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A STUDY OF COMPARATIVE EVALUATION OF BUPIVACAINE PLAIN VERSUS BUPIVACAINE WITH FENTANYL IN SPINAL ANAESTHESIA IN ORTHOPEDIC SURGERY

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ABSTRACT

Introduction: Opioids and local anesthetics administered together intrathecally have potent synergistic analgesic effect, enhancing the sensory blockade without altering the degree of sympathetic blockade ensuring better hemodynamic stability. The addition of Fentanyl to hyperbaric Bupivacaine increases the intra-operative quality of subarachnoid block and synergistic anti-nociceptive effects with local anesthetics. The study was done to compare effects of addition of Fentanyl to Bupivacaine in spinal anesthesia for orthopedic lower limb surgeries.

Method: The prospective randomized study was conducted in 60 ASA I/II adult patients, aged 18-60 years undergoing lower limb orthopedic surgeries. Patients were given spinal anesthesia and randomly divided in to 2 groups (n=30). Group A (conventional dose- 3 ml of Bupivacaine 0.5%) and Group B (low dose- 2.5 ml Bupivacaine + 0.5 ml Fentanyl).

Result: Addition of Fentanyl to low dose Bupivacaine prolongs the duration of sensory block and does not alter the characteristics of motor block, reduces intra-operative discomfort and produces more post-operative analgesia, more hemodynamic stability and lower incidence of complications (e.g. shivering) than conventional dose of 0.5% plain Bupivacaine.

Conclusion: We concluded that subarachnoid block with 2.5cc Bupivacaine 0.5% and 25 µg fentanyl is a more safer and better option, both in terms of maintaining hemodynamic stability and lower incidence of complications without compromising the surgical conditions for patients undergoing lower limb orthopedic surgeries.

KEYWORDS : Spinal Anaesthesia, Bupivacaine, Fentanyl, Orthopedic Surgery

INTRODUCTION

Alleviation of pain is one of the most fundamental goals in anaesthesiology. Despite improvements in perioperative care, major surgical operations are still followed by sequelae such as pain, organ dysfunction and prolonged convalescence. It has been assumed that sufficient pain relief will improve the surgical outcome with reduced morbidity, need for hospitalization and convalescence, and there is a common consensus that optimal (dynamic) pain relief is a prerequisite for early postoperative recovery.1 Thus, postoperative pain management plays a vital role in deciding the overall outcome of any surgery. Good postoperative analgesia helps in early patient mobilization, reduction of respiratory complications, good patient's outcome, reduced morbidity and improved patient's satisfaction.

Pain relief after surgical procedures continues to be a major medical challenge. Hence, an acute pain service must act as a research vehicle while modern anaesthesiologists remain crucial contributors in the fascinating field of pain management.

The advantages of subarachnoid block is simplicity of technique, rapid onset of action, reliability in producing uniform sensory and motor blockade, preservation of consciousness, thereby preventing the risk of aspiration, good postoperative analgesia, with minimal drug cost and side effects has made this method a viable alternative to general anaesthesia for a variety of infra umbilical, perineal and lower limb surgical procedures. Its main drawback is the lack of long lasting postoperative analgesia.

Therefore, many adjuvants have been used along with local anaesthetic agents to relieve postoperative pain as well as improve the sensory and motor characteristics of subarachnoid block.

In 1973, Pert and Snyder 2 identified the opiate receptors in CNS including spinal cord. Since the discovery of opioid receptors and the increase in spinal cord neuropharmacological knowledge as to transmission inhibition of nociceptive stimulation, there has been an increased interest in spinal drugs for anaesthesiology and pain relief.

Neuraxial administration of opioids in conjunction with local anaesthetics improves the quality of intraoperative analgesia and prolongs the duration of postoperative analgesia.3, 4 Intrathecal opioids are synergistic with local anaesthetics and intensify the sensory block without increasing the sympathetic block with minimal hemodynamic instability. Animal studies have also demonstrated antinociceptive synergism between intrathecal opioids and local anaesthetics during visceral and somatic nociception.5,6,7,8,9 The combination makes it possible to achieve subarachnoid block with reduced dose of intrathecal local anaesthetic drug.

The use of opioids in conjunction with local anaesthetics in subarachnoid block has been associated with improved tolerance power and reduced analgesic requirement in postoperative period. When administered with bupivacaine in subarachnoid block, fentanyl, by virtue of its lipophilic property (like faster onset of action and recovery, prolonged duration), reduces the need for supplements during surgery and produces improved perioperative analgesia which prompted us to evaluate the potential of fentanyl in participants undergoing lower limb orthopaedic surgery.10

MATERIALS AND METHODS

After Institutional Review Board approval and informed written consent, this prospective randomized controlled clinical study was carried out in 60 patients, aged 18 to 60 years belonging to ASA physical status I and II, undergoing elective lower limb surgery under subarachnoid block. All the patients were subjected to detailed pre-anaesthetic evaluation with clinical history and systemic examination. Routine investigations like Haemogram, Random Blood Sugar, Renal Profile, and ECG for patients above 40 years of age were done as per patient clinical evaluation.

Inclusion Criteria:

1. Informed written consent for participation in study.
2. Aged 18 to 60 years of either sex.
3. ASA physical status I and II.
4. Patients posted for lower limb surgery.
5. BMI ≤ 30kg/m2.

Exclusion Criteria:

1. Contraindication to spinal anaesthesia (refusal of patient, local site infection, coagulation disorders, spine deformity).
2. Allergy to local anaesthetic or study drug.
3. Patients taking any analgesics, anticoagulants.
4. Patients with arrhythmias.
5. Patients with psychiatric /neurological disorders.
6. Un co-operative patients.
7. Antenatal female.

Patients were given spinal anesthesia and randomly divided in to 2 groups (n=30). Group A (conventional dose- 3 ml of Bupivacaine 0.5%) and Group B (low dose- 2.5 ml Bupivacaine + 0.5 ml Fentanyl).

Subarachnoid block:

- Patients were explained about the procedure.
- Aseptic precautions
- L2-L3 / L3-L4 subarachnoid space
- Sitting position
- 23 G BD spinal needle (Quinky type, 3.5 inch long).
- Group A received 3 ml (15 mg) of hyperbaric Bupivacaine 0.5% and Group B received 2.5 ml (12.5 mg) of hyperbaric Bupivacaine 0.5% + 0.5 ml (25 mcg) of Fentanyl.
- Returned to supine position.

Sensory block was assessed by pin prick method. Motor block was assessed by using modified Bromage Scale. The sensory block and motor block were assessed every 2 minutes after injecting the drug till the desired level of block achieved and every half hourly post-operatively until the patient complains of pain and the complete regression of motor block.

Hemodynamic data- pulse rate, blood pressure and SpO2 were checked every 2 minutes for the first 10 minutes and every 5 minutes for the next 30 minutes and every 15 minutes thereafter till 1 hour post operatively.

RESULTS

Table 1: Demographics

Parameters	Group A	Group B
Age (years)	38.2 ± 8.2	38.7 ± 7.5
Weight (Kg)	54 ± 6.18	57 ± 8.12
Height (cm)	157.4 ± 7.6	158.1 ± 4.70
ASA grade (I/II)	21/9	20/10
Duration of surgery (minutes)	134 ± 30.6	129.8 ± 32.4

The patients in both the groups were comparable with respect to their age, weight, height, ASA grade and duration of surgery. (Mean ± SD).

Table 2: Sensory Blockade

Sensory blockade	Group A	Group B
Onset of sensory block (min) (Mean±SD)	2.45 ± 0.72	1.8 ± 0.31
Peak of sensory block (min) (Mean±SD)	5.18 ± 1.02	4.5 ± 0.95
Duration of sensory block (min) (Mean±SD)	141.6 ± 9.8	178.5 ± 14.2
Duration of effective analgesia (min) (Mean±SD)	291.1 ± 30.55	345.8 ± 42.44

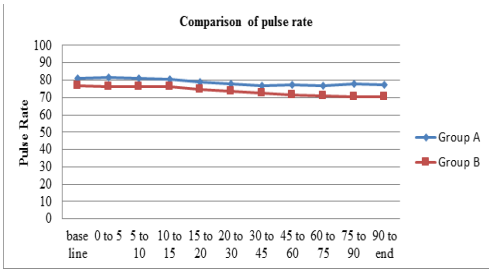
The mean time to onset and peak of sensory block was significantly faster ($p<0.0001$) and mean duration of sensory blockade was prolonged in group B ($p<0.0001$). The duration of effective analgesia was significantly prolonged ($p<0.0001$)

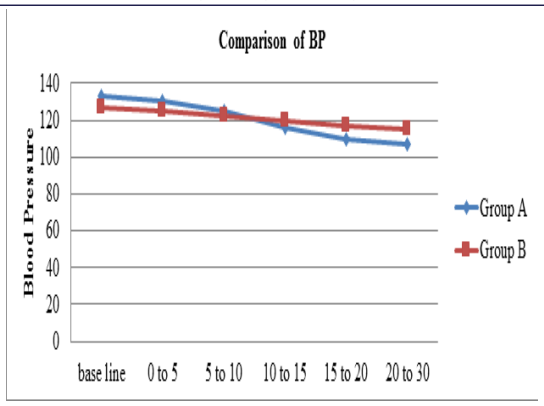
Table 3: Motor blockade

Duration of motor block (minutes)		
	Group A	Group B
Duration of motor block (min)	162.5 ± 7.5	129.4 ± 9.9

Duration of motor block was longer in Group A as compared to Group B which is statistically significant (p value < 0.05).
None of the patients needed supplementation of analgesia during operation.

GRAPH 1: Hemodynamic changes





The above chart show lower pulse rates for the Fentanyl group but within acceptable limits.

The systolic BP at different time intervals, with maximum fall occurring at 15 minutes after giving spinal anesthesia in both the groups.

Fall in blood pressure in group A was more as compared to group B. Thus there is better hemodynamic stability in group B.

Table 4: Intra-operative complications

Complications		
	Group A	Group B
Hypotension	12 (40%)	3 (10%)
Bradycardia	1 (3.3%)	1 (3.3%)
Pruritus	0	2(6.6%)
Nausea & vomiting	0	0
Sedation	0	0
Shivering	3 (10%)	0
Respiratory depression	0	0

The incidence of hypotension and shivering was significantly higher in group A (12 and 3) as compared to group B (3 and 0).

Pruritus was the most common adverse effect in patients who received intrathecal fentanyl (Group B-2) but none of the patients needed treatment for the same.

No patients were suffered from nausea, vomiting and respiratory depression in both the groups

Discussion

Neuraxial opioids are predominantly act at the μ receptors present in the substantia gelatinosa of the spinal cord to exert its synergistic effect more specifically for visceral pain and are not associated with sympathetic nervous system denervation, skeletal muscle weakness or loss of proprioception 11.

Ben-David, Frankel et al (2000) studied the effect of minidose Bupivacaine and Fentanyl in spinal anesthesia for surgical repair of hip fracture in the aged and concluded that minidose combination prolongs duration of sensory block without prolonging recovery of motor block and could dramatically lessen the incidence of hypotension and nearly eliminate the need for vasopressure support 12.

Rajesh Mahajan, V.K.Grover et al (2005) studied the use of Bupivacaine with Fentanyl. They concluded that Intrathecal Fentanyl with low dose Bupivacaine provides good surgical anesthesia prolongs the duration of analgesia without hemodynamic compromise.

In our study, we have added 0.5 ml (25 μg) Fentanyl, a highly lipophilic opioid to lower doses of 0.5% hyperbaric bupivacaine and compared hemodynamic parameters like blood pressure, heart rate changes, side effects of fentanyl and motor and sensory profiles of block, post-operative analgesia

The mean time to onset and peak of sensory block was significantly faster ($p<0.0001$) and mean duration of sensory blockade was prolonged in group B ($p<0.0001$) as observed with previous studies. The duration of effective analgesia was significantly prolonged with addition of fentanyl to bupivacaine ($p<0.0001$).

Duration of motor block for group A was 162.5 ± 7.5 minutes and for group B was 129.4 ± 9.9 minutes which shows there was lesser degree of motor blockade in the combination than Bupivacaine alone. These findings are similar to that obtained by Goel. S. et al and Bruce, Ben-David, Eric Solomon et al (1997) who concluded that intrathecal fentanyl provides better anesthesia without prolonging recovery 12, 13, 14.

Our study also revealed that the degree of blood pressure fall initially among group A was higher than group B that suggests combination with Fentanyl could dramatically lessen the incidence of hypotension and nearly eliminate the need for vasopressure support of blood pressure when compared to Bupivacaine alone.

Because of lipophilicity of Fentanyl, it is rapidly absorbed into spinal cord and epidural fat-this decreases its concentration in CSF rapidly and hence the risk of rostral spread is reduced. The vascular absorption of opioids after intrathecal administration is clinically insignificant. This could explain the reduced incidence of respiratory depression 13. Fentanyl abolishes shivering by central mechanisms.

Pruritus is the most common side effect of intrathecal opioids. Pruritus is thought to be mediated through the μ receptors present centrally.

The incidence of nausea and vomiting were not seen in any of these study groups.

Thus, intrathecal Fentanyl and Bupivacaine associated with lower incidence of complications (e.g. shivering) than conventional dose of 0.5% plain Bupivacaine.

CONCLUSION

Addition of Fentanyl to low dose Bupivacaine has faster onset and prolongs the duration of sensory block, reduces intra-operative discomfort and produces more post-operative analgesia, more hemodynamic stability and lower incidence of complications (e.g. shivering) than conventional dose of 0.5% plain Bupivacaine We concluded that subarachnoid block with 2.5cc Bupivacaine 0.5% and 25 μg fentanyl is a more safer and better option, both in terms of maintaining hemodynamic stability and lower incidence of complications without compromising the surgical conditions for patients undergoing lower limb orthopedic surgeries.

REFERENCES

1. Effect of postoperative analgesia on surgical outcome. H. Kehlet K. Holte. BJA: British Journal of Anaesthesia, Volume 87, Issue 1, 1 June 2001, Pages 62–72,https://doi.org/10.1093/bja/87.1.62
2. Opiate receptor: demonstration in nervous tissue. Pert CB, Snyder SH. Science. 1973 Mar 9; 179(4077):1011-4.
3. Abouleish E, Rawal N, Shaw J, Lorenz T, Rashad MN. Intrathecal morphine 0.2 mg versus epidural bupisssssssvacaine 0.125% or their combination: effects on parturients. Anesthesiology 1991; 74:711-6.
4. Hunt CO, Naulty JS, Bader AM, et al. Perioperative analgesia with subarachnoid fentanyl-bupivacaine for cesarean delivery. Anesthesiology 1989; 71: 535-40.
5. Erman B, Arwestrb'm E, Post C. Local anesthetics IX)- tentiate spinal morphine anfinociception. Anesth Analg 1988; 67: 943-8.
6. Fraser HM, Chapman V, Dickenson AH. Spinal local anaethetic actions on afferent evoked responses and windup of nociceptive neurons in the rat spinal cord: combination with morphine produces marked potentiation of antinociception. Pain 1992; 49: 33-41.
7. Mares TJ, Gebhart GE Antinociceptive synergy between intrathecal morphine and lidocaine during visceral and somatic noeiception in the rat. Anesthesiology 1992; 76: 91-9.
8. Tejwani GA, Rattan AK, McDonald JS. Role of spinal opioid receptors in the antinociceptive interaetiom between intrathecal morphine and bupivacaine. Anesth Analg 1992; 74: 726-34.
9. Wang C, Chakrabani MI~ Whitwam JG. Specific enhancement by fentanyl of the effects of intrathecal bupivacaine on nociceptive afferent but not on sympathetic efferent pathways in dogs. Anesthesiology 1993; 79: 766-73.
10. Harbhej Singh, Jay Yang, Katina Thornton, Adolph H. Giesecke. Intrathecal fentanyl prolongs sensory bupivacaine spinal block. CAN J ANAESTH 1995 / 42: II /pp987-91
11. Ashok Kumar, Shiva Kumar et al: current concepts in neuraxial administration of opioids and non-opioids- An overview and future perspectives. Indian journal of Anesthesia 48(1):13-24,2004
12. Ben-David B, Frankel R et al: Minidose bupivacaine fentanyl subarachnoid block for surgical repair of hip fracture in aged. Anesthesia 93(5):1365,2000.
13. Boucher C, Girard M, Grenier V, Bergeron L, LE Truong H: intrathecal fentanyl dose not modify the duration of procaine block: Canadian journal of anesthesia 48(5): 466-469 2001.
14. Goel S et al: Intrathecal fentanyl added to intrathecal Bupivacaine for day care surgery. European journal of anesthesia 20(4): 294-97, 2003.