Original Research Article

Study of duration of postoperative analgesia in orthopedic surgeries done under intrathecal bupivacaine with buprenorphine

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Abstract

Background: Post operative pain relief can reduce the metabolic response to trauma, thus may prevent (or) postpone post operative negative nitrogen balance. Studies indicate that buprenorphine may safely be administered epidurally and intrathecally. present study aimed to assess the effects of buprenorphine administered with subarachnoid anaesthetic agent like bupivacaine in the relief of post-operative pain. **Material and Methods:** Present study was comparative, observational study, conducted in patients between the age group of 20-60 years, weighed between 45-75 Kg. Patients belonging to ASA Grade-l, undergoing various lower limb orthopaedic surgery willing to participate in study. In surgical theater, 100 patients were randomly allocated to 2 groups of 50 patients each as Group I- 2.4 ml of 0.5% hyperbaric bupivacaine hydrochloride 12 mg (preservative free) and Group II- 0.15 mg (0.5ml) of buprenorphine hydrochloride (preservative free) with the 2.4 ml of 0.5% hyperbaric bupivacaine hydrochloride 12 mg (preservative free). **Results:** Majority of patients were from 21-30 years age group followed by 41-50 years. Percentage of sex for the male is 67% and for the female is 33% for this study. The time of onset of analgesia in both group I and II is between 2% to 4 minutes. The highest level of analgesia was achieved was upto T8 level in both groups. The motor blockade was achieved between 2 hours to 3 hours (Grade III) in all patients of both groups **Conclusion:** The addition of buprenorphine to the local analgesic agent bupivacaine has not interfered with its action as for as duration of action, level of analgesia, the quality of the motor and sensory blockade or incidence of complications.

Keywords: buprenorphine, local analgesic agent, bupivacaine, post operative analgesia

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INTRODUCTION

Pain has been defined by IASP (International Association for Study of Pain) as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.[1] Post operative pain relief is important in reducing the morbidity after surgery. Post operative pain relief can reduce the metabolic response to trauma, thus may prevent (or) postpone post operative negative nitrogen balance. The demonstration of opiate receptors in the substantia gelatinous of spinal cord has created interest in the intrathecal administration of opiates in the management of chronic pain and pain following surgery. But the post-operative pain-relief by means of intrathecal and epidural opioids are associated with problems like respiratory depression.[2] Studies indicate that buprenorphine may safely be administered epidurally and intrathecally. Its high lipid solubility and high affinity for opioid receptors suggest that it would be more useful for postoperative pain relief. Intrathecal and epidural narcotics have shown that

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this method of pain relief provide prolonged segmental analgesia without systemic side effects of narcotics or the sensory, motor (or) autonomic block seen with regional anaesthetic technique for pain relief.[3,4] Since many orthopaedic operations are performed frequently under subarachnoid blockade it was decided to assess the effects of buprenorphine administered with subarachnoid anaesthetic agent like bupivacaine in the relief of post-operative pain especially where longer duration of pain relief is required.

MATERIAL AND METHODS

Present study was comparative, observational study, conducted in department of anaesthesiology, at Government General Hospital, Basaveshwar Teaching and General Hospital, Gulbarga, India. Study duration was of 2 years. Study was approved by institutional ethical committee.

Inclusion criteria: Patients between the age group of 20-60 years, weighed between 45-75 Kg. Patients belonging to ASA Grade-l, undergoing various lower limb orthopaedic surgery willing to participate in study.

Exclusion criteria: Patients with respiratory, cardiovascular or neurological problems. Patients with spinal deformity or any skin lesion over lumbar region.

The patients were informed of the procedure and drugs that are going to be used as a method of post operative pain relief and their consent was also taken for surgery and study.

Patients had a thorough pre-operative examination including history. clinical examination and investigations like blood hemogram - Hb%, TC, DC. ESR, Blood sugar, Blood urea, Serum creatinine, Urine - albumin, sugar, microscopy, ECG, Chest X-ray PA view, were done.

In surgical theater, 100 patients were randomly allocated to 2 groups of 50 patients each as

In control group (Group I) only 2.4 ml of 0.5% hyperbaric bupivacaine hydrochloride 12 mg (preservative free) was injected.

In the study group (Group II) patients 0.15 mg (0.5ml) of buprenorphine hydrochloride (preservative free) was mixed with the 2.4 ml of 0.5% hyperbaric bupivacaine hydrochloride 12 mg (preservative free) was injected.

The preoperative pulse rate, blood pressure, respiratory rate, etc., were recorded. A secure intravenous line was established and the patient was put in the lateral position, spinal given at L_1-Ls interspace with 22 G Quinke's spinal needle. Pulse rate, blood pressure, respiratory rate, onset of analgesia, highest level of analgesia, duration of sensory and motor blockade, supplementation, if any, complication arising in intraoperative period and post operative analgesia (pain was assessed by visual analogue scale) were recorded.

The criteria of post operative analgesia followed:

a) Excellent: When the analgesia is between 10-12 hours.
b) Good: When the analgesia is between 8-10 hours.
c) Fair. When the analgesia is between 6-8 hours.
d) Poor when the analgesia is less than 6 hours.

Complications such as respiratory depression, vomiting, urinary retention, itching, neurological deficit were noted as and when they occurred.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

Majority of patients were from 21-30 years age group followed by 41-50 years. Percentage of sex for the male is 67% and for the female is 33% for this study.

Table 1: Age and sex-wise distribution of cases in Group I and II.

Age group (in years)	Group 1			Group 2		
	Male	female	Total	Male	female	Total
21-30	10	3	13	15	3	18
31-40	6	5	11	9	3	12
41-50	9	6	15	5	4	9
51-60	7	4	11	6	5	11
	32	18	50	35	15	

The time of onset of analgesia in both group I and II is between 2% to 4 minutes. The highest level of analgesia was achieved was upto Ta level in both groups. The motor blockade was achieved between 2 hours to 3 hours (Grade III) in all patients of both groups.

The average time duration of Group I was 5.081.13 and the average time duration of Group II was 10.50±1.45. The time duration in the Group-1 and Group-Il shows statistically highly significant.

Group I - In comparison the POA of fair group (6-8 hours) had had 4 patients (mean ± SD - 6.36 ± 10.15 hrs.) and to poor group (< 6 hours) had 46 patients (mean ± SD - 4.56 ± 11.46 hrs.). The net effect the df = 30, P <0.001 significant.
Group II -In comparison the POA of excellent group (10-12 hours) 34 patients (mean ± SD -11.32 ± 1.8 hrs.) and to good group (8-10 hours) 11 patients (mean ± SD - 9.15+1.47 hrs.). The net effect is t3 df= 4.01 P<0.001 significant.
In comparison the POA of good group (8-10 hours) had 11 patients (mean ± SD - 9.15 ± 1.47 hrs.) and to fair group (6-8 Hours) had 5 patients (mean ± SD - 7.54 ± 0.3 hrs.), The Net effect in t 14 df = 3.5 P <0.001 significant.
In Group- I, there were maximum number of cases with poor post operative analgesia i.e., < 6 Hours = 92% and Minimum number fair post operative analgesia i.e., 6-8 Hours - 8%. In Group-II, there were maximum number of cases with Excellent Postoperative analgesia i.e., 10-12 Hrs. -68%, Good post-operative analgesia i.e., 8-10 Hrs. - 22% and Fair post-operative analgesia i.e., 6-8 Hrs. - 10% and nil poor post-operative analgesia cases.

Table 2: Incidence of Post-Operative Analgesia (P.O.A.)

Post Operative Analgesia	Group I (mean ± SD)	Group II (mean ± SD)
10-12 Hrs. (Excellent)		34 (11.32 ± 1.8)
8-10 Hrs. (Good)		11 (9.15 ± 1.47)
6-8 Hrs. (Fair)	4 (6.36 ± 0.15)	5 (7.54 ± 0.31)
6 Hrs. (Poor)	46 (4.56±1.46)	-
Total	**50**	**50**

Tso df = 21.68; P <0.001 highly significant.

In present study, intraoperative bradycardia and hypotension as well as nausea and vomiting were noted more in group II as compared to group I, also retention of urine and pruritis were noted more in group II as compared to group I, difference was not statistically significant.

Table 3: Incidence of Intra-operative and Post-operative Complications

Complications	Intra-operative			Post-operative		
	Group I	Group II	Total	Group I	Group II	Total
Bradycardia and Hypotension	2	6	8	-	-	-
Nausea and vomiting	1	1	2	2	6	8
Retention of urine	-	-	-	3	5	8
Pruritis	-	-	-	-	1	1

DISCUSSION

In this study, patients gets post-operative pain relief along with the intra-operative pain relief. The administration of suitable analgesics to the patients in pain is often inconvenient. Hence buprenorphine is given along with bupivacaine as a single shot spinal anaesthesia. Sundnes *et al.*,[5] and Bertil Lofstrom *et al.*,[6] showed the time of onset of analgesia was between 2 minutes to 5 minutes. In our study the time of onset of analgesia was between 2.5-4 minutes in both groups I and II. Our results correlates with studies done by Sundnes *et al.*,[5] and Bertil Lofstrom *et al.*,[6] Bertil Lofstrom *et al.*,[6] recommended 8-12mg of 0.5% hyperbaric bupivacaine for lower extremity operation and major hip surgery and the motor blockade (Grade III) was between 2.5-3 hours. In our study the motor blockade in all patients of group I and II was between 2-3 hours (Grade III). This result correlates with studies done by Bertil Lofstrom *et al.*,[6] According to Chansoriya KP *et al.*,[7], Lipp M. *et al.*,[8], 1987 there were no significant changes in pulse rate, blood pressure and respiratory rate attributable to spinal buprenorphine. In our study the incidence of intra-operative complications like bradycardia and hypotension in Group-1 6% and in Group-II is 10% with buprenorphine. No patients required vasopressor for correction of hypotension. In this study, the drug buprenorphine is chosen because it is easily available and highly lipophilic. Hence, diffusion of drug from CSF to neuraxis is faster and the stay of drug in CSF is less duration and there is less likelihood of rostral spread drug and there was no respiratory depression. In this study, bupregesic brand of buprenorphine used which does not contain any preservative. ampoules contain 2 ml. hydrochloride. Each ml contains 0.3 mg buprenorphine. The longer duration of action of buprenorphine analgesia was 10-24 hours seen.[9] In our study, the post-operative pain relief with 0.15 mg buprenorphine hydrochloride is up to 12 hours. Standard deviation 10.50±1.45.

`This longer duration of action is probably because of unusual receptor kinetics of buprenorphine. Buprenorphine forms a very avid drug receptor complex, which tends to persists for long periods without dissociation. The affinity of buprenorphine for the opiate receptor is about 50 times more than that of morphine. This special receptor kinetics and high lipid solubility also explain buprenorphine's longer duration of action in comparison other lipid soluble drugs like Fentanyl, which produces an intense, sharply segmental and short lived analgesia due to rapid egress from the cord.[10] In contrast to

morphine buprenorphine probably forms depots in the lipid tissue of the cord from where it is constantly available for action.[7] As per Jon Gjessing *et al.*,[11] when the patient is treated prophylactically the amount of drug required is considerably less than that would be required if treatment was delayed until pain manifests and intensified. Nausea and vomiting is due to the rostral spread of opioid in spinal fluid to intracerebral structures including the vomiting centre chemoreceptor trigger zone. and The locus of action is thought to be an vascularized area lying superficially on the floor of IV ventricle. The incidence of intra operative complication of nausea and vomiting in both group I and II was 2%. The incidence of nausea and vomiting post-operatively ranged from none to 10%. Our result shows the post-operative nausea and vomiting incidence in Group-1 is 4% and in Group-II with buprenorphine is 12%. Our results correlates with other studies.[7,8] However, the nausea and vomiting subsided without any treatment. The incidence of nausea and vomiting is increased in the post-operative ambulation. Since all the patients are in plaster of Paris cast they cannot be ambulant and hence, the incidence of nausea and vomiting are low. Water-soluble opioids like morphine produce respiratory depression more commonly than a lipophilic drug like buprenorphine. In the Group-II patients moderate sedation was noticed. But they were easily arousable and well oriented.[12] Chansoriya KP *et al.*,[7] reported urinary retention in 6% of their patients. The incidence of post-operative urinary retention in our results were 6% with Group-I and 10% with Group-II. This results correlates with the studies done by Chansoriya *et al.*[7] Facial pruritis may be explained by rapid penetration of opioid to the superficially placed caudal portions of nucleus of the spinal tract of Trigeminal nerve. Also pruritis often subsides like loss of bladder function with subsequent doses of opioids presumably due to adaptation to the change in sensation According to Cousins MJ, and Mather, [9] pruritis found minimal with intrathecal opioid use. In our study with buprenorphine (Group-II) only one case out of 50 cases developed itching and that was not of severe grade or trouble some to the patient. Our results correlate with Cousins MJ and Mather.[9] In this study of post-operative pain relief the route of administration of narcotics was a single shot subarachnoid injection. This commonly done in anaesthesia practice. This procedure in easier when compared to epidural anaesthesia techniques. It has other advantages like rapid procedure, quick onset analgesia, no need for fluid overloading and no appreciable change in blood pressure, pulse rate, respiratory rate. In this study none of the patient had, exhibited any unwanted serious cardiovascular, respiratory or central nervous system effects which has made "Buprenorphine" a one of the suitable agents for the relief of post operative pain.

CONCLUSION

The addition of buprenorphine to the local analgesic agent bupivacaine has not interfered with its action as for as duration of action, level of analgesia, the quality of the motor and sensory blockade or incidence of intraoperative complications like bradycardia, hypotension, nausea, vomiting, dizziness, etc. Buprenorphine 0.15 mg (preservative free) with heavy bupivacaine 12mg (0.5%) (preservative free) is safe, cheap and provides good post operative analgesia without any side effects.

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