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Ropivacaine as a Sole Agent for Brachial Plexus Block Through Axillary Approach

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Abstract

Rapid onset of sensory block and prolonged postoperative analgesia with haemodynamic stability without neuro and cardiotoxicity are important goals in regional anaesthesia. Axillary block is the most distal block performed on the brachial plexus (except for single nerve blocks in the arm and forearm). Because of its distal location, the axillary block have negligible risks of the respiratory compromise secondary to pneumothorax or phrenic nerve blockade. In addition, the peripheral location permits adequate arterial tamponade to be apllied if an advertent puncture occurs. This study was conducted on 80 patients of ASA I & II and were randomly allocated in two groups receiving two different concentrations of ropivacaine through axillary approach. Onset and duration of sensory and motor block was observed, patients with partial or incomplete block were managed accordingly by supplementing sedatives and analgesics. The rate of complete sensory and motor block was higher in both groups at 10, 15 and 20 mins. Onset of sensory bock in group I and II was 18.48±1.52 mins and 18.88±1.45 mins. Onset of motor block in both groups was 19.48±3.84 mins and 20.56±3.78 mins. No significant stastistical differences were observed with different concentrations of ropivacaine, hence it can be concluded that higher concentration does not have additional benefits, both concentrations were found equally good and potent.

Keywords: Brachial Plexus Block; Ropivacaine; Axillary Approach; Forearm and Wrist Surgeries; Sedation.

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Introduction

Pain is the word for which till now no definition is complete. This word is sufficient to frighten the eyes, shiver the limbs and slur the voice. It is one of the biggest reason because of which patient refuses surgical intervention.

Local anaesthetics have a very old history. Friedrich Gaedcke (1828-1890) was the first to isolate the most potent alkaloid "cocaine" from the coca plant [1]. In 1884, Karl Koller instilled a 2% cocaine solution in his own eyes and tested its effectiveness as a local anaesthetic [2].

Brachial plexus block is the most effective and popular technique for upper limb surgeries. There are several techniques for blocking the nerves of brachial plexus. These techniques are classified and well known by the level at which the local anaesthetic is injected to block the nerves of brachial plexus. Axillary approach to achieve the brachial plexus block is the easiest technique. The axillary

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block is particularly useful in providing anaesthesia and postoperative analgesia for surgeries to the elbow, forearm, wrist and hand. The axillary approach is also the safest of all the four approaches to block the brachial plexus, as it does not risk paresis of phrenic nerve, nor does it have the potential to cause pneumothorax. Complications related to axillary approach are relatively lesser as compared with other approaches. It is not only the easiest way, but at the same time it is also the most consistent method for anaesthesia for below elbow surgeries. William Halsted (1852-1922) performed the first brachial plexus block [3,4]. Georg Hirschel(1875-1963) described a percutaneous approach to the brachial plexus from the axilla [5].

Ropivacaine is a long-acting regional anaesthetic which is structurally related to bupivacaine. It is a pure S (-) enantiomer, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block [6]. One of the most important properties of a long-acting local anaesthetic is to reversibily inhibit the nerve impulses, thus causing a prolonged sensory or motor blockade appropriate for anaesthesia in different types of surgeries [6]. It produces effects similar to other local anaesthetics through reversible inhibition of sodium ion influx in nerve fibres. It is less lipophilic than bupivacaine and less likely to penetrate large myelinated motor fibres, resulting in a relatively reduced intensity of motor blockade. Thus ropivacaine has a greater degree of motor-sensory differentiation, which could be useful when motor blockade is not desirable. The reduced lipophilicity is also associated with decreased potential for neuro and cardiotoxicity.

Aims and Objectives

This study was designed to observe the onset, duration and quality of sensory and motor block, postoperative analgesia and its effects on patients haemodynamics.

Material and Method

This single blind, prospective, randomized study was done on 80 patients of either sex belonging to ASA grade I and II, scheduled for forearm and hand surgeries and were allocated randomly in two groups.

Group I- Ropivacaine 0.75%

Group II- Ropivacane 0.5%

All the patients were thoroughly evaluated preoperatively and subjected to all routine & specific investigations (if required). Informed consent was achieved and procedure was explained to every patient. Patients were fasted for 6-8 hrs and no medication was given preoperatively. After shifting to the operation theatre, the monitors were attached and baseline heart rate, blood pressure respiratory rate and oxygen saturation were recorded. patent intravenous line was established with 18 gauze cannula, crystalloid solution infusion was started and uniform premedication with Inj. midazolam 0.03 mg/kg was given before performing the axillary brachial plexus block.

The patient was placed supine with the arm abducted at 90 degrees and flexion of the forearm with external rotation, so that the forearm lies parallel to the long axis of the body. Hyper-abduction was carefully avoided as it will obliterate the axillary artery pulse in 80% of individuals because the artery is compressed between the head of the humerus and the pectoralis minor muscle.

Axilla was prepared with all aseptic measures and drapped properly, axillary artery was located and fixed as high as possible in the axilla, a subcutaneous weal was raised with 2% lignocaine. 24 gauze hypodermic needle was slowly advanced between middle and index fingers until bright red blood is obtained during continuous advancement. Once blood return was obtained, the needle was advanced through the wall of the axillary artery until no additional blood could be aspirated (transarterial approach) [7]. Once it has been verified by the aspiration that the needle tip lies posterior to the arterial wall, the total anaesthetic solution was injected. The success of the block is related to the close proximity of the needle tip to the posterior wall of the artery (clinical sign to ensure this is aspiration of slight blood stained fluid during intermittent aspiration and injection). After injecting major volume of drug, some amount of local anaesthetic was injected subcutaneously over the axillary artery during withdrawl of the needle to block the branches of intercosto-brachial and median brachial cutaneous nerve.

Sustained pressure was applied for 5 mins over injection site to prevent the distal spread of local anaethetic and to prevent hematoma formation. The patient's arm was kept elevated for some time. A 10 cm wide tourniquet was applied to the upper arm and was inflated to 250 mm Hg prior to skin incision. All patients were monitored before starting until atleast one hour after finishing the procedure using automated blood pressure, oxygen

saturation and ECG lead II. Any episode of hypotension or bradycardia (about 20% decrease) in MAP or heart rate in relation to baseline value were noted.

Sensory block was assessed by pin-prick method on the dermatomal areas corresponding to median, radial and ulnar nerves. Sensory onset was considered when there was a dull sensation to pin-prick along the distribution of any nerve. Complete sensory block was considered when no pin-prick sensation was there.

Sensory Block Gradation

1. Grade 0- Sharp pin-prick felt
2. Grade I- Analgesia, dull sensation felt
3. Grade II- Analgesia, no pin-prick sensation felt

Onset of motor block was considered when there was grade-I motor blockade. Peak motor block was considered when there was grade-II motor blockade.

It was observed according to Modified Bromage Scale for upper extremity.

Grade 0- Normal motor function with full flexion and extention of forearm and hand

Grade I- Decreased motor strength with ability to move the fingers only

Grade II- Complete motor blockade.

Patients with incomplete or partial block were supplemented with Inj pentazocine 30 mg IV. Patients with failed block were not included in this study.

Sedation was scored using a five point scale proposed by Culebras et al. [8].

1. Awake and alert
2. Sedation but responding to verbal commands.
3. Sedated but responding to mild stimuli
4. Sedated but responding to moderate painful stimuli
5. Not arousable

Duration of analgesia was recorded as per numeric rating scale of 0-10. The numeric scale was recorded every hour till the score of 5. The rescue analgesia was given in the form of Inj Diclofenac sodium (1.5mg/kg) intramuscularly at the numeric scale 5 and the time was recorded.

Observation

Onset and duration of sensory and motor block, duration of postoperative analgesia, requirement of supplemental analgesia, sedation score and side effects were observed in this study.

Table 1 shows majority of patients were in the age gropu of 31-40 yrs. There was no significant difference between the mean age of patients in both groups ($p>0.05$).

Majority of patients were between 56-60 kg body weight. There was no statistically significant difference between the mean weight of both group patients ($p>0.05$) (Table 2).

There was no significant difference observed on the onset of sensory block in both groups ($p>0.05$) (Table 3).

Table 4 shows mean time of onset of motor block. It was found 19.48±3.84 mins in group I and 20.56±3.78 mins in group II which was statistically not significant ($p>0.05$).

Table 1: Distribution of patients according to age

Age in yrs	Group I	Group II
20-30	8	10
31-40	21	16
41-50	7	9
51-60	4	5
Mean ±S.D.	28.98±5.86	29.36±6.50

Table 2: Distribution of patients according to weight

Weight in kg	Group I	Group II
45-50	11	5
51-55	10	10
56-60	16	18
61-65	8	10
66-70	3	5
Mean ± S.D.	53.86±6.09	55.60±6.05

Table 3: Onset of sensory block (in mins)

	Group I	Group II
Nerve	Onset (mins)	Onset (mins)
Radial	20.9±2.78	21.8±3.12
Median	19.12±2.48	19.38±2.38
Ulnar	18.48±1.52	18.88±1.45

Table 4: Onset of motor block

Time in mins	Group I	Group II
10-15 mins	1	1
16-20 mins	13	20
21-25mins	18	13
26-30 mins	8	6
Mean ± S.D.	19.48 ± 3.84	20.56 ± 3.78

Table 5: Duration of analgesia (in hours)

	Group I	Group II	P Value
Sensory in hrs	9.72±2.73	8.77±1.75	>0.05
Motor in hrs	8.77±1.02	8.55±0.75	>0.05

Table 6: Mean sedation score at different time interval

Time (in hrs)	Group I	Group II
2 hrs	2.50±0.64	2.01±0.56
4 hrs	1.98±0.69	1.67±0.49
6 hrs	1.44±0.55	1.29±0.38
8 hrs	1.08±0.33	0.96±0.00
10 hrs	0.96±0.00	0.96±0.00
12 hrs	0.96±0.00	0.96±0.00

Table 7: Adverse effects

Adverse effects	Group I No.	%	Group II No.	%	P value
Drug reaction	-	-	-	-	-
Hypotension	6	15%	4	10%	>0.05
Bradycardia	2	5%	3	7.5%	>0.05
Nausea	3	7.5%	2	5%	>0.05
Vomiting	-	-	-	-	-

According to this table, it was observed that duration of sensory and motor blocks in both groups were almost similar which was statistically not significant (p.0.05) (Table 5).

12 hrs monitoring of all the patients in this study revealed there was no significant increase in the sedation (p>0.05) (Table 6). Table 7 shows the incidence of adverse effects in both groups. Hypotension and bradycardia was observed in both groups which was statistically not significant (p>0.05). Frequency of nausea was 7.5% and 5% respectively in group I and II. No patient developed neurological and respiratory symptoms.

Discussion

Brachial plexus block is a very old and popular technique for upper extremity surgeries. Even though there are many different approaches to administer the block, axillary approach is the preferred and safer method as it carries the less incidence of pneumothorax, the most feared complication associated with other techniques of brachial plexus block. Earlier bupivacaine was the most widely used drug for the blocks, but being relatively more cardiotoxic, accidental intravascular administration carried dreaded complications. Ropivacaine being less lipid soluble than bupivacaine, which makes it less cardio and neurotoxic.

Both the concentration and volume of local anaesthetic are likely to affect the onset and efficacy of nerve plexus blockade. (*Cockings E, Moore PL, Lewis RC.* Trans-arterial brachial plexus blockade using high doses of 1.5% mepivacaine. Reg Anaesth 1987; 12: 159-64.) Ropivacaine 0.75% was comparable with bupivacaine 0.5% when used for supraclavicular brachial plexus block [9]. In this study, volume of ropivacaine was used according to the recommended maximum dose by the manufacturer for brachial plexus blocks in adults [9]. It provides a high quality dense block, prolonged duration with minimum failure rate or incomplete block. Patients weighing <45 kg were excluded from this study to avoid the potential risks of administering excessive doses. The relative sparing of motor block, as seen with epidural ropivacaine, was not seen in this study as done by Brown DL, Carpenter RL, Thompson GE, in their study titled Comparison of 0.5% ropivacaine and 0.5% bupivacaine for epidural anaesthesia in patients undergoing lower extremity surgery. This may partially be explained by the higher doses used but may also reflect a differential effect on central and peripheral nerves.

In this study, it was observed that onset of sensory block in both groups was 18.48±1.52 mins and 18.88±1.45 mins and onset of motor block was 19.48±3.84 mins and 20.56±3.78 mins respectively and duration sensory block in both groups was 9.72±2.73 hours and 8.77±1.75 hours respectively and duration of motor block in group I was 8.77±1.02 hours and 8.55±0.75 hours in group II, which was found almost similar to other previous studies [10,11,12].

Conclusion

In this study, no statical significant difference was found in both groups. Hence it can be concluded that both 0.75% and 0.5% concentrations of ropivacaine are equivalently good to produce early sensory and motor block and prolonged postoperative analgesia with minimum risk of neuro and cardiotoxicity in nerve blocks.

References

1. Gaedcke F. Ueber das erythroxylin, dargestellt aus den Blattern des in Sudamerika cultivirten Strauches Erythroxylon Coca Lam. Archiv der Pharmazie 1855;132(2):141-50.
2. Koller K. Uber die verwendung des kokains zur anasthesierung am auge [On the use of cocaine for anaesthesia on the eye]. Wiener Medizinische Wochenschrift 1884;34:1276-1309.
3. Karch SB. Genies and furies. A brief history of cocaine from Inca monarchs to Cali cartels: 500 years of cocaine dealing (2nd ed.). Boca Raton Florida: Taylor and Francis group. 2006.pp.51-68. ISBN 978-0849397752.
4. Halsted WS. Practical comments on the use and abuse of cocaine; suggested by its invariably successful employment in more than a thousand minor surgical operations. New York Medical Journal 1885;42: 294-95.
5. Hirschel G. Die anasthesierung des plexus brachialis fuer die operationen an der oberen extremitat [Anaesthesia of the brachial plexus for operations on the upper extremity]. (in german). Munchener Medizinische Wochenschrift 1911;58:1555-6.
6. Borgeat A. All roads do not lead to Rome. Anaesthesiology 2006;105(1):1-2. Doi: 10.1097/ 00000542- 200607000-00002. PMID 16809983.
7. Winnie AP. Perivascular techniques of brachial plexus block. Plexus anaesthesia: perivascular technique of brachial plexus block. 1 (2nd ed.) Philadelphia: W. B. Saunders Company. 1990.pp.126-7.
8. Culebras X, Van Gessel E, Hoffmeyer P, Gamulin Z. Clonidine combined with a long acting local anaesthetic does not prolong postoperative analgesia after brachial plexus block but does induce hemodynamic changes. Anaesth Analg 2001;92: 199-204.
9. Indian J. Anaesth. 2011 Mar-Apr; 55(2):104-110.
10. Bertini et al. 0.75% and 0.5% ropivacaine for axillary brachial plexus block. A clinical comparison with 0.5% bupivacaine. Regional Anaesthesia and Pain Medicine. 1999;24(6):514-8.
11. Janzen PR et al. A comparison of 1% prilocaine with 0.5% ropivacaine for outpatient-based surgery under axillary brachial plexus block. Anesth Analg. 2001 Jul;93(1):187-91.
12. Satapathy AR, Coventry DM. Axillary Brachial Plexus Block. Anaesthesiology Research and Practice 201.pp.1-5.