

Comparison of ropivacaine: Fentanyl and bupivacaine: Fentanyl for spinal anaesthesia for urological surgeries: TURP, TURBT, VIU

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Abstract

Aim: To study the “comparison of intrathecal 0.75% isobaric ropivacaine with fentanyl and 0.5% hyperbaric bupivacaine with fentanyl in urological surgeries-TURP, TURBT, VIU” was done to evaluate effects of adding Fentanyl to Ropivacaine and Bupivacaine with regard to onset of sensory, motor blockade and time for maximum onset of sensory and motor blockade and two segment recession and duration of sensory and motor blockade.

Methodology: In patients, posted for Urological Surgeries, in Osmania general hospital, Hyderabad were chosen for the study. Sixty patient’s aged 20-60 years belonging to ASA I and II undergoing elective Urological surgeries-TURP, TURBT, VIU were randomly allocated for study (n=30) in each group. Group R (Ropivacaine) includes patient’s receiving intrathecally 0.75% Isobaric Ropivacaine 10 mg with 15 mcg Fentanyl. Group B (Bupivacaine) includes patient’s receiving intrathecally 0.5% Hyperbaric Bupivacaine 10mg with 15 mcg Fentanyl.

Results: Both the groups were comparable with regard to age, height, weight, distribution and ASA grading. The common surgeries they underwent were TURP, TURBT, and VIU. We found that there was no statistically significant variation with regard to onset of sensory and motor blockade and attainment of highest level of sensory and motor blockade. The duration of motor blockade was shorter in Ropivacaine group compared to Bupivacaine group. Patient’s maintained haemodynamic stability and no other side effects were noted.

Conclusion: On the basis of present clinical comparative study we can conclude that addition of Fentanyl to Isobaric Ropivacaine and Fentanyl to Hyperbaric Bupivacaine in Spinal Anaesthesia significantly decreased the duration of motor block in Ropivacaine group compared to Bupivacaine group. Hence it can be used as an alternate to pure Ropivacaine in Spinal Anaesthesia for transurethral surgeries.

Keywords: Ropivacaine, fentyl, bupivacaine, TURP, TUBT,VIU, spinal anasthesia

Introduction

The greatest gift that God has given to mankind is not happiness, but relief of pain. In pursuit of relief of pain, particularly pain during and after surgery, many attempts have been made

since time immemorial.

Spinal anesthesia was introduced into clinical practice by Karl August Bier in 1898.¹ More than a century has passed and even today, it is one of the most popular techniques for both elective and emergency surgical procedures particularly Caesarean sections, lower abdominal surgeries, orthopedic and urological surgeries just to name a few ^[1-2].

Spinal anesthesia, defined, as 'the regional anesthesia obtained by blocking nerves in the subarachnoid space' is a popular and common technique used worldwide. The advantages of an awake patient, simple to perform, offers rapid onset of action, minimal drug cost, relatively less side effects and rapid patient turnover has made this the choice of many a surgical procedure ^[3]. These advantages are sometimes offset by relatively short duration of action and uncomfortable postoperative period when its action wears off. Other methods like epidural anesthesia require technical expertise, larger amount of drug usage and some times even ending up with failed epidural analgesia. Further, Transcutaneous electrical nerve stimulator does not stand up against drug therapies as a sole treatment for anything other than mild post operative pain.

Therefore it forms a challenging forefront in clinical and research advances, where if one can enhance sensory blockade into postoperative period by combining the lowest dose of the drugs with longer duration of action and 2 least side effects, probably it may go a long way in alleviation of pain and suffering. In order to extend intraoperative analgesia into postoperative period a number of spinal adjuvants such as opioids like, morphine, buprenorphine and fentanyl, clonidine, and so on have been added to prolong intrathecal bupivacaine action. However each drug has its own limitations, and a need for alternative methods or drugs always exist.

Central neuraxial opioids, intrathecal as well as epidural, offer the benefit of analgesia but however the related side effects include sense of dizziness, nausea, vomiting, pruritis, urinary retention and even cases of respiratory depression have been reported.

Fentanyl is an opioid analgesic used intrathecally. Ropivacaine is an amide local anesthetic used intrathecally. Bupivacaine is an amide local anesthetic with longer duration of action. The sensory and motor block of Ropivacaine and Bupivacaine are very much comparable.

Spinal anesthesia is widely used for transurethral resections because it allows early recognition of symptoms caused by over hydration, transurethral resection of prostate (TURP) syndrome, and bladder perforation. Many patients undergoing TURP or transurethral resection of bladder tumor (TURBT) have coexisting pulmonary or cardiac disease. By reducing the dose of local anesthetic used, side effects can be decreased. However, a low dose of local anesthetic cannot provide an adequate level of sensory block. Ropivacaine is a new amide-type long acting, pure S-enantiomer, local anesthetic, and analgesic.

Ropivacaine has similar efficacy but an enhanced safety profile when compared to bupivacaine, a major advantage in regional anesthesia. Addition of intrathecal opioids to low-dose local anesthetics enhances analgesia and intensifies motor and sensory blockade. Ropivacaine may be a proper alternate local anesthetic for spinal anesthesia in elderly patients with coexisting systemic disease for TURP operations. By adding Fentanyl to Ropivacaine, side effects can be reduced. In this study, we aimed to investigate the characteristics and side effects of spinal blocks achieved by Bupivacaine and Ropivacaine with fentanyl for TURP-BT, VIU surgeries in Urology.

Hence, this study was designed to evaluate the effectiveness of adding 15 µg Fentanyl to Bupivacaine and Ropivacaine for spinal anesthesia and to compare the effectiveness of Ropivacaine-Fentanyl with Bupivacaine-Fentanyl for spinal anesthesia in Urological surgeries.

Objectives of the study

The aim of the study is to compare the following factors in two groups i.e.

- Group R: 0.75% Isobaric Ropivacaine 10 mg + Fentanyl 15µg.
- Group B: 0.5% Hyperbaric Bupivacaine 10 mg + Fentanyl 15µg.
- For Spinal Anaesthesia in Urological surgeries-TURP, TURBT, VIU in adults aged between 20-60.

With respect to:

1. Onset of sensory blockade.
2. Onset of motor blockade.
3. Time for maximum sensory blockade.
4. Time for maximum motor blockade.
5. Time for two segment regression.
6. Haemodynamic changes-Heart rate, blood pressure, respiratory rate, spo2 at various time intervals.

Materials and Methods

Source of Data

In patients, posted for Urological Surgeries, in Osmania general hospital, Hyderabad were chosen for the study.

Inclusion Criteria

- ASA physical status class I and II
- Age between 20– 60 years of either sex.

Exclusion Criteria

- ASA physical status III and IV
- Infection at the site of injection
- Congenital anomalies of lower spine
- Hypersensitivity to any of the drugs
- Contraindications to spinal anaesthesia patient refusal, bleeding
- Diathesis.

Methodology

After approval from the ethical committee of our Hospital, 60 ASA I patients and II scheduled for Urological Surgeries-TURP, TURBT, and VIU under spinal anaesthesia were chosen for the study.

- Pre anesthetic check up was done one day prior to the surgery.
- Patients were evaluated for any systemic diseases and laboratory investigations recorded.
- The procedure of SAB was explained to the patients and written consent was obtained.
- The patients were educated about the use of visual analogue scale.
- Preparation of patients included period of overnight fasting.
- Patients were pre medicated with Tab. Rantac 150 mg and Tab. Alprazolam 0.5 mg H.S.

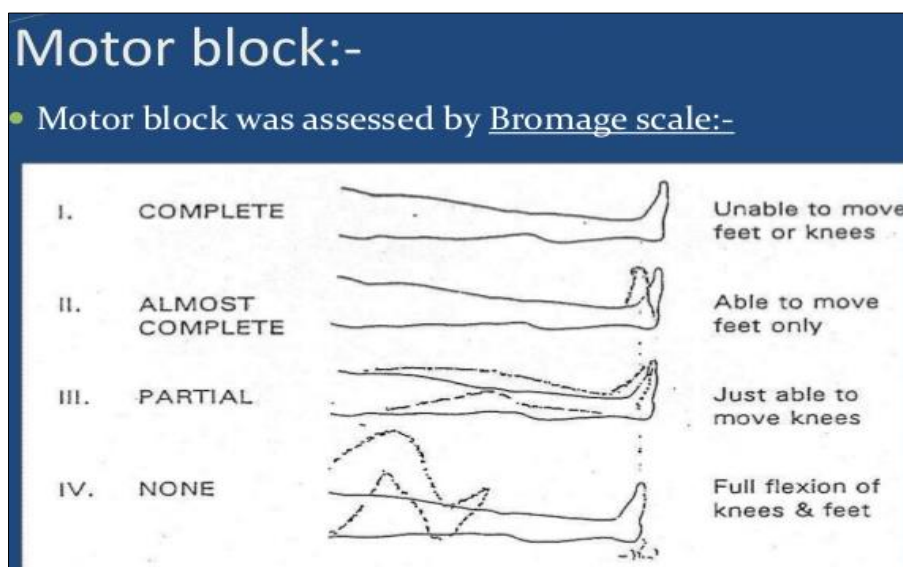
Preparation of Operating Theatre

Boyles anaesthesia machine was checked. Appropriate size endotracheal tubes, working laryngoscope with medium and large size blades, stylet and working suction apparatus were

kept ready before the procedure. Emergency drug tray consisting of atropine, adrenaline, mephenteramine, Ephedrine, dopamine was kept ready.

Procedure

- Patients shifted to OR table, Base vitals were recorded. IV access was obtained on the forearm with No 18G IV cannula and all patients were preloaded with 15 ml / Kg, Ringer's Lactate, 15 mins before the surgery.
- Patients were randomly allocated into groups.
- Under strict asepsis, using 23 G Quincke spinal needle, lumbar puncture was performed at L3-L4 space.
- Group R received 2ml, 0.5% Isobaric Ropivacaine+ 15µgFentanyl (vol. 0.15 ml) Group B received 2ml, 0.5% Hyperbaric Bupivacaine + 15µgFentanyl(vol. 0.15 ml)
- Intraoperative pulse rate, non invasive blood pressure, electrocardiogram, SpO2 was recorded, every one minute for the first 5 minutes, every 3 minutes for the next 15 minutes and every 5 minutes for next 30 minutes and every 10 minutes till the end of surgery.
- Time of onset of T10 sensory block and peak sensory block was noted using pinprick method; time of onset of Bromage 3 motor block was noted.
- Motor block was assessed with Bromage scale



- Bromage 0 - the patient is able to move the hip, knee and ankle
- Bromage 1 - the patient is unable to move the hip but is able to move the knee and ankle
- Bromage 2 - the patient is unable to move the hip and knee but able to move the ankle
- Bromage 3 - the patient is unable to move the hip, knee and ankle.

Following parameters were recorded

- Hypotension (> 20% fall of baseline blood pressure) was treated with bolus dose of 6 mg ephedrine i.v.
- Bradycardia (pulse rate < 50 bpm), was treated with 0.6 mg atropine.iv

Statistical Methods

Descriptive statistics has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max)

Study Design

A Comparative two group randomized clinical study with 60 patients with 30 patients in Group R (Ropivacaine) and 30 patients in Group B (Bupivacaine) is undertaken to study the changes in haemodynamics and side effects. Statistical analysis is done by applying Chi-square test, Anova test and students 't' test to analyze the data, p value was determined.

Observations and Results

Demographic Profile

A total of 60 patients belonging to ASA grade I and II posted for urological surgeries were randomly selected. The patients were divided into 2 groups of 30 each.

- Group "R" received 0.75% Isobaric Ropivacaine 10 mg + 15mcg Fentanyl
- Group "B" received 0.5% Hyperbaric Bupivacaine 10 mg + 15mcg Fentanyl

Table 1

Parameters	Group R	Group B	P Value
Age in Years	46.43 \pm 13.86	42.10 \pm 17.28	0.289,NS
Height in Centimeters	161.10 \pm 5.33	163.30 \pm 5.30	0.114,NS
Weight in Kilograms	51.80 \pm 3.17	52.70 \pm 2.90	0.2541,NS

Values are expressed as Mean \pm SD. NS: Not significant.

The mean age of patient from group R was 46.43 \pm 13.86 and from group B was 42.10 \pm 17.28 years.

The mean height of patient from group R was 161.10 \pm 5.33 and from group B was 163.30 \pm 5.30 (cms).

The mean weight of patient from group R was 51.80.5 \pm 3.17 and from group B was 57.70 \pm 2.90 kg.

Table 2: Onset of Sensory and Motor Block:

Parameters	Group R	Group B	P Value
Sensory Block (Sec)	84.77 \pm 7.40	84.77 \pm 7.40	1,NS
Motor Block (Sec)	157.93 \pm 5.65	157.93 \pm 5.65	1,NS

The mean time for onset of sensory block from group R and Group B was 84.77 \pm 7.40 seconds. The onset of Motor block in groups R and B was 157.93 \pm 5.65 seconds and statistically highly insignificant with P value=1.

Table 3: Highest Level of Sensory and Motor Block

Parameters	Group R	Group B	P Value
Highest Sensory Level	T10 (T8-T10)	T10 (T8-T10)	
Time to Reach Peak Sensory Level	250.73 \pm 38.23	250.73 \pm 38.23	1,NS
Time to Reach Peak Motor Block, Grade 3 (Secs)	354.40 \pm 7.02	354.40 \pm 7.02	1,NS

With regard to highest peak sensory level attained, time it took for patients from both Group R and B is 250.73 \pm 38.23 secs. For motor block, time it took for patients from both Group R and B is 354.40 \pm 7.02 which was statistically insignificant with p value=1.

Table 4: Recovery Parameters

Parameters	Group R	Group B	P Value
Two Segment Regression	127.43±2.4	127.43±2.4	1,NS
Time to Complete Sensory Level – L1	184.0±16.21	210.33±6.28	<0.001,HS
Time to Complete Motor Recovery to Grade I	106.23±11.64	152.97±7.74	<0.001,HS

The time of two-segment regression was considerably slower in group R and Group B with 127.43±2.4 secs. The difference was statistically significant. (P=1). The mean duration of sensory block (time for complete sensory recovery) from group R was 184.0±16.21 and from group B was 210.33±6.28. The mean duration of motor recovery from group R was 106.23±11.64 min and from group B was 152.97±7.74 min. There was statistically highly significant difference in duration of motor and sensory recovery ($p<0.001$).

Table 5: Duration of Analgesia

Parameters	Group R	Group B	P Value
Duration of Analgesia (Secs)	126.43±11.41	183.47±2.93	<0.001,HS

The mean duration of complete analgesia (without need of analgesics) from group R was 126.43±11.41 min and from group B was 183.47±2.93, which was statistically significant ($p<0.001$).

Table 6: Heart Rate

Time Interval in (mins)	Group R	Group B	P Value
0	79.83±8.27	79.83±8.27	1,NS
5	77.40±8.39	77.40±8.39	1,NS
10	75.50±8.33	75.50±8.33	1,NS
15	72.97±9.73	72.97±9.73	1,NS
20	72.87±7.99	72.87±7.99	1,NS
30	74.07±6.87	74.07±6.87	1,NS
60	74.43±6.77	74.43±6.77	1,NS
120	77.13±6.36	77.13±6.36	1,NS

The two groups Group R and Group B did not differ significantly with respect to heart rate at any interval of 5,10,15, 20, 30, 60, and 120 minutes respectively which was statistically insignificant ($p=1$).

Table 7: Systolic Blood Pressure (SBP in mm Hg)

Time Interval in (mins)	Group R	Group B	P Value
0	132.63±13.20	132.63±13.20	1,NS
5	126.33±14.08	126.33±14.08	1,NS
10	118.47±24.06	118.47±24.06	1,NS
15	117.27±10.62	117.27±10.62	1,NS
20	115.83±9.66	115.83±9.66	1,NS
30	117±7.78	117±7.78	1,NS
60	118.73±8.26	118.73±8.26	1,NS
120	122.80±7.11	122.80±7.11	1,NS

The mean Systolic blood pressure in both Group R and Group B decreased from baseline 132.63 mmHg to 126.33 at 5 minutes 118.47 mmHg at 10 minutes 117.27 at 15 minutes 115.83 mmHg at 20 minutes and gradually increased to 122.80 mmHg at the end of 2 hours. Hence the changes in DBP at any interval are statistically and clinically insignificant.

Table 8: Diastolic Blood Pressure (DBP in mm Hg)

Time Interval in (mins)	Group R	Group B	P Value
0	85.90±7.08	85.90±7.08	1,NS
5	76.90±7.14	76.90±7.14	1,NS
10	74.10±7.00	74.10±7.00	1,NS
15	69.83±14.29	69.83±14.29	1,NS
20	71.97±6.17	71.97±6.17	1,NS
30	74.80±6.42	74.80±6.42	1,NS
60	71.83±14.35	71.83±14.35	1,NS
120	77.37±5.30	77.37±5.30	1,NS

The mean diastolic blood pressure in both Group R and Group B decreased from baseline 85.9 mmHg to 76.9 at 5 minutes 76.90 mmHg at 10 minutes 74.10 at 15 minutes 69.83 mmHg at 20 minutes 71.97 mmHg at 30 minutes and gradually increased to 77.37 mmHg at the end of 2 hours. Hence the changes in DBP at any interval are statistically and clinically insignificant.

Table 9: Side Effects

Adverse Effects	Group RN (%)	Group BN (%)
Hypo Tension	4(13.3%)	4(13.3%)
Nausea /Vomiting	2(6.7%)	2(6.7%)
Pruritis	2(6.7%)	2(6.7%)
NIL	2(73.3%)	2(73.3%)

In both group R and Group B, 13.3% patients experienced hypotension, 6.7% had nausea/vomiting, 6.7% had Pruritis. There was no respiratory depression in both the groups.

Table 10: Rescue Vasopressor

Adverse Effects	Group RN (%)	Group BN (%)
Inj Ephedrine 6mg	4(13.33%)	4(13.33%)
NIL	26(86.7%)	26(86.7%)

Rescue Vasopressor Inj Ephedrine was used in 13.3% of patients in Group R and B.

Discussion

Spinal anesthesia consists of the temporary interruption of nerve transmission within the subarachnoid space produced by the injection of a local anesthetic solution into the cerebrospinal fluid. Used widely, safely and successfully for almost 100 years. Spinal anesthesia has many potential advantages over general anesthesia, especially for operations involving the lower abdomen, the perineum and the lower extremities [5-7].

Spinal anesthesia with hyperbaric bupivacaine 0.5% is a popular method. The duration of spinal analgesia can be prolonged by the adjuvants like vasoconstrictors, opioids. Vasoconstrictors (epinephrine, ephedrine and phenylephrine) prolong the duration of action of the local anesthetic by decreasing systemic absorption but have been found to induce neurological signs and symptoms due to reduced blood supply to the spinal cord. Spinal anaesthesia is the most preferred regional anaesthesia technique as it is easy to perform, produces rapid onset of anaesthesia and complete muscle relaxation and is also economical. These advantages are sometimes offset by a relatively short duration of action [8-11].

The aim of intrathecal local anesthetic is to provide adequate sensory and motor block necessary for all infraumbilical surgeries. Hyperbaric bupivacaine is the most commonly used intrathecal local anesthetic. Various adjuvants have been added to bupivacaine to shorten the

onset of block and prolong the duration of block. Fentanyl, a lipophilic opioid agonist, is used as an adjuvant, which prolongs the duration of spinal anaesthesia. Fentanyl is a lipophilic μ -receptor agonist opioid. Intrathecally, Fentanyl exerts its effect by combining with opioid receptors in the dorsal horn of spinal cord and may have a supraspinal spread and action [10-14].

Ropivacaine is a long acting enantiomerically pure S form with low lipid solubility which blocks A delta and C pain fibres than A Beta motor fibres. Ropivacaine is preferable for day care surgery and is associated with early mobilization than Bupivacaine [15-16].

Ropivacaine is the synthetic amide local anaesthetic agent with lower cardiotoxicity and with shorter duration of motor block compared to Bupivacaine. Characteristics of sensory block, haemodynamic changes and onset of motor block was similar to Bupivacaine.

Addition of Fentanyl to Ropivacaine may offer the advantage of shorter duration of complete motor block. Ropivacaine produces more differentiation between sensory and motor block, which could be useful when motor blockade is undesirable as in ambulatory surgeries, and day care procedures. Reduced lipophilicity is also associated with decreased potential for cardio toxicity and CNS toxicity. The co-administration of opioids reduces the total dose of local anaesthetic required for anaesthesia but significantly prolongs the duration of complete and effective analgesia with out prolonging the duration of motor block [17].

Spinal anesthesia is widely used for transurethral resections because it allows early recognition of symptoms caused by over hydration, transurethral resection of prostate (TURP) syndrome, and bladder perforation. Many patients undergoing TURP or transurethral resection of bladder tumor (TURBT) have coexisting pulmonary or cardiac disease. By reducing the dose of local anesthetic used, side effects can be decreased. However, a low dose of local anesthetic cannot provide an adequate level of sensory block. Ropivacaine is a new amide-type long acting, pure S-enantiomer, local anesthetic, and analgesic [18].

Ropivacaine has similar efficacy but an enhanced safety profile when compared to bupivacaine, a major advantage in regional anesthesia. Addition of intrathecal opioids to low-dose local anesthetics enhances analgesia and intensifies motor and sensory blockade. Ropivacaine may be a proper alternate local anesthetic for spinal anesthesia in elderly patients with coexisting systemic disease for TURP operations. By adding Fentanyl to Ropivacaine, side effects can be reduced. In this study, we aimed to investigate the characteristics and side effects of spinal blocks achieved by Bupivacaine and Ropivacaine with fentanyl for TURP-BT, VIU surgeries in Urology [20].

Hence, this study was designed to evaluate the effectiveness of adding 15 μ g Fentanyl to Bupivacaine and Ropivacaine for spinal anesthesia and to compare the effectiveness of Ropivacaine-Fentanyl with Bupivacaine-Fentanyl for spinal anesthesia in Urological surgeries.

Conclusion

On the basis of present clinical comparative study we can conclude that addition of Fentanyl to Isobaric Ropivacaine and Fentanyl to Hyperbaric Bupivacaine in Spinal Anaesthesia significantly decreased the duration of motor block in Ropivacaine group compared to Bupivacaine group. There was no difference in onset of motor block, characteristics of sensory block and haemodynamic changes were similar between both groups, both regimes are effective, addition of Fentanyl to Ropivacaine may offer advantage of shorter duration of complete motor block, haemodynamic stability, without increase in the frequency of major side effects and prolonged postoperative analgesia especially in transurethral surgeries in geriatric patients with diminished cardiopulmonary reserve and facilitate early ambulation. Hence it can be used as an alternate to pure Ropivacaine in Spinal Anaesthesia for transurethral surgeries.

Conflict of Interest: None

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