

Original Article

## A Comparative Study of Low Dose Bupivacaine- Fentanyl with Plain Bupivacaine in Spinal Anaesthesia for Transurethral Prostatectomy

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**Abstract**

**Introduction:** *The patients undergoing transurethral prostatectomy are elderly with co-existing cardiac and respiratory diseases with compromised reserves. Spinal anaesthesia is the mostly used technique for this procedure due to the advantageous of earlier recognition of signs and symptoms of water intoxication, fluid overload, perforation and also elderly patients tolerate regional anaesthesia better. In this study the efficacy of 0.5% hyperbaric Bupivacaine (7.5mg) and 0.5% hyperbaric Bupivacaine (5mg) with 25 µg of Fentanyl given intrathecally were compared.*

**Materials and Methods:** *The patients were randomly allocated into 2 groups, each having 50 patients. Group A: receiving 1.5ml of 0.5% hyperbaric bupivacaine (7.5mg) Group B:receiving 1ml of 0.5% hyperbaric bupivacaine+25 µg fentanyl. Standard subarachnoid block was performed with 27G Quinckie type spinal needle in sitting position in L3-L4 space after infiltrating the space with 2cc of 2%lignocaine and drugs were injected after checking the free flow of csf under strict aseptic conditions. observations were recorded and the results were analysed statistically.*

**Results:** *Addition of Fentanyl 25µg to Bupivacaine resulted in significant faster onset of sensory block(mean time 2.35 minutes as compared to 3.51minutes in group1) and motor block ( mean time of 5.26 minutes as compared to 6.39minutes in group1). The time taken to reach T10 dermatomal level was also faster in group II, though the maximum height of sensory block achieved was comparable in both groups. Time for two segment regression was faster in group II and was significant. Duration of analgesia was significantly prolonged in group II (mean duration of 714.7minutes as compared to 177.28minutes in group1).*

**Conclusion:** *It is concluded that intrathecal Fentanyl 25µg with 5mg of hyperbaric Bupivacaine provides adequate and satisfactory anaesthesia for TURP.*

**Keywords:** *Spinal anaesthesia, TURP, Fentanyl.*

**Introduction**

The patients undergoing TURP are elderly with co-existing cardiac and pulmonary diseases with compromised reserves. Spinal anesthesia is the most widely used technique for this procedure as

the elderly patients tolerate regional anesthesia better and as the signs and symptoms of water intoxication, fluid over load, bladder perforation which are associated with TURP Can be detected at the earliest.<sup>1,2</sup>

It is also important to limit the distribution of spinal block to reduce adverse haemodynamic and pulmonary effects in such patients. For decades Hyperbaric 5% lignocaine has been the local anaesthetic of choice for spinal anesthesia for urologic procedures for rapid recovery. However several editorials have questioned the used of Lignocaine for spinal anesthesia because of the frequency of Transient neurological symptoms (TNS).<sup>3,4,5</sup> These observations generated interest in alternative local anesthesia solution, the addition opioids to small doses of local anaesthetics administered intrathecally has a synergistic effect in augmenting the blocks without prolonging the motor recovery.<sup>6,7,8</sup>

The use of spinal opioids has grown rapidly since their first application in 1979. The aim of using neuraxial opioids is to achieve as good analgesia as with systemic administration and to do it with smaller doses and systemic concentration and the risk of systemic side effects. This lead to the use of intrathecal Morphine but, was associated with side effects like respiratory depression, nausea, vomiting due to slower uptake and longer duration of action with higher CSF concentration with rostral spread of the narcotic. These considerations lead to the use of more lipophilic drugs such as Fentanyl, Sufentanil. Which are more potent and has the advantages over Morphine such as rapid uptake with short duration of action with low CSF concentration with limited rostral spread of narcotic and less respiratory depression and early motor recovery compared to Morphine.<sup>9</sup>

The various physiological alterations in elderly patients may cause significant increases in maximum spread, rate of onset of motor block and cardiovascular instability regardless of solution used.

Age related changes in spinal anatomy, Nerve physiology and cardiovascular reflexes with these changes in the elderly has lead to limit the distribution of spinal block. This lead to the use of small doses of local anesthetic combined with lipophilic opioids administered intrathecally, to produce enhancement of spinal anesthesia without

prolonging motor recovery and reduce adverse cardiovascular and pulmonary effects in such patients.<sup>10</sup>

The present study is aimed at evaluating the efficacy of intrathecal Fentanyl as an adjuvant to intrathecal Bupivacaine (Hyperbaric) in patients undergoing TURP.

### Aims and Objectives

1. To study the efficacy of low dose Bupivacaine 0.5% (Hyperbaric) plus Fentanyl 25µg for spinal anesthesia in providing adequate sensory and motor block for the procedure.
2. To study the haemodynamic and respiratory effects and the incidence of postoperative nausea, vomiting and shivering.
3. To study any adverse effects like pruritis, TNS.

### Methodology

**Design:** Prospective Randomized Comparative Study.

**Study Population:** 100 Patients - 50 In Each Group.

**Place of Study:** Mamata General And Super Specialty Hospital, Khammam

### Inclusion Criteria

Hundred patients ,asa grade II- III aged 60-80years posted for trans urethral resection of prostate in mamata medical college were studied, the patient were divided into two groups of 50 each.

Group A: receiving 1.5ml of 0.5% hyperbaric bupivacaine (7.5mg)

Group B: receiving 1ml of 0.5% hyperbaric bupivacaine+25µg fentanyl.

### Exclusion Criteria

- Patients who refuse spinal anesthesia
- Patients requiring general anaesthesia
- Patients on anticoagulant therapy
- Patients with bleeding diathesis
- Patients with infections on the back

- Patients with spinal deformities
- Patients with history of peripheral neuropathy
- Patients with CNS disorders

**Parameters to Be Studied**

- Onset of sensory block
- Quality of analgesia
- Onset of motor block
- Hemodynamic parameters
- Reduced need for post operative analgesia
- Post operative nausea and vomiting.

**Technique**

All Patients Were Examined and Investigated a Day Prior To Surgery and Were Advised Fasting For 6 Hours Prior To Surgery

After obtaining valid consent and confirming recommended starvation status the patients were wheeled in to the operating theatres, No sedative or analgesic premedication was administered, SAB was performed in operation theatre equipped with standard monitoring devices, oxygen source, suction and resuscitation equipment and drugs. Venous access was obtained in the dorsum of the non-dominant hand or in the cubital fossa with 18 G cannula and an infusion of crystalloid was commenced. The patient is then placed in the sitting position with some flexion of the vertebral column to open the intervertebral spaces. After identifying the L3-L4 intervertebral space, the skin is infiltrated with 2% lignocaine solution. Lumbar puncture is done using 27G pencil-point spinal needle. After confirming free flow of clear cerebrospinal fluid, patients will receive subarachnoid block with 0.5% hyperbaric bupivacaine and the adjuvant 25µg fentanyl depending on whether the patient is in group A or B respectively. Anesthesiologist performing the block was blinded to study drug and recorded intraoperative and post-operative data. Patients were then positioned supine and oxygen is supplied through face mask to maintain saturations of more than 95%. Heart rate, blood pressure and respiratory rate were recorded every 10 minutes intraoperatively till the end of surgery.

Sensory block was assessed by cold alcohol swab along the mid clavicular line bilaterally.

Motor block was assessed by modified Bromage scale.

Intraoperative nausea and vomiting, pruritis, additive analgesia and sedation were recorded.

**Hypotension**

Defined as decrease in systolic BP>30 % below the base line or systolic BP < 100mmhg. Hypotension will be treated with intravenous bolus of crystalloid fluid and mephentermine 6mg.

**Bradycardia**

Defined as Heart rate <50/min will be treated with intravenous atropine 0.6 mg.

**Post-Operative Pain**

Any patient having visual analogue score of more than 4 is considered to have pain post-operatively. Patients are administered oral / parenteral analgesia as follows to counter this pain

1. Paracetamol 1g
2. Tramadol 50 – 100 mg
3. Morphine 5 – 10 mg.

**Sensory Block**

**Table1.** Onset of sensory blockade

Time in minutes	Group I	Group II
Minimum	2.5	1.5
Maximum	4	3
Mean	3.51	2.35

P <. 000

The mean time for onset of sensory block in group I was 3.15minutes compared 2.35 minutes in group II with P<. 000.

**Table 2.** Time for sensory level to reach T10

Time in minutes	Group I	Group II
Minimum	4.5	2.5
Maximum	6	5
Mean	5.32	3.74

P<. 000

The mean time to reach T10 group I was 5.32minutes and in group II was 3.74minutes with P<. 000.

**Table 3.** Height of Analgesia

Height of Analgesia	No. of Patients	Group I (%)	No. of Patients	Group II (%)
T8	0	-	2	4
T9	11	22	12	24
T10	39	78	36	72
Total	50	100	50	100

t=8.214, P<.000

Highest level of sensory level reached in group II was T8 in two cases (4%) and majority of patients in both groups the maximum level of

sensory block attained T10 (78% in group I and 72% in group II).

**Table 4.** Onset of Motor block

Group I (minutes)	Group II(minutes)
6.39	5.28

t=8.217, P<.000

We observed that the onset of motor block was faster in group II (5.28 minutes) as compared to group I (6.39 minutes) which was statistically significant.

**Table 5.** Mean pulse rate

Mean pulse rate / min	Pre	0 min	10 min	20 min	30 min	40 min	60 min	90 min
Group I	77.08	76.18	73.72	72	71.92	71.92	71.46	71.3
Group II	76.88	75.18	73.42	73.42	72.08	71.8	73.12	73.82
Total	76.98	75.68	73.57	72.71	72	71.86	72.29	72.56

Fchange = 16.416, P<.000

Fchange x groups = 1.682, P<.110

**Table 6.** Means of mean arterial pressure

Mean MAP	Pre	0 min	10 min	20 min	30 min	40 min	60 min	90 min
Group I	99.96	95.96	92.54	89.94	89.06	88.86	87.86	87.9867
Group II	95.22	93.72	91.82	91.06	89.6	89.86	89.78	89.62
Total	97.59	94.84	92.18	90.05	89.33	89.36	88.82	88.80

Fchange = 112.76, P<.000

Fchange x groups = 14.066, P<.000

MAP was compared in both groups and was found to be statically insignificant.

**Table 7.** Mean Respiratory rate

Respiratory rate cycles/min	Pre	0 min	10 min	20 min	30 min	40 min	60 min	90 min
Group I	15.74	15.84	15.74	15.78	16.24	16.02	15.94	16
Group II	15.42	15.44	15.78	15.84	15.78	15.84	15.68	15.92

P<.702

Mean respiratory rate was lower in group II and was statistically insignificant with value <.702.

**Table 8.** Time for two segment regression

Time in minutes	Group I (minutes)	Group II (minutes)
Minimum	60	68
Maximum	73	73
Mean	66.06	63.08

t= - 4.483, P<.000

In our study the mean time of sensory regression was 66.06 minutes in group I and 63.08 in group II and was statistically significant.

**Table 9.** Duration of Analgesia

Mean Duration of Analgesia	Group I (minutes)	Group II (minutes)
	177.28 $\pm$ 12.05	214.7 $\pm$ 11.53

$t = -15.856, P < .000$

The mean time for rescue analgesia was 214.7  $\pm$  11.53 minutes in group II as compared to 177.28  $\pm$  12.05 minutes in group I and is significant.

**Table 10** Intraoperative complications

Intraoperative complications	Group I	Group II
Nil	27	41
Hypotension	7	0
Bradycardia	6	2
H + B	1	0
Pruritis	0	5
Nausea	4	0
Vomiting	0	0
Shivering	5	2
Respiratory depression	0	0
Total	50	50

$P < .001$

1. The Intraoperative complication were comparable in both groups and resulted that group I 7 patients (14%) had hypotension has compared to 0 % in group II. Bradycardia was observed in 6 patients (12%) in group I and 2 patient (4%) in group
2. Hypotension and Bradycardia was observed in 1 patient (2 %) in group I. Pruritis was observed in 5 patients (10%) in group II and was not observed in group I. Nausea was observed in 4 patients (8%) in group I. Shivering was noted in 5 patients (10%) in group I and 2 patients (4%) of group II.

## Discussion

One of the age related conditions in males is Benign hyperplasia of the prostate, as such the patients undergoing TURP are elderly, with co-existing cardiac, pulmonary and metabolic disorders and compromised reserves. Spinal anaesthesia is the most widely used technique for

the procedure as the elderly tolerate regional anaesthesia better, because with spinal anaesthesia physiological disturbances are minimal and adequate muscle relaxation is provided which allows relaxation of the pelvic floor, perineal and thigh muscles for improved surgical access and also early recognition of fluid overload, bladder perforation<sup>1,2</sup>.

Due to the age related changes in spinal anatomy, nerve physiology and cardiovascular reflexes in elderly it is important to limit the distribution of spinal block to reduced the adverse haemodynamic and pulmonary effects.

For decades hyperbaric Lignocaine 2% or 5% has been the local anaesthetic of choice for spinal anaesthesia for these procedures for rapid recovery. However, several editorials have questioned the use of Lignocaine because of the frequency of Transient neurological symptoms<sup>3,4,5</sup>. This has lead to the use of alternative local anaesthetic solutions, with addition of small doses of opioids intrathecally to produce synergistic effect in augmenting the block without prolonging motor recovery with minimum side effects<sup>6,5</sup>.

In the early 1970`s it became evident that several subtypes of opioids receptors existed .Mu opioids receptor which are highly concentrated in superficial layers of the dorsal horn all along the spinalcord. Kappa receptors are highly concentrated in the superficial layers of the lumbo-sacral spinal cord, the density decreased in upper levels of the spinal cord and associated with visceral pain nociceptive inputs<sup>71,72</sup>.

The use of spinal opioids has grown rapidly since their first application in 1979. The aim of using neuraxial opioids is to achieve as good analgesia as with systemic administration, but in small doses and concentrations without the risk of systemic side effects. Morphine was the first drug to be used mainly for intractable pain and later it was found to be associated with side effects like respiratory depression, nausea vomiting due to slower uptake and longer duration of action with higher CSF concentration with rostral spread of the narcotic due its low

lipophilic nature. These considerations lead to the use of more lipophilic drugs such as Fentanyl, Sufentanil which are more potent with rapid uptake, short duration of action with low CSF concentrations and limited rostral spread, thereby, less incidence of respiratory depression and early motor recovery<sup>9</sup>.

In this comparative study 100 patients in the age group of 60-80 years belonging to ASA II-III posted for transurethral prostatectomy were selected. The patients were randomly distributed into two groups.

Group I- 1.5 ml of hyperbaric Bupivacaine 0.5% (7.5mg).

Group II- 1ml of hyperbaric Bupivacaine 0.5% (5mg) +25µg of Fentanyl

**Table 11.** The results of present study.

	Group1	Group11	P value
Mean age (years)	67.5	68.32	<.217
Mean onset of sensory block(min)	3.15	2.35	.000
Mean time taken to reach T10	5.32	3.73	.000
Mean onset of motor blockade (min)	6.39	5.26	.000
Mean time for two segment regression(min)	66.06	63.08	.000
Mean time of post operative analgesia(min)	177.28	214.7	.000
Mean duration of surgery(min)	43.44	43.54	.955
Hypotension	7	0	.000
Bradycardia	6	2	
H+B	1	0	
Shivering	5	2	
Pruritis	0	5	
Nausea	4	0	

### Coexisting Diseases

In this study of 100 patients who were randomly distributed, 13 (13%) patients were found to have cardiac problems like IHD, valvular diseases, and 18(18%) patients had respiratory problems like chronic bronchitis and emphysema and 32(32%) of patients were hypertensives and 1(1%) patient had both hypertension and COPD. So all these patients were thoroughly investigated and appropriately treated and optimised before the surgery.

### Sensory Block

In the present study the mean onset of sensory block in group I was 3.51 minutes and in group II 2.35 minutes which was significant P.000. Most of the authors have not mentioned this observation.

It was that the time taken to reach dermatomal level T10 was significantly shorter in group II (mean 3.7 minutes) and in group I (Mean 5.3 minutes). This is in correlation with Diana et al, the time to reach dermatomal level T 10 was 13.5 minutes in plain Bupivacaine group and 10.1 minutes in Fentanyl group. This is because the dose of Bupivacaine used was higher (12.5mg).

Maximum level reached was T8 in 2 (4%) patients in group II and this could not be explained. The addition of adjuvants to local anaesthetic solutions, may reduce the density of the latter. In theory, it may appear hypobaric but no effect has shown in clinical practice.<sup>14</sup>

This study showed that the time of two segment regression was significantly shorter in group II (mean 63.08 minutes) as compared to group I (mean 66.06 minutes) which was longer. As previous studies by Karamaz et al who observed that the time of two-segment regression was 88.4 minutes in Fentanyl group and 92.8 minutes in Bupivacaine group.

We observed that the duration of analgesia was significantly more in group II (214.7 minutes) as compared to 177.28 minutes in group I. This was comparable to the previous studies showing the duration of analgesia in Fentanyl group to be 222.1 minutes in Bupivacaine group to be 192.3 minutes and no patients demanded rescue analgesia within this period.

The addition of intrathecal Fentanyl to spinal anaesthesia has been shown to improve the quality of block, increasing the duration of sensory block, and provide post-operative analgesia without affecting motor function blockade of Aδ and especially C fibres by intrathecal Fentanyl may explain the increased dermatomal spread.

### Motor Block

From our study we observed that the onset of motor block was faster in group II (mean 6.39 minutes). Most of the authors have not mentioned on this parameter.

Study results showed that the duration of motor block was shorter in group II (mean 90 minutes) as compared to 105 minutes in group I patients which was significant. This is in correlation with the previous observations by Kararmaz et al showing longer duration of motor block in Bupivacaine group (134.2 minutes) and less in Fentanyl group (105.6 minutes).

### Intra-Operative Monitoring and Complications

Continuous monitoring of heart rate, blood pressure SPO<sub>2</sub>, ECG, respiratory rate were done to assess the haemodynamic and respiratory effects of intrathecal Fentanyl when added to a conventional dose of hyperbaric Bupivacaine. There were no fresh ST, T wave changes, arrhythmias in any of the patients including the one with preexisting cardiac condition.

In our study intra-operative parameters were comparable in both groups.

Hypotension was observed in 7 (14%) patients in group I. There was no hypotension in group II patients, though the patients were more than 76 years (16%) patients and also (16%) of cases had cardiac ailments. Surprisingly, there was no hypotension in these cases also showing that group II were more haemodynamically stable. Hypotension was treated when the systolic arterial pressure decreases by 20% - 30% or to less than 80-100 mmHg.

Bradycardia was encountered in 6 (12%) patients in group I and 2 (4%) patients in group II. Bradycardia was taken into account when heart rate went below 50 beats per minute, treated with Inj. Atropine 0.6 mg whenever necessary.

10 (20%) cases of group I were anxious and received Inj. Midazolam 1 mg, intra-operatively where as no such observation was seen in group II. Pruritis was observed in 5 (10%) patients of group II and none of the patients of group I had

Pruritis. None of the patients required treatment which subsided by itself. Several authors have noted in their study occurrence of Pruritis as the common adverse effect in patients receiving Fentanyl.

The Kristiina et al, Kararmaz et al, Diana-fernandaz et al, have all noted Pruritis in their observations.

Nausea was felt by 4 (8%) patients in the post-operative period in group I.

Shivering was observed in 5 (10%) patients in group I and 2 (4%) patients in group II. Studies have shown that using the irrigating fluids which are stored at room temperature and significant absorption of this fluid caused shivering and also studies resulted that addition of Fentanyl to low doses of Bupivacaine decreased the incidence of shivering during spinal anaesthesia in elderly patients.

All patients had SPO<sub>2</sub> of 98%, and none of the patients had respiratory depression which is said when respiratory rate  $\leq 12$  beats per minute and oxygen saturation was  $< 94\%$  with room air. Studies by Varassai et al demonstrated that the subarachnoid administration of 25  $\mu$ g of Fentanyl during spinal anaesthesia in nonpremedicated did not alter the respiratory rate, end tidal tension of CO<sub>2</sub>, minute ventilation. On the contrary, 50  $\mu$ g of subarachnoid Fentanyl could cause an early respiratory depression in elderly patients.

### Conclusion

The recent advances in the field of Medicine has resulted in longevity of life and hence more and more geriatric patients are subjected to surgery and anaesthesia. TURP is the surgical technique of choice for patients with Benign hyperplasia of prostate which is usually performed under spinal anaesthesia due to its advantages. Due to the physiological changes pertaining to cardiovascular and respiratory system drug metabolism, and spinal anatomy there is continuous quest for limiting the block by reducing the concentration and dosage of the local anaesthetics and also by

adding adjuvants to achieve augmentation of the block with minimal adverse effects.

In this study 25µg of Fentanyl was used as an adjuvant to 1ml (5mg) of hyperbaric Bupivacaine and compared the effects with 1.5ml (7.5mg) of hyperbaric Bupivacaine.

Our observations revealed that addition of Fentanyl was found to be advantageous in the following ways:

1. Quickens onset of sensory and motor block.
2. Provided excellent surgical anaesthesia and good muscle relaxation to facilitate the positioning .
3. Provides haemodynamic stability .
4. Earlier motor recovery.
5. No respiratory depression and no intravenous supplementation .
6. Reduces the incidence of shivering .
7. Can produce mild pruritis which does not require any treatment.
8. No post-operative complications like TNS.

This study shows that intrathecal Fentanyl 25µg acts synergistically to potentiate Bupivacaine induced sensory block, with early motor recovery good haemodynamic stability, reduces the need for post operative analgesics, without any significant adverse effects.

It is concluded that intrathecal Fentanyl 25µg with 5mg of hyperbaric Bupivacaine provides adequate and satisfactory anaesthesia for TURP.

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