

Clonidine as an Adjuvant to Ropivacaine in Brachial Plexus Block

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Abstract

Regional blocks are gaining popularity to perform surgery by blocking an isolated part of the body. Trauma is one of the consequences of this fast moving world. To deal with the surgeries related to upper limb, brachial plexus block is the most popular and effective technique with less side effects and bypasses the exposure of general anaesthesia and its related consequences and side effects. Many drugs are used as adjuvants to local anaesthetic agents to increase its efficacy, for early onset of block and to prolong the duration of block. Bupivacaine has been the most popular and frequently used local anaesthetic agent in various regional blocks but ropivacaine has also been successfully used since this drug has come in existence. In compare to bupivacaine, this drug has less cardiotoxic effects, less arrhythmogenic and less toxic to the central nervous system and has intrinsic vasoconstrictor property. Clonidine is one of the most attractive adjuvant used in regional blocks. It has analgesic and sedative effects and also reduces the anaesthetic requirements, enhances the efficacy and duration of block without any respiratory depression. In this study clonidine has been used as adjuvant to ropivacaine to analyze its effectiveness in brachial plexus block for upper limb surgeries. This study was done on 100 patients of either sex of ASA grade I & II undergoing for upper limb surgeries. It was observed that the degree of sedation was more in the clonidine group in the post-operative period. It was concluded that the addition of 150µgm of clonidine to 20 ml (0.75%) Ropivacaine for brachial plexus block prolongs the duration of motor block, sensory block and post-operative analgesia with adequate and acceptable sedation with minimum side effects.

Keywords: Brachial Plexus Block; Supraclavicular Approach; Ropivacaine; Clonidine; Upper Limb Surgery.

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Introduction

“Pain is a perfect misery; the worst of all evils and excessive overturns all patients. (John Milton: Paradise lost)

The word anaesthesia was given by Oliver Holmes in 1846. Since then this word act as a coolant against the fear of pain of surgery. It was the beginning of modern anaesthesia. Since then various drugs and

techniques are used to alleviate pain and fear. Generally upper limb surgeries were performed under general anaesthesia, but due to the cost effectiveness of general anaesthesia, problems of operation theatre pollution by gases and associated risk of general anaesthesia, regional anaesthetic techniques are started achieving popularity over general anaesthesia.

Regional anaesthesia is a low cost anaesthetic technique and safe as compared to general anaesthesia. Complete sensory and motor block with

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adequate muscle relaxation provides satisfactory surgical conditions. Brachial plexus block is a safe and useful method to block the upper limb. This block can be given by various approaches and techniques such as supraclavicular, infraclavicular, interscalene and axillary approach. Supraclavicular approach is the most commonly used technique to block brachial plexus. Bupivacaine is the most commonly used local anaesthetic agent but ropivacaine has also been successfully used in recent time as it less lipophilic than bupivacaine and less likely to penetrate large motor fibres, resulting in a relatively reduced motor block. It is less cardiotoxic, less arrhythmogenic and less toxic to CNS in compare to bupivacaine.

Limited duration of block and requirement of large doses and volumes of local anaesthetic drug are the two practical difficulties. Role and use of adjuvants started gaining popularity to overcome the limitations of local anaesthetic drugs. These adjuvants when added with local anaesthetic drugs improves the quality of block.

Clonidine is a selective partial agonist at α_2 adrenergic receptors, has been used as centrally acting antihypertensive agent and has also been used as an adjuvant with local anaesthetic agents for regional anaesthesia. The ability of clonidine to reduce the requirements of anaesthetic and analgesic drugs is increasingly being used in the peri-operative period as it has analgesic and sedative action with minimum respiratory depression.

Hence, clonidine has been used in this study to analyze its effects as an adjuvant to ropivacaine in brachial plexus block.

Aims and Objectives

The purpose of this study was to evaluate the effects of clonidine as an adjuvant to ropivacaine on peripheral nerves during brachial plexus block in terms of its onset, duration and quality of block, postoperative analgesic quality and efficacy and its effects on hemodynamics.

Material and Methods

This single blind, prospective, randomized placebo controlled study was carried out on 100 patients belonging to either sex aged 20-60 yrs under ASA grade I & II undergoing various orthopaedic and surgical operations for upper limb surgeries and randomly divided into 2 groups.

Group I- Control group receiving 20 ml (0.75%) Ropivacaine

Group II- Patients receiving 150 μ gm (1ml) of inj Clonidine added to 20 ml (0.75%) Ropivacaine.

Patients who were in exclusion criteria not included in this study.

Exclusion Criteria

- Patients refusal
- Patients having peripheral neuropathy or hypersensitivity to local anaesthetics
- Brachial plexus injury
- Patient with history of seizures
- Systemic infection or local infection at the site
- Patients with bleeding disorders and receiving anti-coagulants
- Reynaud's disease
- Patients on β blockers
- Patient with bilateral upper limb fractures & injuries

All patients were kept on 6-8 hrs fasting before surgery and no premedication was given pre-operative period.

After explaining the procedure and obtaining informed consent, patent intravenous line is secured in non-operating limb in operation theatre. basal heart rate, blood pressure, oxygen saturation and sensitivity to local anaesthetic drug is checked. A drip of cristaloid solution was started. Desired part of supraclavicular brachial plexus block was prepared with all aseptic precautions. A subcutaneous bleb was formed with 2% lignocaine at the site of injection.

Brachial plexus block through supraclavicular approach was given by eliciting the paraesthesia. Drug was injected with aspiration test assuring the drug is not getting injected intra-arterially. A 5 min compression was performed at the site of injection to facilitate an equal drug distribution. Patients were observed for any subsequent side effects.

Sensory block was assessed by pin prick test at every 2 min interval after completion of drug injection upto 30 min with a 24-G hypodermic needle on entire dermatomes of upper limb innervated by brachial plexus. Complete sensory block was considered when there was complete loss of pin prick sensation on all the dermatomes.

Sensory block was graded as:-

Grade 0: sharp pin prick felt

Grade I: dull sensation felt

Grade II: no sensation felt

Motor block was assessed at every 2 min interval by evaluating the against the gravity. Inability to flex the elbow, wrist and fingers considered as complete motor block. Motor block was determined according to Modified Bromage Scale. Sparing of any nerve to be blocked was considered as incomplete block even after 30 mins of drug injection. These patients were supplemented with intravenous Inj fentanyl (1µgm/kg). When there was normal motor function with full flexion and extension of elbow, wrist and fingers, it was considered as failed block. Those patients were undertaken under general anaesthesia for surgical procedure.

Patients were premedicated with 30 mg pentazocine and midazolam (0.03mg/kg) intravenously. Heart rate, blood pressure and oxygen saturation was observed every 5 mins intra-operatively and every hr in post-operative period. At the conclusion of the operation, quality of block and operative conditions was assessed with the following criteria. Grade IV-Excellent (no complaint from patient) Grade III- Good (minor complaint with no intervention)

Grade II- Moderate (patient required additional analgesia) Grade I- Unsuccessful (procedure was performed under general anaesthesia)

Patients were assessed for duration of analgesia as per numerical scale of 0-10. It was observed every

hour post operatively. Diclofenac sodium (1.5mg/kg) was administered intramuscularly for analgesia and time was recorded. All patients were observed for any complication related to supraclavicular brachial plexus block like as pneumothorax, hoarseness of voice, hematoma, post block neuropathy and side effects like nausea, vomiting and dryness of mouth etc. The duration of sensory block was defined as the duration between the onset of sensory block till complete resolution of block in all the blocked nerves. The duration of motor block was defined as the duration between performing the block till recovery of all motor functions of the upper limb.

Observations

Patients were randomly divided into 2 groups comprising of 50 patients in each group.

Group I- patients receiving 1ml (150µgm) inj clonidine added to 20 ml (0.75%) of inj ropivacaine

Group II- patients receiving 20ml (0.75%) inj ropivacaine

Assessment of sensory, motor block and duration of block

Motor block were significantly short and fast and duration of block was significantly longer in group I in which clonidine was used as an adjuvant with local anaesthetic drug.

Characteristics	Group I	Group II	P value
Onset of sensory block(min)	5.97±1.46	9.02±1.41	<0.001
Duration of sensory block(min)	557.40±13.47	457.8±15.76	<0.001
Onset of motor block(min)	9.84±1.29	17.37±1.63	<0.001
Duration of motor block(min)	655.52±20.28	426.79±17.18	<0.001
Onset of surgical block	10.08±1.13	16.34±1.68	<0.001
Duration of analgesia(min)	754.2±18.20	567.6±22.91	<0.001

Mean systolic blood pressure

Time (in mins)	Group I	Group II
Basal	115.55±7.22	120.04±8.67
5 mins	115.48±7.20	120.18±7.98
10 mins	115.42±7.23	118.93±7.78
15 mins	114.57±7.16	118.37±7.21
20 mins	114.26±6.88	117.89±6.97
30 mins	113.84±5.96	117.02±6.1
60 mins	112.18±5.8	115.17±5.52
90 mins	109.91±5.76	114.54±5.13
120 mins	108.56±5.42	114.17±5.16

There was no drastic change in systolic blood pressure in both the groups. Maximum drop in systolic blood pressure was observed during 60-90 mins in both groups.

Discussion

Clonidine has been used as adjuvant to local anaesthetic agents to extend the duration of block in various regional blocks. It is previously reported that clonidine added to bupivacaine increases duration of analgesia in brachial plexus block. By adding clonidine as an adjuvant to ropivacaine in brachial plexus block enhances the onset and duration of both sensory and motor blockade. Along with this beneficial effect, necessity of analgesic drugs was also significantly reduced in post-operative duration. In previous studies, Bernard and Macarie reported that the addition of clonidine hastened the onset of the block and improved the efficacy and quality of surgical anaesthesia.

In a dose finding study evaluating the minimum required effective dose of clonidine to prolong duration of analgesia after axillary brachial plexus block, Singelyn et al. suggested that 0.5µgm clonidine should be used. At this dose, significant prolongation of analgesia was achieved without undue sedation, hypotension and bradycardia. It has been demonstrated in many studies that perineural administration of clonidine is more effective than subcutaneous or intramuscular injection which suggests that the local anaesthetic-prolonging effect of clonidine is probably mediated locally at the neurons.

In previous studies, the increase in motor blockade ranged from 1.5 hr to 4 hr depending on the local anaesthetic used. A total of 150µgm clonidine was also found to increase the duration of brachial plexus block by Duma et al. Lohom et al. (2005) found that clonidine added to mepivacaine for axillary brachial plexus block enhances both anaesthesia and post-operative analgesia. As far as dose-responsiveness is concerned, it has been observed in other studies that difference in the duration of block was not significant. Hence failed to demonstrate a dose-responsiveness.

All patients were haemodynamically remained stable throughout the intra-operative period at the dose of 150µgm. No incidence of severe hypotension, bradycardia, sedation or respiratory depression was observed. The side-effects like hypotension, bradycardia and sedation are limited upto a dose of 150µgm clonidine was previously observed in various studies.

Conclusion

It can be inferred on the basis of this study that addition of clonidine as an adjuvant to a local anaesthetic drug produces early onset and prolonged duration of sensory and motor block along with prolonged post-operative analgesia.

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