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Original Research Article

To evaluate whether additional anesthetic and analgesic effect could be derived from administration of potassium chloride into brachial plexus sheath with bupivacaine.

Dr. Pramod Kumar Raikwar[1] (PG 3rd Year), Dr. Purvi Jain[2] (PG 3rd Year), Dr. Abhay Kumar Babar[3] (Associate Professor) & Dr. Deepak Joshi[4] (Professor & HOD)

Department of Anaesthesiology, R D Gardi Medical College, Ujjain[1,2,3&4]

Corresponding Author: Dr. Pramod Kumar Raikwar

Abstract:

Background & Method: The aim of this study is to evaluate whether additional anesthetic and analgesic effect could be derived from administration of potassium chloride into brachial plexus sheath with bupivacaine.

Result: Mean and Standard Deviation of the Duration of Analgesia in both the groups. Duration of Analgesia was calculated from the completion of administration local anesthetic to the time when patients had VAS score >5 (time of first rescue analgesia). It was longer in Group A(study) as compared to Group B(control), with p value 0.000 which was statistically highly significant.

The changes produced in SBP & DBP in group A (study) and group B (control) has been shown in figure. Thus DBP was stable in both groups and the difference between group A (study) and group B (control) was statistically not significant.

Conclusion: Addition of Potassium Chloride to bupivacaine solution for brachial plexus block can modify the action of local anesthetic solution beneficially. The dose 0.2mmol of Potassium chloride used in present study significantly shortens onset of sensory and motor block and gives longer duration of sensory and motor and better quality analgesia of longer duration than local anesthetic alone in supraclavicular block. There were no clinically significant side effects noticed. Hence Potassium chloride can form an useful adjuvant for bupivacaine when used for brachial plexus block.

Keywords: anesthetic, potassium, chloride, brachial plexus, sheath & bupivacaine.

Study Designed: Observational Study.

1. INTRODUCTION

Pain is an unpleasant sensory and emotional experience that occurs in response to tissue damage. Surgery is a necessity but does not necessarily have to be painful with advances in anaesthesiology we can make surgery painless, tolerable and even pleasant.

Various methods have been used for pain relief like Oral drugs, local anaesthesia nerve blocks. Good pain relief can be provided by interrupting the transmission of pain. Peripheral nerve blocks with local anaesthesia give longer and more localized pain relief than systemic opioids and non-steroidal anti-inflammatory drugs. In 1884, Austrian ophthalmologist Karl Koller demonstrated effect of cocaine in Ocular surface anaesthesia which was a new era in topical anaesthesia for the attenuation of pain. Later Willium steward Halsted performed first brachial plexus block in 1884.

1911 German surgeon Diedrich Kulenkampff described the first percutaneous brachial plexus block by supraclavicular approach. The regional block spares the *CNS* and so patients remain conscious during surgical procedure. Supraclavicular brachial plexus block is safe and gives effective surgical analgesia and is an easy procedure with minimum side effects and complications. It is low cost anaesthesia with good and prolonged postoperative analgesia. it can also be used as a supplementation to general anaesthesia to reduce the analgesic requirments and better tourniquet tolerance. Brachial plexus is used as a sole anaesthetic technique in situation where general anaesthesia is relatively contraindicated like emergency situations where the fasting time is inadequate, and if proper precautions are not taken, may lead to aspiration of stomach contents.

Brachial plexus can be easily blocked because it lies in a sheath and by eliciting paraesthesia of one of the roots/trunks/cords can give a success rate by injecting large volume of local anaesthetic solution. Various approaches to block brachial plexus are used such as interscalanae, supraclavicular, infraclavicular and axillary.

In most of the peripheral nerve blocks lignocaine and bupivacaine are mixed together and used. lignocaine provides early onset of blockade whereas bupivacaine has a longer and prolonged analgesia.

Most of the local anaesthetics developed between 1900-1940 were amino ester compounds like cocaine, procaine, chloroprocaine, but they were associated with allergic reactions and short duration of action. Lofgren and his associates synthesized lignocaine and Ekenstam synthesized Bupivacaine which improved the quality of Regional anaesthesia. Though lignocaine is short acting it is widely used till date. Bupivacaine, an amide local anaesthetic with a longer duration of action is also used in nerve blocks. If an inadvertant accidental intravenous or intra-arterial injection of any of these two drugs occurs they produce serious complications involving cardiovascular and central nervous system.

2. MATERIAL & METHOD

The present study was conducted in 60 patients of ASA grade I & II, between the age group 20 to 60 years of age, each group comprises of 30 patients. after receiving institutional ethics committee approval and also consent of the patient. The brachial plexus block is performed with the patients lying supine with the head turned to contralateral side. Supraclavicular brachial plexus block was given after eliciting paresthesia on the side to be operated.

INCLUSION CRITERIA

1. Patients belonging to ASA I & II Age -20 to 60 years of age
2. Both genders
3. All patients scheduled for elective upper limb surgeries.

EXCLUSION CRITERIA

1. Patients belonging to ASA grade 3&4 Patient refusal
2. Known allergy to the drugs to be studied

3. Patients with systemic disease like respiratory, cardiac, hepatic, renal, and neurological disorders, diabetes and hypertension
4. Alcohol/drug abuse Very obese
5. Pregnant/lactating mothers
6. Not fulfilling inclusion criteria

Ethics committee approval was obtained for study. Written informed consent was obtained. ASA1&2 patients aged 20 to 60 years, of either gender undergoing any upper limb surgeries were divided in to two groups of 30 patients each.

Each patient randomly assigned to one of the two groups 30(each), group I or group II. For randomization control and potassium chloride group patients posted for upper limb surgeries were selected alternately from operation list. The operation list was prepared as routine by nursing in charge O.T. who was not informed on which day the study will be conducted.

3. RESULTS

Table 1: Age distribution

	Group					
	Group A			Group B		
	Mean	SD	Total N	Mean	SD	Total N
Age	39.23	9.60	30	38.83	11.69	30

This table shows age Distribution in Group-A(study) varies from 20-60 years with mean value of 39.23 and standard deviation of 9.60 years.In Group-B(control) it varies from 20- 60 years with a mean value of 38.83 years & standard deviation of 11.69years. The distribution of patients according to mean age, they were comparable in both groups and there was no significant difference.

Table No 2: Sex Distribution

Sex	Group		Total
	Group A	Group B	
F	10	11	21
	47.6%	52.4%	100.0%
M	20	19	39
	51.3%	48.7%	100.0%
Total	30	30	60
	50.0%	50.0%	100.0%
Chi-Square = 0.073, p = 0.787			

This table shows sex distribution in group A(study) males were 20 and females were 10 where as in group B(control) males were 19 and females were 11.

Table 3: Duration of Analgesia

	Group				p
	Group A		Group B		
	Mean	Standard Deviation	Mean	Standard Deviation	
Duration of analgesia	454.50	8.98	373.10	10.42	0.000

Mean and Standard Deviation of the Duration of Analgesia in both the groups. Duration of Analgesia was calculated from the completion of administration local anesthetic to the time when patients had VAS score >5 (time of first rescue analgesia). It was longer in Group A(study) as compared to Group B(control), with p value 0.000 which was statistically highly significant.

Table 4: Mean comparison of SBP between study groups at different time

SBP	Group				p
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre-op	121.53	7.04	122.60	5.66	0.520
Immediate	122.27	4.29	123.73	3.92	0.172
intra-operative	121.07	4.57	123.93	3.66	0.010
10 min intra-operative	120.27	4.23	122.00	4.17	0.115
20 min intra-operative	120.07	4.08	123.00	3.55	0.004
25 min intra-operative	122.20	4.18	123.53	4.45	0.236
30 min intra-operative	121.87	3.32	122.67	3.61	0.376
60 min intra-operative	121.60	4.41	155.87	182.89	0.309
90 min intra-operative	122.33	4.99	123.67	2.93	0.212
120 min intra-	121.80	5.16	124.20	4.15	0.052
150 min intra-	121.40	4.67	123.80	3.69	0.031
Immediate Post-	122.80	4.63	123.97	3.81	0.291
30 min Post-operative	121.27	4.44	124.00	4.00	0.015
60 min Post-operative	120.90	4.43	124.50	3.57	0.001
90 min Post-operative	121.13	4.63	123.53	4.38	0.044
120 min Post-	121.33	4.44	124.47	4.09	0.006
240 min Post-	122.37	3.35	123.57	4.05	0.216
360 min Post-	122.27	3.63	123.67	4.58	0.195
480 min Post-	121.07	4.75	122.47	4.78	0.260

The changes produced in SBP in group A (study) and group B (control) has been shown in figure. Thus SBP was stable in both groups and the difference between group A (study) and group B (control) was statistically not significant.

Table 5: Mean comparison of DBP between study groups at different times

DBP	Group				p
	Group A		Group B		
	Mean	SD	Mean	SD	
Pre-op	75.33	4.47	73.33	3.94	0.071
(Immediate)	79.80	16.02	76.13	3.56	0.226
intra-operative	74.60	2.53	77.33	4.18	0.003
10 min intra-	74.47	2.96	77.20	4.12	0.005
20 min intra-	77.13	4.42	77.93	3.84	0.457
25 min intra-	77.20	4.25	76.87	3.59	0.744
30 min intra-	77.67	10.08	77.07	4.39	0.766
60 min intra-	75.37	4.60	77.80	4.37	0.040
90 min intra-	76.60	4.30	75.93	2.38	0.461
120 min intra-	76.63	3.76	77.27	3.69	0.513
150 min intra-	76.67	4.34	77.73	3.67	0.308
Immediate Post-	77.20	3.99	75.47	4.07	0.101
30 min Post-	77.47	4.58	78.93	4.66	0.224
60 min Post-	75.67	3.90	75.07	3.55	0.536
90 min Post-	75.77	3.40	75.37	3.24	0.643
120 min Post-	75.43	3.80	75.53	3.55	0.917
240 min Post-	77.93	4.77	75.90	3.72	0.071
360 min Post-	78.40	3.50	76.67	3.90	0.075
480 min Post-	78.57	7.23	76.73	4.94	0.256

The changes produced in DBP in group A (study) and group B (control) has been shown in figure. Thus DBP was stable in both groups and the difference between group A (study) and group B (control) was statistically not significant.

4. DISCUSSION

The mean time from onset of block to request of analgesia is taken as total duration of analgesia. it was 454.50 mins in potassium chloride group and 373.10 mins in control group. the difference is also statistically significant. The duration of effective analgesia was calculated from the completion of administration of local anaesthetic to the time when patients having VAS score > 5 or asked for first rescue analgesic.

Results in many studies were compared with our observations and similar results were found with following studies-

Result of our study were similar to study conducted by Usha kumary Reghunathan et al[6] where the duration of analgesia was 332.0 mins in group L(lignocaine) and 643.0 mins in group LP (potassium). (p value =0.01). This was statistically significant.

Our study well matched with a meta-analysis that was conducted by Ankala mahadevappa shreedhar, borkette radish hagde, leela patel[7]: Where the potassium group had a longer duration of analgesia than other group. The study which was conducted by Dr. H.R. Swetha, et al[8] Potassium chloride group showed longer duration of analgesia when compare to other group ($p<0.000$).

Similar observation was made by Dr. Sarita kumari, Mohammad yahah[9] the potassium group had a longer duration of analgesia. In another study is conducted by G Shravan Kumar,

D Shrikanth, B Shrinivas Rao, Marreddy Srinath[10] where the longer duration of analgesia in potassium group when compared to plain bupivacaine group.
Also the result of our study support the findings of M. Ruhiyyih[11] parris et al who showed that addition of potassium chloride to prilocaine or bupivacaine significant ly prolonged the analgesia.
In our study no significant difference in mean arterial blood pressure in both the groups was seen. There are so many other studies which are similar to our study as mentioned earlier. In the present study no significant difference in Pulse rate was noted in both groups. Majority of studies which are similar have observations similar to our study as mentioned earlier.
In the present study No significant differences were seen regarding mean saturation and mean respiratory rate of the patient in both the groups and is supported by all the studies mentioned previously.

5. CONCLUSION

The patients were randomly divided into two groups, group A (study) & group B (control) with 30 patients in each group. In group B 30 ml of 0.375% Bupivacaine is given, while in group A potassium chloride 0.2 ml (0.2mmol) was added to Bupivacaine 0.375% in a dose of 30ml and given in brachial plexus block via supraclavicular approach.
Addition of Potassium Chloride to bupivacaine solution for brachial plexus block can modify the action of local anesthetic solution beneficially. The dose 0.2mmol of Potassium chloride used in present study significantly shortens onset of sensory and motor block and gives longer duration of sensory and motor and better quality analgesia of longer duration than local anesthetic alone in supraclavicular block. There were no clinically significant side effects noticed. Hence Potassium chloride can form an useful adjuvant for bupivacaine when used for brachial plexus block.

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