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A Comparative Study of the block Characteristics of Intrathecal 0.5 Bupivacaine with and without Fentanyl as Adjuvant in Patients Undergoing Transurethral Resection of Prostate

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Abstract
Background: *Spinal anaesthesia is a regional technique that blocks the spinal nerves in the subarachnoid space. The anaesthetic agents that are deposited subarachnoid space act on the spinal nerve roots. It is extensively used for genitourinary surgeries like transurethral resection of prostate, transurethral resection of bladder tumours, cystoscopy, gynaecological and obsteteric procedures, abdominal surgeries, orthopaedic procedures etc. This study is designed to evaluate the block characteristics of intrathecal hyperbaric bupivacaine with and without fentanyl as adjuvant in patients undergoing TURP.*
Objective: *To study the block characteristics of intrathecal hyperbaric bupivacaine with and without fentanyl as adjuvant in patients undergoing TURP, as assessed by time to 2 segment regression of sensory blockade ,time to regression of sensory block level to L1, time to first rescue analgesic, duration of motor blockade,and the maximum motor block produced, in patients undergoing TURP.*
Methodology: *40 Patients undergoing transurethral resection of prostate (TURP) belonging to American Society of Anaesthesiologists Physical Status (ASA) grade 1 and 2 were enrolled in this study after getting informed consent and institutional ethical board clearance and randomly allocated into two groups. Group '1' received 7.5mg 0.5% heavy Bupivacaine (1.5ml) with 25µg Fentanyl (0.5ml)- total of 2ml, while group '2' received 7.5mg 0.5% heavy Bupivacaine (1.5ml) with 0.5ml sterile water (total 2ml) .*
Results: *It was found from this study that Group '1' prolongs the duration of sensory block (91.8±5.3 min) compared to Group '2'(75.7±4.9 min),provides longer duration of postoperative analgesia,227.5±24min in Group'1'compared to 183.2±8.6min in Group '2' and causes a delay in the attainment of peak sensory levels 7.4±1.0 min in Group '1' compared to 6.3±0.7 min in Group'2', without affecting the peak sensory block, maximum motor block or duration of motor block.*
Keywords: *Intrathecal fentanyl, block characteristics, TURP, postoperative analgesia.*

Introduction

Spinal anaesthesia is the most commonly used anaesthetic technique in patients undergoing transurethral resection of prostate (TURP) [1] in geriatric population where it is reported to preserve cerebral function[2]. It provides both analgesia and muscle relaxation and has a rapid onset of action. However considering the fact that many patients undergoing TURP are elderly and have coexisting cardiac or pulmonary disease it is important to limit the distribution of the spinal block to reduce the adverse haemodynamic / pulmonary effects of the technique. Simultaneously it allows early detection of hyponatremia associated with water intoxication and fluid overload.[3] The distribution of spinal block can be limited by decreasing the dose of the local anaesthetic used, but that comes with the disadvantage of not providing adequate sensory block. It is in such a scenario that intrathecal adjuvants assume significance, the most commonly used ones being opioids. Adjuvants serve to:

- Prolong the duration of anaesthesia
- Decrease local anaesthetic dose and thus side effects
- Abolish visceral pain and thus improve patient comfort
- Alter the onset of block maximum level of sensory block

By combining intrathecal opioids with local anaesthetics, it is possible to provide successful spinal anaesthesia using otherwise inadequate doses of local anaesthetics[4,5,6,7,8]. Short acting opioids are particularly useful to provide analgesia in elderly patients[9] . Other adjuvants that can be used include adrenaline, neostigmine, clonidine[10], midazolam[11], and ketamine among others.

It was reported that a spinal block of dermatomal level higher than L_1 was adequate during TURP when bladder pressures were monitored and kept low. It is possible to attain this level with 7.5mg bupivacaine[12].

It has been observed that neuraxial opioids along with local anaesthetics improve the quality of intraoperative analgesia and at the same time prolong the duration of postoperative analgesia[13] . It has also been observed that intrathecal fentanyl can reduce the intraoperative opioid requirements in patients[12].

Materials and Methods

Study design: This study is a hospital based prospective comparative study.

Study setting: Department of Anaesthesiology, Government Medical College Hospital, Thiruvananthapuram.

Study population: Patients undergoing transurethral resection of prostate (TURP) belonging to American Society of Anaesthesi-ologists Physical Status (ASA) grade 1 and 2.

Study period: 1 year from January 2015 to January 2016.

Sampling technique: Consecutive sampling. Patients are alternatively allocated to either the bupivacaine fentanyl group (1) or the bupivacaine group (2) of the study.

Data collection

After the approval from the hospital research committee and the hospital ethical committee, informed written consent was attained from patients. Patients were included and excluded depending on the criteria mentioned above. Patients were allocated into 2 groups '1' and '2' as mentioned earlier. Group '1' received 7.5mg 0.5% heavy Bupivacaine (1.5ml) with 25µg Fentanyl (0.5ml)- total of 2ml, while group '2' received 7.5mg 0.5% heavy Bupivacaine (1.5ml) with 0.5ml sterile water (total 2ml) .

The spinal blocks were performed under strict aseptic precautions with the patient in the sitting position at the L_{3-4} level with a 23G Quinke spinal needle. After ensuring free flow of CSF, the study drugs as mentioned above were given over 30 seconds. The patient was positioned for surgery only after the attainment of peak sensory level. The motor blockade at this point of time was considered the maximum motor blockade. Once the patient was positioned for surgery, oxygen was given via facemask. Intraoperative monitoring was

done with ECG and oxygen saturation continuously and with non-invasive blood pressure every 5 minutes. Any alteration in haemodynamic parameters such as hypotension or bradycardia was managed as appropriate.

Assessment of sensory blockade

Was tested by loss of normal sensation to alcohol swab every 2 minutes in the midline till the level stabilized for 3 consecutive tests. Testing was then conducted every 5 min till 2 segment recession. Further testing was done at 10 min intervals till regression to L_1 dermatome. The highest dermatomal level of block attained and the time to reach it was noted as well as the time for 2 segment recession.

Assessment of motor blockade

Was assessed by the modified Bromage scale:

Motor blockade is considered maximum at the time of attainment of peak sensory blockade. Duration of motor blockade is considered to be the time till patient attains complete motor recovery (modified Bromage scale 0).

Assessment of analgesia

The time till the first request for analgesia (first rescue analgesia) was also noted. Rescue analgesia given was Inj. Tramadol 50mg IV. All the durations were calculated from the time of intrathecal injection.

Data analysis was done with student's T test and chi square test. A 'p' value less than 0.05 is taken as significant. Observations are represented both graphically and numerically

Observations and Results

40 patients undergoing TURP over a period of 1 year were included in this study.

Table 1 Characteristics of patients for TURP surgery. Values are mean (SD) or number (Proportion)

	Bupivacaine with fentanyl n=20	Plain Bupivacaine n=20
Age; Years	65.4(9.6)	70.3(8.2)
Height;cm	163.4(4.8)	162.7(5.3)
Weight;Kg	61.8(4.4)	63.4(4.8)

Table 2 Comparison of time for 2 segment regression based on group

Group	Mean (min)	SD	N	t	p
Bupivacaine with fentanyl	91.8	5.3	20	9.92**	0.000
Plain bupivacaine	75.7	4.9	20		

**: Significant at 0.01 level

The mean time for 2 segment regression was 91.8±5.3 min in the group that received bupivacaine with fentanyl and 75.7±4.9 min in the group that received plain bupivacaine. These figures show a statistically significant difference.

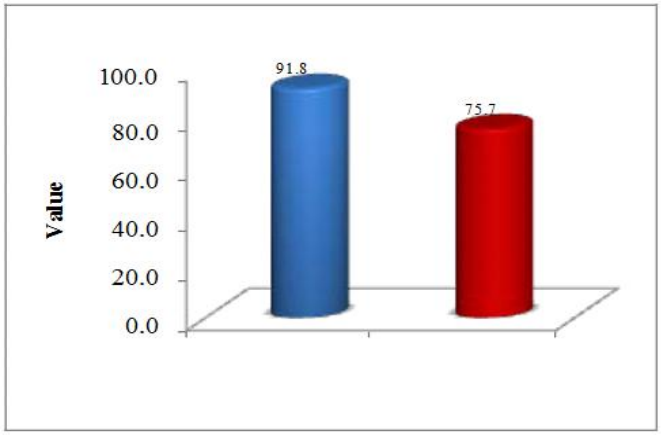

Figure 1 Comparison of time for 2 segment regression based on group

Table 3 Comparison of time for regression to L_1 based on group

Group	Mean (min)	SD	N	t	p
Bupivacaine with fentanyl	142.6	5.1	20	14.65**	0.000
Plain bupivacaine	111.2	8.1	20		

**: - Significant at 0.01 level

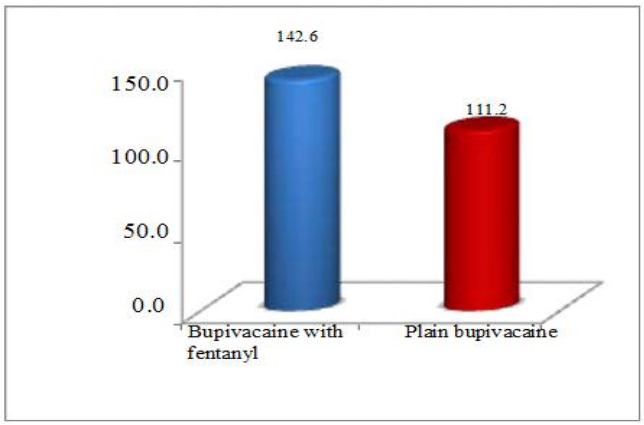

Figure 2: Comparison of time for regression to L_1 based on group

Table 4 Comparison of time till first rescue analgesia based on group

Group	Mean (min)	SD	N	t	P
Bupivacaine with fentanyl	227.5	24.0	20	7.76**	0.000
Plain bupivacaine	183.2	8.6	20		

**: - Significant at 0.01 level

Table 5 Comparison of duration of motor blockade based on group

Group	Mean (min)	SD	N	t	P
Bupivacaine with fentanyl	160.3	4.9	20	0.43	0.672
Plain bupivacaine	160.9	3.9	20		

Table 6 Comparison of maximum motor blockade based on group

Maximum motor blockade	Bupivacaine with fentanyl		Plain bupivacaine		χ^2	p
	Count	Percent	Count	Percent		
1	3	15.0	2	10.0	2.54	0.468
2	6	30.0	8	40.0		
3	9	45.0	10	50.0		
4	2	10.0	0	0.0		

Discussion

Spinal anaesthesia is the preferred anaesthetic technique in TURP. The choice of local anaesthetic drug depends on the duration of action of the drug and the potential for neurologic injury. The duration of action of bupivacaine is intermediate, between that of lignocaine and tetracaine. It has a lower incidence of transient radicular irritation than lignocaine a more rapid onset and shorter duration of action compared to tetracaine. Bupivacaine also has a longer duration of action compared to levobupivacaine and ropivacaine, and a higher success rate than an identical dose of levobupivacaine. Intrathecal bupivacaine does not show any selectivity for afferent and efferent pathways. Intrathecal fentanyl acts synergistically to enhance the effect of bupivacaine on the afferent pathway without a measurable effect on the sympathetic outflow. Using an intrathecal opioid, decreases the period of recumbence after spinal anaesthesia by allowing earlier ambulation, resulting in a lower incidence of post dural puncture headache and hospital stay.

Fentanyl at a dose of 25µg was chosen for this study as most studies have shown that this dose provides the maximum duration of postoperative analgesia with minimal adverse effects like respiratory depression and pruritus. Seewel et al suggest that in non-obstetric population receiving spinal anaesthesia for lower abdominal surgeries like hernia repair, adding just 10µg fentanyl to the intrathecal bupivacaine significantly improves quality and duration of analgesia. There was no further advantage of increasing the dose to 40µg. The ideal intrathecal opioid should have rapid onset of action as well as minimal side effects. It should also have a long duration of action, thereby providing adequate intra and postoperative analgesia.

It was found that the peak sensory levels attained in either group did not show any statistically significant differences. However only 35% of patients who received bupivacaine with fentanyl had a sensory level of T_{10}, compared to 70% of the patients who received plain bupivacaine. The rest of the patients in the former group had a peak sensory level higher than T_{10}. Similar results were obtained in a study by Khanna and Singh in geriatric patients. This was also consistent with the bupivacaine limb of the studies by Akcaboy et al in Turkey and Kararmaz et al[1]. Study by Makwana et al also did not show any significant differences in the peak sensory levels attained. BJ Chandra et al, Rajesh Mahajan et al, S Liu et al all observed similar results.

The two groups were comparable in terms of the maximum motor blockade that was produced. 75% of the patients who received bupivacaine with fentanyl and 90% of the patients who received plain bupivacaine developed a maximum motor blockade of 2 or 3 on the modified Bromage scale. However no statistically significant difference could be identified between the groups. This

implies that the motor blockade that is produced, is influenced by the dose of bupivacaine rather than just the total volume of the solution as is observed in the study by Kararmaz et al where they kept the total volume of the drug same while varying the dose of bupivacaine.

This study did not find any difference in the duration of motor blockade produced in either group. This is also consistent with the observation that the motor blockade characteristics are dependent on the dose of local anaesthetic in the spinal drug rather than just the total volume of the drug. Results consistent with this observation was also seen in the study by Dhumal et al in a study on patients undergoing caesarean section and also the study in TURP patients by Kararmaz et al . Similar results were also observed by Singh et al in their study in patients undergoing lower extremity or genitourinary surgeries. Hunt et al also obtained similar results in patients undergoing caesarean section. Ackerman et al also obtained similar observations with intrathecal morphine.

This study showed a statistically significant difference in the time taken to attain peak sensory levels between the two study groups. The mean time to attain peak sensory level was 7.4±1.0 min in the group that received bupivacaine with fentanyl and 6.3±0.7 min in the group that received plain bupivacaine. Sensory block was assessed by loss of normal sensation to alcohol swab. This may not be of much clinical significance except that one probably need not get unduly worried about a seemingly inadequate sensory level immediately following spinal anaesthesia with added opioid. In a study by Makwana et al, the addition of fentanyl did not significantly affect the onset of sensory blockade. This difference however may be due to the difference in sample size in both studies. There was a statistically significant difference in the time the group that received plain bupivacaine. That is, it took more time for the sensory level to recede when fentanyl was added to bupivacaine compared to plain bupivacaine. This was found to be consistent with the study by Dhumal et al. the reason for this is that opioids have a synergistic action with local anaesthetics. Similar results were also observed by Sergio DB, who concluded that the time to regression below T_{12} was longer and increased with increasing dose of fentanyl.

The mean times for regression of sensory levels to L_1 was found to be significantly longer in the group that received fentanyl, compared to those who received only bupivacaine. The mean time for regression of blockade to L_1 was 142.6±5.1 min in the group that received bupivacaine with fentanyl and

111.2±8.1 min in the group that received plain bupivacaine. This is consistent with the study by Dhumal et al and that which was observed by Sergio DB. Similar results were also observed by Singh et al.

The group that received fentanyl had a significantly longer duration of postoperative analgesia as expressed by time to first rescue analgesia. The mean time at the first request of rescue analgesia was 227.5±24.0 minutes in the group that received bupivacaine with fentanyl and 183.2±8.6 min in the group that received plain bupivacaine. These observations were found to be consistent with those from studies conducted in orthopaedic patients by Roussel and Heindel and also by Akanmu ON, Soyannwo OA et al in Nigeria. The present study results were consistent with observations by Jaishri Bogra et al, Shende D et al, Hunt OC et al, Dhumal et al , and Khanna et al also.

Conclusion

It is concluded from this study that fentanyl when added as adjuvant to intrathecal bupivacaine

- Prolongs the duration of sensory block
- Provides longer duration of postoperative analgesia
- Causes a delay in the attainment of peak sensory levels
- Does not affect the peak level of sensory block
- Does not affect the maximum motor block
- Does not affect recovery from motor block

Thus it may be concluded that fentanyl may be given safely to patients undergoing TURP to provide longer duration of sensory block and postoperative analgesia.

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