Original Research Article

Low dose bupivacaine and bupivacaine with fentanyl for spinal anesthesia for transurethral resection of prostate

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Abstract

Background: Spinal anesthesia is most frequently used for transurethral prostatectomy (TURP), because it permits early recognition of transurethral resection of prostate (TURP) syndrome and bladder perforation. In this study, we compared the effects of low dose bupivacaine (5 mg) with fentanyl (25µg) and conventional dose of bupivacaine (7.5 mg) in elderly patients undergoing TURP. This comparative study was conducted to evaluate the efficacy of addition of fentanyl 25 µg intra thecally to bupivacaine 5 mg and bupivacaine 7.5 mg alone for transurethral prostatectomy.

Material and methods: The patients were randomly allocated into 2 groups, each having 30 patients. Group-A: Inj. Bupivacaine 5 mg (0.5%) (1ml) + Inj. Fentanyl 25 µg (0.5 ml). Group-B: Inj. Bupivacaine 7.5 mg (0.5%) (1.5 ml). A standard subarachnoid block was performed in L2-L3 / L3-L4 Space in sitting / lateral position with 22G/23G BD spinal needle (Quinky type, 3.5 inch long) under all aseptic and antiseptic precautions after local infiltration of skin and subcutaneous tissue with 2 cc 2 % lignocaine. Drugs were injected after checking of free flow of CSF and according to group selected. All the observations were recorded and all the results were analyzed statistically.

Results: The mean time of onset sensory blockade was significantly shorter in group A than group B. Group A took less time to reach the peak sensory level (3.57 min) as compared to group B (5.8 min). Onset of motor blockade was delayed in group B as compared to group-A, and the differences were statistically significant. Changes in pulse rate of all groups are statically not significant and comparable. The incidence of hypotension and shivering was significantly higher in group B as compared to group A.

Conclusion: It was observed that intra thecal bupivacaine 5 mg combined with fentanyl 25 µg provided adequate anesthesia for TURP in elderly patients and is associated with lower incidence of hypotension and shivering than a conventional dose of bupivacaine. The addition of fentanyl

improves the quality of block, increases duration of sensory block and makes the blockade hemodynamically more stable than conventional dose of bupivacaine.

Key words

Bupivacaine, Fentanyl, Spinal anesthesia, TURP.

Introduction

Spinal anesthesia is most frequently used for transurethral prostatectomy (TURP), because it permits early recognition of transurethral resection of prostate (TURP) syndrome and bladder perforation [1]. In addition, short-acting spinal anesthesia may help to prevent complications associated with delayed immobilization. Lidocaine [2] has been a popular anesthesia for urologic procedures. When hyperbaric 5% lidocaine is used for spinal anesthesia, patients recover rapidly. However, several editorials have questions the use of lidocaine for spinal anesthesia because of the frequency of transient neurologic symptoms. Lipophic opioids (e.g. fentanyl and sufentanil) [3] are increasingly being administered intrathecally as adjuncts to local anesthetics. They enhance spinal anesthesia without prolonging motor recovery and discharge time [3, 14, 18]. This study was designed to examine whether adding, 25 µg of fentanyl to bupivacaine would intensify sensory and motor block without increasing sympathetic blockade and prolonging recovery time. In this study, we compared the effects of low dose bupivacaine [4] (5 mg) with fentanyl (25 µg) and conventional dose of bupivacaine (7.5 mg) in elderly patients undergoing TURP. This comparative study was conducted to evaluate the efficacy of addition of fentanyl 25 µg intra thecally to bupivacaine 5 mg and bupivacaine 7.5 mg alone for transurethral prostatectomy.

The parameters observed were: Onset and duration of sensory blockade, Onset and duration of motor blockade, Effect on vital parameters, Incidence of intraoperative and post – operative complications in both groups, To compare the duration of sensory and motor block.

Material and methods

After obtaining informed and written consent, 60 patients undergoing transurethral prostatectomy, ASA risk I-III were selected for the study. Pre-anesthetic check up was done on the previous day of surgery. Routine and specific investigations were noted. All patients were informed in general terms regarding the procedure of study and their queries were answered. Patients with spinal deformities, neurological disorders, mental disturbances, acute/chronic infection, known hypersensitivity to local anesthetic agents and bleeding disorders were excluded from the study.

The patients were randomly allocated into 2 groups, each having 30 patients.
Group-A: Inj. Bupivacaine 5 mg (0.5%) (1ml) + Inj. Fentanyl 25 µg (0.5 ml)
Group-B: Inj.Bupivacaine 7.5 mg (0.5%) (1.5 ml)

All the patients were fasted over night. No patient received any sedative or narcotic premedication before arrival in the operation theatre. All patients had received Inj. Ondansetron 4 mg i.v and inj. Ranitidine 50 mg i.v. 30 min. before surgery. Patients were taken to the O.T. and pulse rate, blood pressure, ECG, SpO_2, respiratory rate, temperature were noted intravenous line was secured with 18 G intra cath. A standard subarachnoid block was performed in L_2-L_3 / L_3-L_4 Space in sitting / lateral position with 22G/23G BD spinal needle (Quinky type, 3.5 inch long) under all aseptic and antiseptic precautions after local infiltration of skin and subcutaneous tissue with 2 cc 2 % lignocaine. Drugs were injected after checking of free flow of CSF and according to group selected. Immediately after completion of block, patients were remained in supine position until

adequate sensory and motor blockade reached to required level of surgery. After that all the patients were placed in the supine lithotomy position and then surgery was started.

Criteria of block

Onset of sensory block: Sensory block was assessed every 30 seconds by pin prick method. At the L_1 level, failure to perceive pain on prick was taken as the onset of sensory block. **Onset of motor block:** Motor block was assessed by using the modified Bromage Scale. It was recorded every 5 minutes until the surgery started. After surgery, total duration of motor blockade was noted.

Bromage scale [5]:

- Grade-0: No block – full flexion of knee and feet.
- Grade-I: Partial block - just able to flex knee but full flexion on feet.
- Grade-II: Almost complete block – unable to flex knee but complete flexion of feet possible.
- Grade-III: Complete block: Unable to flex knee and feet.

Peak level of sensory block

Time to peak level of sensory block was calculated from the time of drug injection intra thecally to the time at which the sensory blockade reached the highest dermatome level and stabilized. Dermatomal levels were tested every 2 min from injection until the level stabilized for four consecutive tests. Testing was then conducted every 10 minutes until 2 segment regression. Further testing was then performed at 20 minute intervals in the recovery room until recovery of the S_2 dermatome. Thus, total duration of sensory blockade was recovered.

Hemodynamic changes

Intraoperative vital signs like pulse rate, blood pressure were recorded every 3 min in the first 15 min after spinal anesthesia and then every 15 min until the end of surgery. Postoperatively the parameters were recorded at 30 min intervals until the patient met the criteria for discharge. IV fluids were administered according to requirement. Criteria for hypotension was considered as BP below 30% of preinduction value and bradycardia was considered if fall in heart rate was greater than 20% of preinduction value. Hypotension was treated by bolus of intravenous fluids and if necessary Inj. Mephentermine 15 mg i.v. was given. Bradycardia was treated by Inj. Atropine 0.6 mg i.v. defined as HR < 60/min. The duration of spinal anesthesia was calculated from the time of spinal injection to the time taken for two level sensory regression from the peak block height. Time of sensory regression to below L_5 level and time to complete motor resolution were recorded from the time of spinal injection.

Complications [6]

All the patients were observed for intra-operative complication like Bradycardia, Hypotension, Arrhythmias, Respiratory Depression defined as respiratory rate of less than or equal to 8/min or oxygen saturation of $\leq$ 85%, Nausea, vomiting if present, were treated with Inj. Ondansetron 4 mg i.v, Rigors, shivering, Itching, post operative pruritus was controlled with 120 mg of oral Fexofenadine (a non=selective H_1 antagonist)

The duration of surgery was recorded. Post-operatively all patients were assessed hourly for 3 hours and then hourly up to 12 hours in recovery room. Duration of sensory and motor block was recorded. Post-opertive complications were observed.

Statistical method

All the observations were recorded and all the results were analyzed statistically. Data were present as mean $\pm$ SD. For comparing data between 2 groups, Z test was used and Z Values > 2 were interpreted as statistically significant.

Results

In our study, we had selected 60 patients of BPH of ASA-I, II, III [7] undergoing TURP and divided into two groups, 30 patients in each group. There was no difference between the

groups regarding their age, weight and height as per **Table - 1**.

Table – 1: Demographics.

	Group - A	**Group - B**
Age (years)	64.8 ± 86.6	62.8 ± 8.60
Weight (Kg)	56.97 ± 7.84	57.76 ± 7.64
Height (cm)	170.33 ± 7.60	169.73 ± 8.68

As per **Table – 2**, average median height of sensory block was T10 in both groups. The mean time of onset sensory blockade was significantly shorter in group A than group B. Group A took less time to reach the peak sensory level (3.57 min) as compared to group B (5.8 min). The difference in time taken to reach the peak height of sensory blockade was significant. Duration of sensory blockade was longer in group A (164.70 ± 12.7) as compared to group B (159.0 ± 8.84) and it was statistically significant.

Assessment of motor block was as per **Table - 3**. Onset of motor blockade was delayed in group B as compared to group-A and the differences were statistically significant. Duration of motor blockade was longer in group B (134 ± 11.32 min) as compared to group A (119 ± 8.85) and it was statistically significant. None of the patients needed supplementation of analgesia during operation and surgeons were satisfied with the intensity of sensory and motor block in both groups. Total duration of surgery was comparable in two groups as per **Table - 4**. Changes in pulse rate of all groups are statically not significant and comparable as per **Table - 5**. Fall in arterial blood pressure in group B was significantly more as compared to group A as per **Table - 6**.

Table – 2: Sensory blockade.

Sensory Blockade	**Group-A**	**Group-B**	**Z Value (Group - A and B)**
Time of onset sensory block (min) (Mean ± SD)	0.79 ± 0.38	1.10 ± 0.43	2.98
Peak sensory block level (Mean)	T_8	T_{10}	
Time to reach peak sensory block level (min) (Mean ± SD)	3..57 ± 0.93	5.8 ± 1.03	8.88
Duration of sensory block (min) (Mean ±SD)	164.70 ± 12.7	159.0 ± 8.84	2.1

Table – 3: Motor blockade.

Motor Blockade	**Group-A**	**Group-B**	**Z Value (Group-A and B)**
Time of onset sensory block (min) (Mean ± SD)	1.62 ± 0.58	2.05 ± 0.44	3.23
Duration of motor block (min) (Mean ±SD)	119 ± 8.85	134 ± 11.32	5.72

Table – 4: Duration of surgery.

	Group A	**Group B**
Duration of surgery (min) (Mean ± SD)	46.83 ± 11.78	46.33 ± 12.38

Table – 5: Changes in pulse rate/min (Mean ± SD).

Time	Group A	Group B
Pre-operative	8713 ± 10.77	86.00 ± 9.15
5 min	83.60 ± 0944	81.53 ± 8.15
10 min	81.73 ± 08.92	80.60 ± 8.60
15 min	81.40 ± 896	79.93 ± 8.09
20 min	80.80 ± 09.03	79.53 ± 7.75
30 min	82.20 ± 9.54	77.53 ± 7.35
40 min	82.53 ± 9.70	77.10 ± 7.11
50 min	82.96 ± 9.79	76.13 ± 7.45
60 min	81.73 ± 9.50	75.26 ± 7.17

Table – 6: Changes in Arterial Blood Pressure (mmHg) (Mean ± SD).

Time	Group A		Group B	
	Systolic BP	Diastolic BP	Systolic BP	Diastolic BP
Pre-operative	129.33 ± 13.75	82.06 ± 7.24	128.20 ± 12. 80	82.53 ± 08.72
5 min	120.93 ± 12.19	76.93 ± 7.25	117.86 ± 14.07	74.73 ± 10.10
10 min	119.93 ± 11.30	76.26 ± 6.72	116.40 ± 13.98	73.00 ± 10.60
15 min	118.06 ± 11.47	74.80 ± 7.99	112.93 ± 18.31	73.33 ± 08.09
20 min	117.20 ± 09.93	74.60 ± 5.70	115.73 ± 10.44	72.86 ± 06.53
30 min	121.06 ± 12.83	75.60 ± 6.54	115.00 ± 9.24	72.26 ± 05.65
40 min	120.53 ± 11.45	75.60 ± 5.81	111.4 ± 20.38	71.20 ± 06.40
50 min	121.60 ± 11.23	75.26 ± 6.35	115.06 ± 7.13	72.33 ± 07.10
60 min	120.86 ± 11.72	76.33 ± 7.22	114.46 ± 7.04	71.80 ± 06.46

Incidences of intra-operative complications were as per **Table - 7**. The incidence of hypotension and shivering was significantly higher in group B as compared to group A. Pruritus was the most common adverse effect in patient who received intra thecal fentanyl (group A) and none of patients had needed treatment for the same. No patient suffered from nausea and vomiting in both the groups.

Table – 7: Intra-operative complications.

Intra-operative complication	Group A	Group B
Hypotension	0	4
Bradycardia	0	1
Pruritus	3	0
Nausea	0	0
Vomiting	0	0
Shivering	0	5
Respiratory depression	0	0

Discussion

With increase knowledge of potential safety, benefits, increased experience with the technique and moreover early diagnosis of TURP syndrome in awake state, spinal anesthesia is becoming more popular and preferred technique in TURP. Spinal anesthesia is easier to perform, it has rapid and predictable onset, produces more intense and complete block and has high success rate [8]. Intra thecal opioids are synergistic with local anesthetics intensify the sensory block without increase the sympathetic block. The addition of fentanyl to hyperbaric bupivacaine increases the intra-operative quality of subarachnoid block and synergistic anti-nociceptive effects with local anesthetics. The major advantages of neuraxial opioids are the preservation of preganglionic sympathetic function (selective spinal anesthesia), post-operative analgesia and augmentation of spinal

anesthesia using local anesthetics [9]. Lipophilic opioids are increasingly being administered intra thecally as adjuvant to local anesthetics. They enhance spinal anesthesia without prolonging motor recovery and discharge time [10]. The combination makes it possible to achieve spinal anesthesia with otherwise inadequate doses of local anesthetics as intra thecal opioids offer hemodynamic stability [11]. We carried out a study in 60 patients of varying age, weight, height of ASA risk I-III planned for TURP. All patients were randomly divided into 2 groups A and B, each having 30 patients. The present study shows that in elderly patients adding of 25 µg of fentanyl to bupivacaine 5 mg provides adequate spinal anesthesia for TURP and better hemodynamic stability than conventional dose.

Onset and duration of block

The spread of sensory block was assessed by pin prick and motor block by Bromage score. In our study, the onset time for a maximum sensory block was lower in group A as compared to group B and total duration of sensory block was longer in group A as compared to group B. Onset of motor blockade was delayed in group B as compared to Group A and duration of motor blockade was longer in group A. A number of studies have used 25µg of intra thecal fentanyl as adjunct to the anesthetic agent with good results. 25µg of fentanyl provides maximum duration of post-operative analgesia with minimal side effects like respiratory depression and pruritus as studied by Biswas, et al. [12]. Uses of lower doses of bupivacaine with fentanyl reduce the intensity of motor blockade. As studied by Dehlgren, et al. [13] and Liu, et al. [14] found that fentanyl 20 µg in combination with spinal lidocaine prolongs sensory anesthesia without prolonging recovery of motor function or time to micturition. Sensory block was prolonged in both thoracic and lumbar dermatomes with the addition of fentanyl. Ben-David, et al. [15] found that a small dose of diluted bupivacaine (5 mg) in ambulatory patients undergoing knee arthroscopies intensified and increased the sensory blockade without increasing intensity of motor block or prolonging recovery of micturition or stress fitness. He showed that fentanyl added to bupivacaine did not affect median block level, but it intensified sensory blockade and increased duration of sensory block. Kuusneimi, et al. [16] studied the effects of adding fentanyl 25 µg to 3 different doses of bupivacaine (10, 7.5, 5 mg) and compared it with 10 mg bupivacaine without fentanyl in spinal anesthesia for urological surgeries. They concluded that the addition of 25 µg of fentanyl to 5 mg bupivacaine resulted in shorter lastin motor block but maintained the same level of sensory analgesia as with larger doses of bupivacaine (7.5, 10 mg) with or without fentanyl. Boucher, et al. [17] suggested that fentanyl did not change the characteristics of spinal block with spinal procaine. We added fentanyl to bupivacaine to determine its effect on anesthesia quality, motor block and sensory block. Opioids are increasingly being administered intra thecally as adjuncts to local anesthetics. Various studies have indicates the synergism between intra thecal opioids and local anesthetics may allow a reduction in the dose of local anesthetics and reduce hypotension, while still maintaining adequate anesthesia [18]. In our study, fentanyl increase dermatomal spread without affecting motor function. These results are consistent with those studies in which it has been demonstrated that fentanyl added to small dose of local anesthetics improve the quality of block and increase duration of sensory block. Beers, et al. [19] reported that a mid-lumbar block level provided adequate anesthesia for TURO, when bladder pressure kept low. Sensory block up to T_{10} is necessary to provide adequate analgesia. The sensory block was frequently higher than full level, when bupivacaine 5 mg combined with 25 µg of fentanyl was used for spinal anesthesia. In our study, median block height was higher in group A as compared to Group B. The surgeon who carried out all the procedures in study ensures that the bladder is regularly emptied. Cheng Wang, et al. [20] studied that bupivacaine alone or with opioids, has been shown to provide adequate pain relief without motor paralysis. They concluded that intra thecal bupivacaine has no selectivity for the

afferent and efferent pathways and fentanyl acts synergistically to enhance the effect of bupivacaine on the afferent pathway. A. Kararmaz, et al. [21] evaluated the effects of intra thecal administration of low dose bupivacaine 4 mg with fentanyl 25 µg (Group A) and compared it with plain bupivacaine 7.5 mg (Group B) for TURP and reported that median sensory height of T_{10} in both the groups. The addition of fentanyl provides adequate analgesia for TURP. The mean level of motor block was higher and duration of motor block was longer in Group B.

Hemodynamic changes

There was no any significant difference in mean heart rate. BP in group B was lower in first 10 minutes than group A. Hypotension and bradycardia in our study could be explained by high level of sympathetic blockade and elderly patients. Fluid loading has not always been effective since the reduced physiological reserve of the elderly makes them less able to increase their cardiac output in response to fluid loading. Hypotension was treated with Inj. Mephentermine and no complications related to further myocardial ischemia were observed during intra and post operative period. A. Kararmaz, et al. studied that intra thecal bupivacaine 4 mg combined with fentanyl 25 µg provides adequate anesthesia for TURP in elderly patients and is associated with a lower incidence of hypotension than a conventional dose of bupivacaine (7.5 mg). Critchley, et al. suggested that in order to avoid hypotension a preloading of 500 ml of inj. Ringer lactate solution was administered, followed by continuous infusion of 8 ml/kg/hr throughout the operation. Intra and post-operative complications: Spinal opioida carry the risk of respiratory depression in elderly patients. Some authors demonstrated that the administration of 25 µg of fentanyl during spinal anesthesia in elderly non-premedicated patients did not alter respiratory rate minute ventilation, $ETCO_2$ respiratory drive, respiratory timing or ventilator response to CO_2 He Showed that 25µg fentanyl did not cause respiratory depression but 50µg did.

Some authors suggested that 25 µg of spinal fentanyl induced oxygen desaturation, but benzodiazepines used during pre and per operative period were responsible for that. Martyr and Clark suggested that intra thecal fentanyl with small doses of i.v. midazolam can be safely administered to elderly patients because low dose fentanyl can't produce respiratory depression. They provided oxygen and observed closely. In our study, no patient out of 60 suffered from respiratory depression. Pruritus was the most common adverse effect in patients who received intra thecal fentanyl as previously reported by investigators. Liu, et al. [14] found that the addition of 20 µg of fentanyl intra thecally lead to pruritus. Some authors studied intra thecal fentanyl at doses of 7.5 µg, 10 µg, 12.5 µg. They found that incidence of pruritus (33%) and nausea, vomiting (6.6%) was same at all doses. In our study, 3 patients of group A had complaining of itching (pruritus) but none of the patients needed treatment. No patient of both groups suffered from nausea, vomiting. Shivering during spinal anesthesia is complication in elderly patient undergoing TURP. Shivering is known to increase oxygen consumption, ventilation, ventilation and cardiac output which can result in morbidity in patients with limited cardiopulmonary reserve. A. Kararmaz, et al. studied that intra thecal bupivacaine 4 mg + fentanyl 25µg was associated with lower incidence of shivering and higher incidence of pruritus than bupivacaine (7.5 mg) alone in elderly patients undergoing TURP. In our study, no patient of group A had shivering while 5 patients of group B had shivering. This confirms that the addition of fentanyl to low dose bupivacaine decreases incidence of shivering spinal anesthesia in elderly patients.

Conclusion

To conclude, it observed that intra thecal bupivacaine 5 mg combined with fentanyl 25 µg

provided adequate anesthesia for TURP in elderly patients and is associated with lower incidence of hypotension and shivering than a conventional dose of bupivacaine. The addition of fentanyl improves the quality of block, increases duration of sensory block and makes the blockade hemodynamically more stable than conventional dose of bupivacaine.

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