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To Assess the Effect of Intrathecal Fentanyl With Two Different Doses of Hyperbaric Bupivacaine on the Charcteterstics of Spinal Anaesthesia

KEYWORDS: Spinal Anaesthesia, Fentanyl, Early discharge, Bupivacaine

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ABSTRACT ***Background: -*** *Spinal Anesthesia, following an accidental intrathecal injection by Corning in 1885 to the present day, has become an accepted modality of Anaesthesia for surgical procedures,1,2. In view of early ambulation and discharge, it is important that the quantity of local Anaesthetic administered to be at a minimum at the same time providing good sensory block, cardiovascular stability and postoperative analgesia and does not prolong motor recovery. The addition of a narcotic like Fentanyl to local Anaesthetic has been accepted as a method to accomplish these goals.3 The objective of this study was to quantitatively examine the effectiveness of using varying doses of hyperbaric Bupivacaine with Fentanyl on duration, recovery of sensory and motor block and post-op analgesia during Spinal Anesthesia.*

Methods: - *60 patients for short duration surgical procedures like Transurethral Resection of Prostate, Hemorrhoidectomy, Dilatation and Curettage etc. were selected divided by random sample technique into two groups of thirty each. Group 1 received injection 0.5% hyperbaric Bupivacaine 5 mg (1.0 ml) with 25 g Fentanyl (0.5 ml) intrathecally. Group 2 received injection 0.5% hyperbaric Bupivacaine 7.5 mg (1.5 ml) with 25 g Fentanyl (0.5 ml) intrathecally. The recovery parameters of Spinal Anaesthesia were studied in both groups.*

Results: - *The data were collected and analysed. Proportions were compared using Chi-square test of significance. The students 't' test was used to determine whether there was a statistical difference between Group 1and Group 2 in the parameters measured.*

No statistically significant differences were noted amongst the recovery parameters including full sensory recovery time, 2 dermatomal regression time, time for voiding, time to meet PADSS criteria. It was found that except for increase in motor blockade for Group 2 all recovery parameters remained same in both groups with no significant side effects in both groups

Conclusion: - *We conclude that addition of Opioid to Local Anaesthetic in Spinal Anaesthesia aids in lowering the dose required thereby promoting early ambulation and discharge*

Introduction: -

Spinal anesthesia, defined[2], as 'the regional anesthesia obtained by blocking nerves in the subarachnoid space' is a popular & common technique used worldwide. The advantages of an awake patient, minimal drug cost, relatively less side effects & rapid patient turnover has made this the choice of many a surgical procedure.

However, allowing an early discharge requires motor blockade to be at it's minimal without compromising on the sensory block provided along with it. A reduction in Local Anaesthetic volume along with addition of adjuvants has been tried with varying success rates earlier.[4]

The sensory and motor blockade results from direct effects of local Anaesthetic on the spinal nerve roots. The primary site of action is on both anterior and posterior nerve roots, affecting smaller nerve fibers first and thick large motor fibers last.

The sequence of nerve modality block[5]:

1. Vaso motor block – dilatation of skin vessels and increase cutaneous blood flow
2. Temperature fibers – cold first and then warmth
3. Loss of temperature discrimination
4. Pain – pin prick fibres first
5. Loss of tactile sensation
6. Motor paralysis
7. Pressure sensation
8. Proprioception and vibratory sensation

Opioids have been used as an Analgesic from time immemorial. In addition to the Central Nervous system level, Opioids, through its opioid receptors, mediate analgesic activity at the spinal levels also. Clinical reports and studies in animals provide evidence of spinally induced receptor effects like suppression of micturition reflex, increased evidence of urinary retention, pruritus, delay in gastro intestinal function and depression of motor neuron firing evoked by muscle stretch6. All these effects are mediated by δ and μ receptors.

Synthesized in the 1960, Fentanyl Citrate is a phenylpiperdine opioid agonist that is structurally related to meperedine. As an analgesic, Fentanyl is 75-125 times more potent than morphine. Primarily a mu receptor agonist with an analgesic potency greater than Morphine, Pethidine and Alfentanyl. Analgesia is produced principally through interaction with mu receptor at supraspinal site. It also binds to a lesser degree to kappa receptor, substantia gelatinosa of spinal cord. Intrathecal administration of Fentanyl produces selective spinal analgesia by acting on opiod receptors at substantia gelatinosa of dorsal horn of spinal cord

The major advantage of "selective " blockade of pain by Fentanyl lies in the absence of sympathetic blockade and postural hypotension potentially allowing early ambulation of the patient and avoidance of cardiovascular collapse or convulsions, which are major complications of spinal anesthetic blockade.

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Materials and Methods: -
INCLUSION CRITERIA:
Patients belonging to ASA grade I & II.
Patients between 18-80 years of age
Elective surgery

EXCLUSION CRITERIA:
Patient refusal
Patients belonging to ASA grade III & IV
Infection at site of injection
Coagulation abnormalities
Hypersensitivity to local Anaesthetic or Fentanyl
Neurological or neuromuscular disease

PRE ANAESTHETIC EXAMINATION & PREPARATION:
Preanaesthetic checkup was done one day prior to the surgery. Patients were evaluated for any systemic disease and laboratory investigations recorded. The procedure of SAB explained to the patient and written informed consent was obtained. The patients were educated about the use of visual analogue scale.

Preparation of patients included period of overnight fasting. Premedication was done with oral tablet Alprazolam 0.25 mg and capsule Omeprazole 20 mg.

Materials
25 Gauge Quincke Spinal needle. Hyperbaric bupivacaine. Fentanyl.

Method:
Sixty patients were randomly allocated into two groups of thirty each.

GROUP I:
Thirty patients received injection 0.5% hyperbaric Bupivacaine 5 mg (1.0 ml) plus 25µg Fentanyl (0.5 ml) intrathecally.

GROUP II:
Thirty patients received injection 0.5% hyperbaric Bupivacaine 7.5 mg (1.5 ml) plus 25µg Fentanyl (0.5 ml) intrathecally.

SAB was performed with patient in sitting position. Under strict aseptic precautions LP was performed with no: 25-gauge spinal needle Quincke type at L3-L4 or L4-L5 intervertebral space using midline approach. Following free flow of CSF, respective drugs were injected. Patients were positioned supine immediately after the administration of intrathecal agents.

The following parameters were observed and recorded:
1. HR, B.P, ECG and RR every 2 minutes for the first ten minutes and every five minutes thereafter till the end of surgery.
2. Onset of analgesia was recorded using loss of pinprick sensation at the site of surgery.
3. Level of sensory analgesia defined as loss of sensation to pinprick done with help of hypodermic needle at every five-minute interval for thirty minutes.
4. Time taken to attain highest level of sensory analgesia.
5. Intensity of motor blockade was assessed by modified Bromage scale(BS)

   Observations were made at 5,10,20,30,45,90 and 120 min after injection. Time for recovery from motor block defined as BS>5 was noted.
6. Side effects like hypotension, bradycardia, giddiness, nausea, vomiting, pruritus, shivering, respiratory depression etc. and corrective therapeutic measures taken to correct it whenever necessary were noted.
7. Postoperatively patient's vital parameters were monitored every fifteen minutes in the Recovery Room PACU) and every half hourly in the ward till they required "rescue analgesic' agent. Any complication and time of voiding were noted down.
8. Pain was assessed using "Visual Analogue Scale7.
9. The following recovery parameters were observed.

- Sensory level – Two-Dermatomal regression time in minutes
- Motor level - Assessed by Modified Bromage Scale.
- Time of voiding of urine in minutes

10. Time to meet Discharge criteria was assessed using "Modified Post Anaesthesia Discharge Scoring Sys tem" (PADSS) 8. Patients scoring > or = to 9 were considered fit for discharge.

Results: -
The mean age of the study groups was 46.05 + 19.16 ranging from 20 to 78 years. Demographic details such as age , weight and height were comparable between two groups. TURP and perineal surgeries were the commonest surgeries in both the groups. The duration of surgery between the two groups were not statistically significant.

HIGHEST LEVEL OF SENSORY BLOCK
Table 1

SENSORY LEVEL	GROUP I		GROUP II	
	No: Of Patients	Percentage	No: Of Patients	Percentage
T 6	3	10%	4	13.3%
T7	2	6.7%	3	10%
T8	8	26.7%	8	26.7%
T9	3	10%	2	6.7%
T10	14	46.6%	13	43.3%
TOTAL	30	100%	30	100%

Table 1 shows highest level of sensory blockade achieved in both groups. Sensory blockade varied between T6 to T10 dermatomes. Most of the patients had a sensory level of T10 in both the groups (46.6% in Group I and 43.3% in Group II) and this was found to be statistically insignificant.

Statistical comparison of both the groups for mean time to attain highest level and mean onset of action was found to be statistically insignificant. Also, a comparison of all intra operative parameters were found to be statistically insignificant between the two groups.

MOTOR BLOCK
Table 2

Modified Bromage Scale	Group	
	GROUP I	GROUP II
2	0	1
		3.3%
3	6	18
	20%	60%
4	23	11
	76.7%	36.7%
5	1	
	3.3%	
Total	30	30
	100.0%	100.0%

Volume : 6 | Issue : 10 | October 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Chi-Square Value	df	'p' value
12.235	3	.004

Table 2 shows the Modified Bromage Scale grading in each groups. 80% of the patients in Group I were found to be in grade 4-5 and 96% of patients in Group II were in grade 3-4. This was found to be statistically and clinically significant. P < 0.05.

TIME OF ONSET OF PAIN AS ASSESSED BY VAS > 6
Table 3

	GROUP I		GROUP II	
Vas > 6	No; of patients	Percent-age	No; of patients	Percent-age
2nd hour	4	13.3%	4	13.3%
3rd hour	25	83.4%	26	86.7%
4th hour	1	3.3%	0	0
Total	30	100%	30	100%

Table 3 shows the Onset of Pain as assessed by VAS > 6 in both the groups. In both the Groups majority of patients reached VAS > 6 in the 3rd hour (83.4% in GP I and 86.7% in GP II). P value is > 0.05 and it is statistically insignificant.

Complications were minor and none of the patients required pharmacological assistance.

DISCUSSION

Sub arachnoid block is one of the most commonly used Anaesthetic techniques for lower extremity and lower abdominal surgeries because of its simplicity, rapid onset of action, intense analgesia and relatively less complications. In current practice most of the short duration surgeries are done on a day care basis thereby, reducing the length of hospital stay and cost. Such day care surgeries demand modification of conventional spinal anesthesia techniques to make patient discharge as early as possible. Selective Spinal Anaesthesia, using lower doses of intrathecal agents with intrathecal adjuvants has been used to provide spinal anesthesia with greater selectivity and rapid return of function9,10.

Bupivacaine, an amide type of local Anaesthetic, has high potency, slow onset and long duration of action. In addition to motor impairment, one of the major clinical concerns in the use of local anesthetics is sympathetic blockade. Intrathecal opioids enhance analgesia from sub therapeutic doses of local Anaesthetic and make it possible to achieve successful spinal anesthesia and extended period of analgesia without prolonging recovery. Intrathecal opioid does not prolong motor recovery and thus does not delay discharge home. Because intrathecal Fentanyl causes neither by itself nor in combination with Bupivacaine any further depression of sympathetic activity, it is possible to enhance the sensory blockade without altering the degree of sympathetic blockade9.

The aim of this study was to investigate whether a modification of the Spinal Anaesthesia technique with addition of opioid to the injectate, combined with a reduction in the amount of Bupivacaine, could produce adequate surgical analgesia with reduction in the recovery time, thus making Spinal Anesthesia more suitable for day care surgeries.

Most patients in Group I had minimal to moderate motor blockade and were able to move feet and knees (Modified Bromage Scale Grade 3) or were able to perform a straight leg raise (Modified Bromage Scale Grade 4) and had a faster motor recovery with a mean duration of 89.00 minutes when compared to Group II patients in whom motor blockade was more intense with most of the patients being able to move feet and knees (Modified Bromage Scale Grade 3) or were able to move feet only (Modified Bromage Scale Grade 2) and took a longer duration for motor recovery (116.43 min.) .

Among the recovery parameters we found that except for full motor recovery, there was no significant differences among the recovery parameters including full sensory recovery time, 2 dermatomal regression time, time for voiding, time to meet PADSS criteria

Thus, with the addition of 25µg of Fentanyl, the dose of local Anaesthetic Bupivacaine can be reduced from 7.5 mg to 5 mg for short day care surgical procedures permitting the patient early ambulation and recovery at the same time providing good surgical Anaesthesia, postoperative analgesia, haemodynamic stability without any major side effects.

CONCLUSION

Our study concludes that with the addition of 25µg Fentanyl dose requirement of 0.5% Hyperbaric Bupivacaine is reduced in Spinal Anaesthesia which achieves good operating conditions, perioperative haemodynamic stability, early motor recovery, post-operative analgesia, a culmination of which results in making safe early discharge home possible. We also summarize that intrathecal Fentanyl acts synergistically to potentiate the Bupivacaine induced analgesia and sensory block while reducing the intensity of motor blockade, allowing for a safe and effective dose reduction of the local Anaesthetic.

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