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Ropivocaine 0.75% With and Without Dexmedetomidine in Upper Limb Surgeries: Hemodynamic Changes

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ABSTRACT
Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres; therefore, it has selective action on the pain-transmitting A ß and C nerves rather than Aß fibres, which are involved in motor function. Dexmedetomidine is a new generation highly selective α2-adrenergic receptor (α2-AR) agonist that is associated with sedative and analgesic sparing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilizing effects and preservation of respiratory function. The study population were randomly divided into 2 groups with 30 subjects in each group using shuffled opaque sealed envelopes containing the name of the group and patient was asked to choose an envelope. There was no statistically significant difference between in SBP between two groups at baseline, intraoperatively and postoperatively. There was statistically significant lower postoperative VAS score in group RD at 6th hour, 10th hour, 12th hour, 14th hour compared to group RN.

INTRODUCTION

Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is a pure S (-) enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles. Ropivacaine belongs to group of local anaesthetics, the Pipecoloxylidides. It differs from bupivacaine in the substitution of a propyl for the butyl group on the piperidine nitrogen atom of the molecule[1].

Ropivacaine causes reversible inhibition of sodium ion influx, and thereby blocks impulse conduction in nerve fibres. This action is potentiated by dose-dependent inhibition of potassium channels. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres; therefore, it has selective action on the pain-transmitting A ß and C nerves rather than Aß fibres, which are involved in motor function[2].

Peripheral nerve block is employed for anaesthesia for orthopaedic surgery and the onset and spread of local anaesthetic is influenced by the site of injection. The long-acting sensory and motor block provided by ropivacaine is 0.5% or 0.75% for axillary, interscalene and subclavian perivascular brachial plexus block for hand or arm surgery compared favourably with bupivacaine 0.5% or levobupivacaine 0.5% (30-45 ml bolus dose) with a similar quality of regional anaesthesia. In lower limb surgeries where sciatic or combined femoral and sciatic block was given for knee, ankle, or foot procedures, ropivacaine 0.75% (25 ml) had a significantly faster onset of sensory and motor block than 25 ml bupivacaine 0.5%. Although ropivacaine had a significantly shorter duration of sensory block, the duration of motor block remained similar with both agents[3-4].

Dexmedetomidine is a new generation highly selective α2-adrenergic receptor (α2-AR) agonist that is associated with sedative and analgesic sparing effects, reduced delirium and agitation, perioperative sympatholysis, cardiovascular stabilizing effects and preservation of respiratory function[5].

The loading dose of dexmedetomidine results in a transient increase in blood pressure and a reflex drop-in heart rate, presumably caused baroreceptor reflex especially in young, healthy patients. This initial cardiovascular response is most likely due to vasoconstriction induced by the stimulation of peripheral α-2B receptors in vascular smooth muscle; however, subsequent hypotension occurs when the vasodilatory effects of the central α-2A receptors predominate. The dose-dependent bradycardia seen with dexmedetomidine treatment is mediated primarily by a decrease in sympathetic tone and partly by baroreceptor reflex and enhanced vagal activity[6].

MATERIALS AND METHODS

Inclusion Criteria:

- All ASA grade I and grade II patients between 18-60year age group.

Exclusion Criteria:

- All ASA grade III and IV patients.
- Diabetes and Hypertension.
- Cardiovascular, respiratory and neurological disorders.
- Obesity (BMI>30kg/m2).
- Drug allergy and allergic to Ropivacaine, Dexmedetomidine.
- Patient with preexisting neuropathies and myopathies.
- Patients who need general anaesthesia.
- Patients not willing to give consent for Supraclavicular brachial plexus block.
- Patients with local infection at injection site and untreated pneumothorax.
- The study population were randomly divided into 2 groups with 30 subjects in each group using shuffled opaque sealed envelopes containing the name of the group and patient was asked to choose an envelope. The envelopes were opened by a senior anaesthesiologist who was assigned to prepare the test drugs and was not involved with the study.
- **Group RN:** Ropivacaine 0.75% (19ml) + 1ml NS.
- **Group RD:** Ropivacaine 0.75% (19 ml) +Dexmedetomidine 50 mcg (0.5 ml) + 0.5 ml NS.

Pre-anaesthetic evaluation done on the evening day before the surgery. A routine pre-anaesthetic examination was conducted assessing:

- General condition of the patient
- Airway assessment by Mallampatti grading.
- Nutritional status and body weight of the patient.
- A detailed examination of Cardiovascular system.
- A detailed examination of Respiratory system.

A detailed written informed anaesthetic consent was obtained from all the subjects volunteering for the study.

RESULTS AND DISCUSSIONS

The patients in group RD showed significantly lower heart rate at 10 min, 20 min, 30 min, 2 hours, 6 hours from time of block compared to patients in group RN. There was no statistically significant difference between in SBP between two groups at baseline, intraoperatively and postoperatively.

There was statistically significant lower DBP was noted in patients of group RD at 10 min, 20 min, 30 min, 60min, 2 hours from block compared to patients in group RN.

There was statistically significant lower postoperative VAS score in group RD at 6th hour, 10th hour, 12th

Table 1:Comparison of mean heart rate at various time intervals among two groups

Heart Rate	Group RD		Group RN		p-Value
	Mean	SD	Mean	SD	
Baseline	77	16	73	19	0.363
0min	78	16	78	21	0.902
5min	71	17	73	18	0.580
10min	60	12	75	16	<0.001
20min	61	10	73	17	<0.001
30min	61	8	73	14	<0.001
60min	63	8	70	16	0.040
2hr	61	9	75	15	<0.001
6hr	62	10	78	15	<0.001
12hr	69	15	80	13	0.003
18hr	71	14	80	14	0.011
24hr	75	14	80	14	0.106

Table 2: Comparison of mean SBP at various time intervals among two groups

SBP	Group RD		Group RN		p-Value
	Mean	SD	Mean	SD	
Baseline	128	15	120	15	0.050
0min	125	13	133	17	0.052
5min	129	16	128	13	0.868
10min	114	15	126	9	<0.001
20min	125	10	128	17	0.344
30min	124	15	126	16	0.538
60min	125	16	127	9	0.568
2hr	122	12	134	8	<0.001
6hr	113	37	135	6	0.002
12hr	119	11	131	5	<0.001
18hr	117	12	133	6	<0.001
24hr	125	14	133	6	0.005

Table 3: Comparison of mean DBP at various time intervals among two groups

DBP	Group RD		Group RN		p-value
	Mean	SD	Mean	SD	
Baseline	78	7	75	8	0.328
0min	76	6	77	5	0.441
5min	76	9	75	7	0.842
10min	63	7	74	9	<0.001
20min	63	7	75	11	<0.001
30min	64	8	74	12	<0.001
60min	62	7	76	10	<0.001
2hr	62	7	81	6	<0.001
6hr	62	5	78	5	0.024
12hr	70	6	80	5	<0.001
18hr	74	9	82	7	<0.001
24hr	77	9	82	7	0.021

Table 4: Comparison of mean VAS at various time intervals among two groups

VAS	Group RD		Group RN		P Value
	Mean	SD	Mean	SD	
1st Hour	1.0	.0	1.0	.0	-
2nd hour	1.0	.0	1.0	.0	-
4th hour	1.0	.0	1.0	.0	-
6th hour	1.0	.0	1.4	.5	<0.001
8th hour	1.3	.5	1.6	.5	0.009
10th hour	1.4	.5	2.0	.0	<0.001
12th hour	1.7	.5	2.3	.7	<0.001
14th hour	1.7	.5	3.7	.8	<0.001
16th hour	2.0	.0	1.9	.4	0.420
18th hour	2.8	.9	2.4	.5	0.063
20th hour	3.3	1.0	2.6	.5	<0.001
24th hour	2.0	.0	3.6	.5	<0.001

hour, 14th hour compared to group RN.

In our current study we found that group RD showed significant lower heart rate at 10 min, 20 min, 30 min,2nd hour, 6th hour from time of block compared to group RN. Similarly, Gerhard Fritsch *et al.* patient who received dexmedetomidine has significantly reduced heart rate compared to control group[7]. H. Kaur *et al.* in 2015 conducted a RCT to evaluate the effectiveness of addition of dexmedetomidine of 1mcg/kg to levobupivacaine for supraclavicular BPB. There was statistically significant lower heart rate in group B from 10th minute of block till 24hour in postoperative period[8]. Gerhard Fritsch *et al.* in their study observed patient who received dexmedetomidine has significantly reduced heart rate compared to control group[7].

Effect on Systolic Blood Pressure: In our study we have found there was no statistically significant difference with Systolic Blood pressure between group RD and group RN. Similarly, Gerhard Fritsch in their study found no significant difference in blood pressure

between groups[7].

In contrast H. Kaur *et al.* evaluated the effectiveness of addition of dexmedetomidine of 1mcg/kg to levobupivacaine for supraclavicular BPB and found that there was significant lower systolic blood pressure. Gerhard Fritsch et al. in their study found no significant difference in blood pressure between groups[7].

Effect on Diastolic Blood Pressure: In our study we have found that there was statistically significant lower Diastolic blood pressure in group RD at 10th min, 20th min, 30th min, 60th min, 2nd hour, 12th hour, 18th hour. Similarly, H. kaur *et al.* in their study found there was statistically significant lower systolic and diastolic blood pressure was observed from 10th-24hour postoperative period[8].

Gerhard Fritsch *et al.* in their RCT compared effect of addition of dexmedetomidine 150 mcg to 0.5% ropivacaine for ultrasound guided interscalene BPB over plain 0.5% ropivacaine did not find any significant differences in blood pressure between the groups[7].

Adverse Effects: Kariem El Boghdadly *et al.* in their meta-analysis study on effectiveness of perineural dexmedetomidine over clonidine described common side effects associated with alpha 2 agonists bradycardia, arterial and orthostatic hypotension, rebound hypertension and syncope. They have also commented that dexmedetomidine has improved side effect profile over clonidine and it has reduced rate of hemodynamic side effects[9]. From their meta-analysis found that dexmedetomidine appeared to increase risk of bradycardia and hypotension. They noted that all the hemodynamic side effects were transient and resolved spontaneously without any intervention. They also observed there were incidence of excessive sedation with dexmedetomidine. There were also incidences of postoperative nausea and vomiting in some studies[10].

In our current study there were no incidences of hypotension, bradycardia, respiratory depression, sedation, or any other drug related side effects were noted in two groups.

CONCLUSION

In our study we have found that there was statistically significant lower Diastolic blood pressure in group RD at 10th min, 20th min, 30th min, 60th min, 2nd hour, 12th hour, 18th hour.

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