A Prospective Study of the Efficacy of Clonidine added to Bupivacaine as Compared with Bupivacaine alone used in Supraclavicular Brachial Plexus Block for Upper Limb Surgeries

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ABSTRACT

Introduction: Relief of pain during and after the surgery forms the pivot in conduction of anaesthesia. The aim of our study was to compare the effect of a randomized controlled double-blind prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries.

Material and Methods: The present study was conducted at Gandhi Hospital, Secunderabad. The study protocol was placed for review and approval of the institutional ethical committee. A written informed consent was obtained from every subject before initiation of any related procedure. Fifty patients of either sex in age group of 18 – 70 years and ASA status I and II scheduled for upper limb surgery under supraclavicular brachial plexus block were randomized to either. Study Group(S) received 40 ml of 0.25% Bupivacaine + 150 mcg of clonidine, Control Group(C) received 40 ml of 0.25% Bupivacaine + Nacl of 0.9% solutions.

Results: The present study was carried out in 50 patients of ASA grade I/II in two groups for the upper limp surgeries under supravcalvicular brachial plexus block. Twenty five patients were given clonidine as an adjuvant to bupivacaine and twenty five were given bupivacaine alone. The hemodynamic and the analgesic characteristics were recorded and statistically analysed. The following conclusions were drawn from our present study. The time of onset of sensory and motor blockades were fast in clonidine group. The duration of sensory and motor blockades were prolonged with usage of clonidine.

Conclusion: From the above study it is concluded that clonidine is a better adjuvant to bupicaine for supraclavicular brachial plexus block, it provides faster, longer duration of analgesia and sedation with hemodynamic stability.

Keywodds: Clonidine, Bupivacaine, Supraclavicular Brachial Plexus, Upper Limb Surgeries

INTRODUCTION

To alleviate pain we use various techniques like general anaesthesia and regional anaesthesia. Acute postoperative pain is the result of a complex physiological reaction to tissue injury. The dorsal horn of the spinal cord is the site of termination of primary afferents and there is complex interaction between such afferent fibers, intrinsic spinal neurons, descending pain modulating fibers, and various associated neurotransmitters such as serotonin, norepinephrine, acetylcholine, adenosine, and glutamate in the dorsal horn[1]. Regional anaesthesia of upper extremity surgery is close to the ideal match for anaesthetic and surgical procedures, for patients, anaesthesiologists and surgeons. Regional anaesthesia provides a safe technique with the advantage of prolonged post operative pain relief. Brachial plexus block is a very popular mode of anaesthesia for upper limb surgeries. Three methods of approach are there and in it supraclavicular approach is very popular because it offers several advantages over other routes. It has a high success rate and rapid onset of action, compared with axillary approach it provides complete anaesthesia of the plexus as it is carried out at the level of the trunks of brachial plexus and does not require abduction of arm to perform the block[2] The plexus is blocked at the middle of the plexus where it is more compact[3] resulting in homogenous spread of the drug with a faster onset and complete block[4]. The inter-scalene approach is difficult to master with high incidence of intrathecal, epidural or intraarterial injections[5]. In an attempt to improve the onset time, duration of action perioperative and post operative analgesia a variety of opioids, non opioids and local anaesthetics have been administered concomitantly into the brachial plexus sheath. Local anesthetics administered as regional nerve blocks are utilized in providing postoperative pain relief in many surgical procedures by blocking signal traffic to the dorsal horn. Certain drugs may be used as adjuvant to local anesthetics to lower doses of each agent and enhance analgesic efficacy while reducing the incidence of adverse reactions. Tramadol and fentanyl had been successfully used as adjuvants to local anesthetic in brachial plexus block[6]. The concurrent injection of α_2 adrenergic agonist drugs has been suggested to improve the nerve block characteristic of local anesthetic solutions through either local vasoconstriction and facilitation of C fiber blockade or a spinal action caused by slow retrograde axonal transport or simple diffusion along the nerve. Clonidine is a selective α_2 adrenergic agonist with some α_1 agonist property. In clinical studies, the addition of clonidine to local anesthetic solutions

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improved peripheral nerve blocks by reducing the onset time, improving the efficacy of the block during surgery and extending postoperative analgesia. Clonidine possibly enhances or amplifies the sodium channel blockade action of local anesthetics by opening up the potassium channels resulting in membrane hyperpolarization, a state in which the cell is unresponsive to excitatory input. Therefore we proposed this study of a randomized controlled double-blind prospective study of the efficacy of clonidine added to bupivacaine as compared to bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries.

MATERIAL AND METHODS

The present study was conducted at Gandhi Hospital, Secunderabad. The study protocol was placed for review and approval of the institutional ethical committee. A written informed consent was obtained from every subject before initiation of any related procedure. Fifty patients of either sex in age group of 18 – 70 years and ASA status I and II scheduled for upper limb surgery under supraclavicular brachial plexus block were randomized to either.

Study Group(S) received 40 ml of 0.25% Bupivacaine + 150 mcg of clonidine.

Control Group(C) received 40 ml of 0.25% Bupivacaine + Nacl of 0.9% solutions.

Inclusion Criteria: Patients belonging to ASA grades I and II. Patients aged between 18 to 70 years undergoing various surgical procedure under general anaesthesia.

Prerandomisation Exclusion Criteria: Patients belonging to ASA grades other than I and II. Patients of age group below 18 years or more than 70 years. Pregnant patients. Focal neurological deficits, convulsions. Contralateral phrenic nerve palsy. Pneumothorax. Patients who are on beta blockers, adrenoreceptor agonists or antagonists. Patients who are Cardiac, respiratory, hepatic and renal failure states. The subjects were randomized into 1:1 ratio in two groups using computer generated random table. Each subject was given a random number with identification of drug code in an individual sealed envelope indicating the A or B codes for the anesthetic mixture to be administered. The A and B syringes were loaded with drug by another anaesthesiologist not involved in administering the injections and in further evaluation of the patients. All observations (hemodynamic variables, oxygen saturation, level of sedation, time required to achieve surgical block in the operation theatre and the time to rescue analgesic in the post-anesthesia care unit) were also recorded in a blinded manner. On the day of study, the patient was identified, preoperative orders were checked, fasting status, informed consent were confirmed. A base line vitals like Heart rate, B.P, SPO2 and respiratory rate were noted. An 18 gauge IV cannula was secured and IV fluid was started. The patient was placed in a comfortable supine position with ipsilateral arm adducted at the side and gently extended towards the ipsilateral knee. The patient head is turned towards the opposite side. Under strict aseptic precautions after preparation and draping of the area, the most lateral pulsations of the subclavian artery were palpated. A 22G, 38 mm short bevel needle was introduced in cauded, slightly medial and posterior direction until either paraesthesia was elicited or first rib is encountered, with elicitation of paraesthesia the needle was walked symmetrically anteriorly and posteriorly along the rib until plexus (paraesthesia) or subclavian artery (pulsation) was located. Location of the artery provided a useful land mark, the needle was withdrawn and reinserted in a more posterolateral direction that resulted in paraesthesia. After intermittent negative aspirations, the local anaesthetic solution was injected slowly into the brachial plexus sheath. The blindness of administration of clonidine was maintained by a third person. The observer and patient do not know about the drug. Time of onset: this was assessed by pin prick method[17] 0 → sharp pain, 1 → touch sensation only and 2 → No touch sensation. By pin prick and comparing the same stimulus on the contra lateral limb at an interval of one minute for 10 minutes followed by every 2 minutes, for 30 minutes. The sensory score 2 was considered the optimum sensory loss due to the blockade and that time was considered as the time of onset of the sensory block/ effect. Simultaneously motor blockade was assessed by the technique described by Bromage on the three point scale. 0 → Normal, motor function with full extension and flexion of the Elbow, wrist and fingers. 1 → Decreased motor strength with ability to move fingers only. 2 → Complete motor block with inability to move fingers. The score 2 was considered as the time of onset of motor block. The degree of sedation was evaluated by using the University of Michigan Sedation Scale (UMSS) of 0 to 4.0 = awake and alert; 1 = minimally sedated/sleepy, appropriate response to conversion and/or sound; 2 = moderately sedated, somnolent/sleepy, easily aroused with tactile stimulation and/or simple verbal command; 3 = deeply sedated/deep sleep, aroused only with significant stimulation and 4 = could not be aroused. During and after completion of surgery, the persistence of nerve block was assessed at an interval of 30 min until complete recovery. Recovery of touch sensation or sensory score 1 was considered as the end of the duration of block and time was noted as duration of effect. Pain intensity was assessed by using a 10 cm Visual Analogue scale in which 0 cm → No pain at all. 10 cm → worst pain subject can feel. A score of 4 cm and above or the when patient demands for pain relief was considered as the end of the duration of pain relief and the time period as duration of pain relief. Pulse rate, blood pressure, respiratory rate, SPO_2 and continuous E.C.G. display was monitored during the performance of the block, intra-operatively and post operatively every 5 minutes until complete recovery occur. All the subjects were observed for any complications and adverse effects during performance of the block, intra operatively and post operatively for the next 24 hrs.

STATISTICAL ANALYSIS

Statistical analysis were performed using the Statistical

	Control Group	Study Group	P value (<0.05)*
Age (Years)	33.56±8.63	33.68±7.70	0.9589
Weight (Kgs)	58.72±10.50	61.2±8.96	0.3737
Avg. Duration of surgery	103.6±16.4	101.72±12.98	0.6563
ASA status	I/II	I/II	

Table-1: Shows summary of demographic profile of both groups

Time profiles in mins	Control Group	Study Group	P value (<0.05)*
Onset of sensory block	14.20±1.36	8.2±0.93	<0.0001
Duration of sensory	324.2±11.6	517.4±1.5	<0.0001
Onset of motor block	19.8±1.6	13.4±1.5	<0.0001
Duration of motor block	288.4±20.7	460.6±13.6	<0.0001
Duration of analgesia	508.4±16.9	1005±12.4	<0.0001

Table-2: Shows time profiles of sensory and motor blocks and duration of analgesia in the study groups.

Sedation Score	Control Group	Study Group	P value (<0.05)*
Sedation	0	20	<0.0001

Table-3: Shows sedation scores of study group.

Haemodynamic Parameters	Control Group	Study Group	P value (<0.05)*
Pulse rate	77.8±2.0	77.4±1.87	0.477
Systolic Blood Pressure	120.4±3.30	118.5±5.95	0.1737
Diastolic Blood Pressure	76.1±3.14	74.32±4.89	0.1284
Respiratory Rate	14.7±1.0	14.7±0.92	1
SPO2	99.5±1.55	99.4±0.71	0.09076

Table-4: Shows haemodynamic parameters of both the groups.

Baseline characteristics	Control Group	Study Group	P value (<0.05)*
Bradycardia	0	0	-
Hypotension	0	3	0.2347
Nausea/Vomiting	2	3	1
Convulsions	0	0	-

Table-5: Shows summary of adverse effects/complications of the study groups.

Package for the Social Sciences (SPSS 14 Chicago; IL). The P value is identified by paired t test. Probability values <0.0001 were considered as statistically significant.

RESULTS

The present study was undertaken on 50 ASA grade I and II patients aged between 18 to 70 years of age posted for upper limb surgeries. These patients were randomly divided into two groups – each group of 25 patients who received 0.25% bupivacaine 40 ml (control group) or 0.25% bupivacaine plus 150 µg of clonidine 40 ml (study group). Table 1 shows age, weight and duration of surgery of both the groups, the difference is statistically not significant. Table 2 shows onset of sensory blockade, duration of sensory blockade, onset of motor block, duration of mortar blockade and duration of analgesia in both the groups. The difference is statistically significant P value <0.0001). Table 3 shows sedation scores of study group. Table 4 shows the hemodynamic parameters of both the groups, Pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate and Spo_2, the difference is statistically not significant. Table 5 shows that the adverse effects of both the groups, hypotension was observed in clonidine group but it is not statistically significant.

Table 3 shows the sedation was noticed in bupivacaine + clonidine the difference is statistically significant.

DISCUSSION

In this prospective, randomized, double blind, comparative group study, we have included the patients undergoing upper limb surgery and requiring supraclavicular brachial plexus block. Patients were to receive either bupivacaine or a mixture of bupivacaine and clonidine in two separate groups to compare their clinical efficacy in parameters like onset time and duration of block and duration of post operative analgesia. Clonidine is a frequently used adjuvant to local anesthetics. The analgesic properties of clonidine when administered intrathecally or epidurally have been demonstrated, they seem to be attributable to its α_2 agonist properties[7]. Clonidine has been demonstrated to inhibit the action potential of A and C fibers in de-sheathed sciatic nerves.[8] Many authors favor the hypothesis that clonidine exerts its local anesthetic-prolonging effect directly on the nerve fiber, as a result of complex interaction between clonidine and axonal ion channels or receptors.[9] Peripheral antinociception induced by clonidine has also been related to α_2 adrenoceptor-mediated local release of enkephalin-like substances[10]. The benefit of adding clonidine to local anaesthetics for peripheral nerve blocks is less clear, although it is widely believed that conidine improves quality and duration of a local anaesthetic block. In our study the onset time of sensory blockade was rapid. The rapid onset

of time was statistically significant (P<0.0001), without any significant hemodynamic changes. The results of our study were similar to Priti M. Chawda et al[11], they also reported faster onset of sensory blockade with addition of clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block. In our study we observed that addition of clonidine to bupivacaine resulted in faster on set of motor blockade which was statistically significant P (<0.0001). Our study was similar to Shivinder Singh et al[12] compared the effects of clonidine added to bupivaciane with bupivacaine alone on supraclavicular brachial plexus block and observed faster onset of motor blockade. Susmita Chakraborty, et al[13] compared the effects of 30µg of clonidine added to 0.25%Bupivacaine with 0.25% bupivacaine alone on supraclavicular brachial plexus block and they also compared all the parameters and concluded that clonidine prolonged the duration of analgesia. The findings our study were very similar to their study, the only comparison was that in their study they used 30µg of clonidine added to 0.25%Bupivacaine with 0.25% bupivacaine, and in our study we have used 150µg of clonidine and duration of analgesia profoundly prolonged, was statistically significant with P value as <0.0001 and also without any hemodynamic changes. Duration of analgesia suggested prolongation in clonidine group which are in agreement with Jean.J[14] study using clonidine in brachial plexus block (P < 0.001). Murphy DB et al[15] and Popping et al[16] collected group of studies on clonidine as adjuvant for brachial plexus block the results of these studies were in close approximation to our present study. In our study by adding 150 µg clonidine we have observed high sedation scores without any hemodynamic changes, which is statistically significant. Our study was similar to Susmita Chakraborty, et al compared the effects of 30µg of clonidine added to 0.25%Bupivacaine with 0.25% bupivacaine on supraclavicular brachial plexus block and they also compared all the parameters including sedation but their sedation scores were low, it was due to addition of low dose i.e. 30 µg of clonidine. Several studies reported that higher doses of clonidine had increased the incidence of hypotention[17]. Many studies used 150 µg of clonidine without significant hemodynamic changes[18], so in our study we have also used 150 µg of clonidine. In our study we have observed hypotension which was statistically not significant. patients have recovered with intravenous fluids only but in comparison with Bernard.S[19] he has used different concentrations of clonidine in axillary plexus block with lignocaine. He observed significant fall in systolic blood pressure, diastolic blood pressure and bradycardia at 300 µg while in smaller doses no hemodynamic changes were noted. Hutschala D et al[20] added clonidine to bupivacaine and epinephrine as intramuscular injection and along with block and found clonidine prolonged duration of analgesia when added along with the block than used an intramuscular injection suggesting that the local anesthetic-prolonging effect of clonidine is probably mediated locally at the neuron. We have added clonidine perineurally and found significant prolongation of analgesia. But at the same time injecting clonidine as the sole analgesic into the brachial plexus sheath does not provide clinically relevant analgesia. 150µg of clonidine has been safely used in supraclavicular brachial plexus block without any hemodynamic changes, it reduced the onset time of both sensory and motor blockade and it also prolonged the duration of analgesia.

CONCLUSION

From the above study it is concluded that clonidine is a better adjuvant to

bupicaine for supraclavicular brachial plexus block, it provides faster, longer duration of analgesia and sedation with hemodynamic stability.

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