v. midazolam 1mg and fentany l 0. . . .5µg/kg prior to block.

Inside the operating room patient was given position for brachial plexus block via supraclavicular approach. Supine position with head resting on ring, ipsilateral arm abducted, shoulder depressed and roller pack placed in between scapula and head turned slightly to contralateral side. Under all aseptic precaution, local site was prepared. Subclavian artery palpated 1 to 1.5 cm. above midclavicular point and push medially by thumb. An insulated needle (23G, 5 cm) was directed posteriorly, caudally and toward the axilla. A Peripheral nerve stimulator was used to locate the brachial plexus. When the desired response obtained that was a muscle twitch of fingers that will be clearly visible, the Current strength of nerve stimulator was reduced up to 0.6mA. If the desired response was persisted at 0.6 mA, the drug solution injected. If there was no adequate response, the needle was moved anteriorly or posteriorly along the first rib to elicit a response. Following the injection, the area was massaged to help the solution to dissipate along the plexus. Monitoring of vital parameters like pulse, BP and oxygen saturation were done throughout procedure and were recorded at preoperative before block, Intraoperative after block and Postoperatively till 20 hour.

Assessment of sensory and motor block with analgesia - Sensory block was assessed by a 3 - point scale: - 0 - normal sensation (feeling of pain), 1 - loss of sensation of pinprick (analgesia), 2 - loss of sensation of touch (anesthesia). Onset of time and duration of sensory block was recorded. Motor blockade was assessed by Modified Bromage Scale (MBS) for the upper limb surgery. Motor block was assessed at each 1 minute till complete motor blockade after drug injection**.** Pain was assessed using a standard 10 cm Visual Analog Scale (VAS). The duration of analgesia or first request for analgesic duration of analgesia defined as the time from loss of sensation of pinprick to attain a Visual Analogue Score (VAS) of 3 or >3/complain of pain/demand of analgesic drug.

Intraoperative heart rate, systolic, diastolic pressures, sensory and motor block scores, and the VAS scores were noted every 5 min during the first 15 min, then every 30 min throughout the surgery and hourly thereafter till complete recovery of the block. Time for the first request of postoperative analgesic when VAS >3 (duration of analgesia) were noted and rescue analgesic intramuscular tramadol, 50 mg was given. All patients were observed for any side - effects like nausea, vomiting, dryness of mouth and complications like pneumothorax, hematoma & levobupivacaine toxicity and treated with appropriate measures

Statistical analysis

The obtained data were tabulated and analyzed using unpaired student T - test. Results were expressed as mean + standard deviation. T - test was applied for onset and duration of sensory and motor blockade and duration of analgesia, and hemodynamic parameters. SPSS software was used for statistical analysis of observed parameters. P value <0.05 was considered statistically significant. P value >0.05 was considered statistically insignificant.

3. Observation and Results

Table 1: Demographic Variables

Parameters	Group A (n - 30)	Group B (n - 30)	P value
Age in years (mean±SD)	35.83±10.83	34.26±10.52	1.000
Weight in kg (mean±SD)	63.46±9.73	64.23±7.60	0.734
SEX (M: F)	23: 07	22: 08	0.729
ASA (I: II)	24: 06	25: 05	0.784

All demographic parameters like age, sex, weight and ASA were comparable and observed statistically non significant. (p>0.05)

Table 2: Anasthetic characteristic

	Group A (n - 30)		Group B (n - 30)		Results (P value)
	Mean	SD	Mean	SD	
Onset of Sensory block (min)	6.90	1.21	5.66	1.12	p<0.05 (S)
Onset of Motor block (min)	10.56	1.81	8.73	1.66	p<0.05 (S)
Duration of sensory Block (min)	442.63	49.71	605.27	65.85	p<0.05 (S)
Duration of motor Block (min)	400.33	45.18	536.80	60.15	p<0.05 (S)
Duration of analgesia (mins)	642.73	54.09	898.37	92.98	p<0.001 (HS)

S = Significant; NS = Non Significant

The mean onset of sensory and motor block along with standard deviation is depicted in the table. The mean onset of sensory block for Group A was 6.9 ± 1.21 (min) and for Group B was 5.66 ± 1.12 (min). The mean onset of motor block for Group B was 10.56± 1.81 (min) and for Group B was 8.73 ± 1.66 (min) and the difference was found to be statistically significant for both. The mean duration of sensory block was 442.63 ± 49.71 mins in Group A and 605.27± 65.85 mins Group B. The mean duration of motor block was 400.33 ± 45.18 mins in Group A and 536.80± 60.15 mins in Group B, the p value being < 0.05. Thus the total duration of sensory and motor block was significantly prolonged in group B compared to group A. The time for the demand of first dose of rescue analgesia is 642.73 ± 54.09 in group A and 898.37 ± 92.98 in group B, the p value being < 0.001 (Highly significant). Thus, time for the demand of rescue analgesia (Duration of Analgesia) is significantly prolonged in group B when compared with A.

Intraoperative Heart Rate (beats/min)

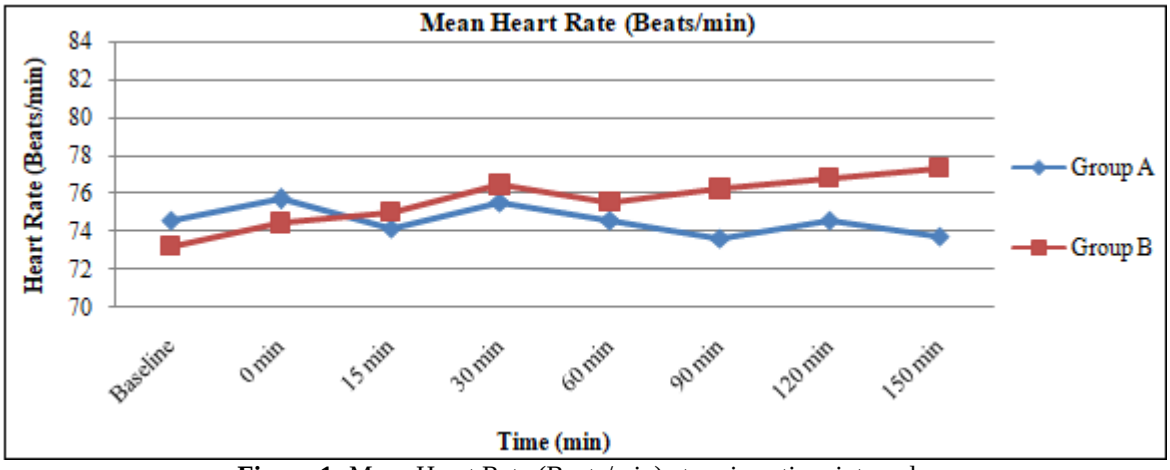

Figure 1: Mean Heart Rate (Beats/min) at various time intervals

Figure 01 shows intraoperative mean heart rate with standard deviation at various intervals during surgery and was found to be statistically non - significant. (p>0.05)

VAS Score

Table 3: VAS Score

Time interval	Group A		Group B	
	Mean	SD	Mean	SD
Pre block	5.10	0.71	5.03	0.80
0 min	3.53	0.57	2.87	0.57
15 min	1.73	0.45	1.06	0.58
30min	0.70	0.53	0.23	0.43
60min	0.57	0.50	0.23	0.43
90min	0.70	0.47	0.23	0.43
120min	1.00	0.53	0.23	0.43
150min	1.30	0.47	0.23	0.43
180min	1.67	0.48	0.43	0.50
240min	1.80	0.41	1.03	0.55
300min	1.83	0.38	1.40	0.56
360min	1.87	0.35	1.57	0.50
480min	1.93	0.25	1.67	0.47
600min	2.13	0.35	1.77	0.43
780min	3.23	0.43	1.93	0.25
960 min	3.93	0.52	2.47	0.51
1200 min	4.10	0.40	3.90	0.75

As shown in table 03, Pre - block VAS score in A & B group was 5.10±0.71 & 5.03±0.80 respectively. Maximum reduction of mean VAS score in B group occurred at 15 min which was 0.23±0.43 while in A group; maximum reduction occurred at 60 min which was 0.57±0.50.

Intergroup comparison, basal VAS score was similar in both groups but after administration of block decrease in VAS score was more in group A as compared to group B. The VAS score remained significantly at low level (<3) in group B as compared to group A till 960 min after the block & difference was statistically significance (P<0.05) while in group A VAS <3 was at 600 min which represent the duration of Analgesia as 960 min in group B and 600 min in group A. At 1200 min (20 hrs) mean VAS score in B group was 3.90 min which was less than in comparison to A group which was 4.10 min but difference was not significant (P>0 - 05)

Table 4: Complications & side effects

Complication & side effects	Group A (n=30)		Group B (n=30)	
	No	%	No	%
Blood on aspiration	1	3.3	1	3.3
Hematoma	1	3.3	0	0
Horner syndrome	0	0	0	0
Bradycardia	0	0	0	0
Hypotension	0	0	0	0
Allergic reaction	0	0	0	0
Pneumothorax	0	0	0	0
Phrenic nerve palsy	0	0	0	0
Nausea & vomiting	0	0	0	0

Table no 04 shows that there were no significant side effects during the study period. In group A 01 patients developed haematoma and only 1 patient developed blood in aspiration due to arterial puncture. In group B 01 patient developed blood in aspiration. No significant bradycadia and hypotension had been seen among both groups.

4. Discussion

This study was prospective randomized, double blinded and controlled. Sixty patients were divided into 2 equal groups, in Group A 30 patients were given 30 ml of 0.5% levobupivacaine with 2ml dexamethasone (8 mg) and in Group B 30 patients were given 30 ml levobupivacaine and 2ml of normal saline. Supraclavicular brachial plexus block is an excellent alternative and offers several perioperative advantages over general anaesthesia like stress response is reduced, less blood loss, provides superior surgical conditions, provides optimal postoperative analgesia and reduces the incidence of postoperative nausea and vomiting, provides early ambulation and reduced length of hospital stay which leads to improved patient acceptance and improved clinical outcomes.

Using lower volume of local anaesthetic may produce either shorter duration of block or incomplete block. Therefore Performing supraclavicular block via paraesthesia technique, we use large volume 30 ml of local anaesthetics to improve success rates and prolong sensory and motor block. To improve block characteristics and prolong the duration of postoperative analgesia, many adjuvants are added to local anaesthetics in peripheral nerve blocks. Authors like **Dr Sridhar N. V et al (2009) [5], Hanumansetty K et al (2017) [6], Pani N et al (2017) [7]** are few studies and have reported on steroids such as dexamethasone when used as adjuvants have prolonged the duration of postoperative analgesia.

In our study as shown in table no 02 we demonstrated that the addition of dexamethasone to 0.5% isobaric levobupivacaine in supraclavicular brachial plexus block had faster onset of sensory and motor blockade. The mean onset of sensory and motor block along with standard deviation is depicted in the table. and the difference was found to be statistically significant. (p<0.001) Our results are similar to study conducted by **Baloda et al (2016) [8]** and they also concluded that addition of dexamethasone to levobupivacaine significantly shortened the onset of sensory and motor block. (p<0.001)

In our study, the mean duration of sensory and motor block was significantly higher in group B than group A (p value <0.001) Thus, the total duration of sensory and motor block was significantly prolonged in group B compared to group A. Our results were similar to study conducted by **Persec J et al (2014) [9], Hanumansetty K et al (2017) [6] and Pani N et al (2017) [7]** studies, they evaluated the effect of dexamethasone added to local anaesthetic mixture and concluded that duration of sensory and motor blockade was significantly longer in the dexamethasone group. This could be due to that steroids have prolonging effects of nerve block by blocking transmission of nociceptive myelinated c - fibers and suppressing ectopic neuronal discharge. They also thought to alter the function of potassium channels in the excitable cells.

In our study Duration of Analgesia prolonged in group B (898.37 ± 92.98 mins) than in group A (642.73 ± 54.09 mins) and this difference was statistically highly significant (p<0.001). Rescue analgesia was demanded when pain started which indicates the duration of analgesia. Our results also coincide with study by **Pani N et al (2017) [7]** observed time for request of the first rescue analgesia was 396.13 ± 109.42 min in Group S and 705.80 ± 121.46 min in Group D (P < 0.001). Similar results of prolonged duration of analgesia with addition of dexamethasone in brachial plexus block was found by **Hanumansetty K et al (2017) [6], Persec J et al (2014) [9]**

5. Conclusion

From this study we conclude that, levobupivacaine 0.5% with dexamethasone (8mg) when compared to levobupivacaine 0.5% alone in supraclavicular brachial plexus block prolongs total duration of analgesia with faster onset and duration of sensory and motor block significantly, without increasing the side effects.

6. Future Scope

Future study can be done with USG guided block. there is the possibilities of further study of pharmacodynamics of levobupivacaine with other adjuvant.

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