e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(1); 1098-1104

Original Research Article

# Comparison of Intrathecal Dexmedetomidine with Buprenorphine as an Adjuvant to Hyperbaric Bupivacaine in Infraumbilical Surgeries

**Babli Das[1], Abhijit Das[2]**

[1,2]Department of Anaesthesiology and critical care, Silchar medical college and hospital, Silchar, 788014, Assam

**Received: 05-11-2023 / Revised: 16-12-2023 / Accepted: 06-01-2024**
**Corresponding Author: Dr. Babli Das**
**Conflict of interest: Nil**

**Abstract:**

**Background and aims:** Emerging regional anesthesia trend uses less local anaesthetic, segmental blocks, supplemented with opioids, α2 agonists for prolonged analgesia and minimizes spinal anaesthesia drawbacks. Current study evaluated effects of dexmedetomidine (5µg) and buprenorphine (75µg), with intrathecal hyperbaric bupivacaine (0.5%) for sensorimotor block and analgesia.

**Methods:** This prospective, randomized controlled, single-blinded study conducted in the Department of Anaesthesiology, Silchar Medical College, Assam after obtaining ethical committee clearance. Informed written consent obtained from 120 ASA I/II patients, aged18-60years, for infraumbilical surgery. Exclusions: coagulopathy, cardiac issues, pregnancy, obese (>30 BMI), spinal deformities. Randomly divided (3 groups, n=40 each) via sealed envelopes.

Group BC received 3ml (15mg) of 0.5% Bupivacaine heavy + 0.5ml of normal saline (control).

Group BD received 3ml (15mg)of 0.5% Bupivacaine heavy+ dexmedetomidine(5µg)in 0.5ml NS.

Group BB received 3ml (15mg) of 0.5% Bupivacaine heavy+ 0.5ml of buprenorphine (75µg). Parameters assessed: onset and duration of sensorimotor block, analgesia duration, haemodynamics, sedation and side effects. Data analyzed with relevant statistics.

**Results:** Onset of sensory and motor blockades showed no statistical difference. However, Group BD exhibited considerably longer sensory (438.88±31.27min) and motor (447.9±34.23min) blocks compared to Group BC (204.7±28.63min; 307.98±16.11min) and Group BB (279.88±16.58min; 305.2±11.1min) ($p<0.0001$). Group BD also displayed prolonged post-operative analgesic request time (459.13±37.11min), surpassing other groups ($p<0.0001$). Although Group BC had the highest sympathomimetic need (65%), Group BD demonstrated superior hemodynamic stability ($p<0.022$) despite transient bradycardia in fewer subjects.

**Conclusion:** Dexmedetomidine (5µg) as an intrathecal adjuvant with 0.5% hyperbaric bupivacaine prolong the sensory and motor blockade duration. It increases the time to rescue analgesia, minimizes side effects, and provides sedation compared to other groups.

**Keywords:** Dexmedetomidine, Hyperbaric Bupivacaine, Buprenorphine.



## Introduction

Spinal anesthesia stands out as an optimal choice for lower abdominal surgeries due to its unique ability to maintain consciousness, spontaneous breathing, and concurrently offer analgesia and muscle relaxation. However, the inherent advantages of subarachnoid block are somewhat curtailed by its brief duration of action and the occurrence of side effects, notably hypotension and bradycardia, attributed to sympathetic blockade.

In contemporary practice, the augmentation of local anesthetics with adjuvants has gained widespread acceptance. This strategic approach not only facilitates the reduction of local anesthetic doses but also serves to mitigate associated side effects, thus contributing to an extended duration of anesthesia. This thoughtful integration of adjuvants enhances the overall efficacy of spinal anesthesia, aligning with the evolving landscape of surgical techniques and patient care. Opioids, long-standing in their historical use, have been employed for pain management. Buprenorphine [1,2], a lipid-soluble analogue of thebaine, acts centrally and displays analgesic effects at both spinal and supraspinal levels. Its utilization in diverse surgeries [4] over recent decades has consistently shown the ability to extend anesthesia duration.

However, elevated doses may result in side effects such as pruritus, drowsiness, nausea, and vomiting. Dexmedetomidine, a targeted α-2 adrenergic agonist [5,6], made its debut in human intrathecal

use during transurethral resection of the prostate. Remarkably, it not only extends both sensory and motor blocks but also exhibits analgesic [7] properties for visceral and somatic pain. Presently, it is under investigation as a promising adjuvant to local anesthetics. In the context of spinal anesthesia, dexmedetomidine [1,3] operates on alpha 2 receptors within dorsal horn cells, curbing sympathetic neurotransmitter release.

Furthermore, its interaction with spinal cord motor neurons suggests a potential for prolonged motor block[2]. No existing literature has conducted a comparative analysis of the advantages and potential adverse effects associated with utilizing buprenorphine and dexmedetomidine as supplementary agents to bupivacaine in lower abdominal surgeries.

Consequently, we initiated this study to examine and compare the efficacy, hemodynamic stability, post-operative analgesia [4,8], and side effects of buprenorphine and dexmedetomidine when used as adjuvants to hyperbaric bupivacaine.

**Aims and Objectives:** To evaluate and compare the following factors in two groups-intrathecal dexmedetomidine and intrathecal buprenorphine as an adjuvant to hyperbaric bupivacaine in infraumbilical surgeries with respect to:

1. Sensory and motor blockade -onset and duration.

2. Duration of analgesia.

**Inclusion Criteria**

1. ASA I and ASA II participants.
2. Age-18-60 years.
3. Weight-40kg to 80kg.
4. Height-150 cm and above.
5. Patients undergoing orthopaedic lower limb surgeries.
6. Patients undergoing lower umbilical general surgeries.
7. Women undergoing gynaecological surgeries.

**Exclusion Criteria:**

1. Patient's refusal.
2. Patients with contraindication for specified drugs.
3. Obesity (BMI >30).
4. Pregnant patients.
5. Infection at the site of injection (spinal).
6. Coagulopathy or any other bleeding diasthesis.
7. Severe hypovolemia.
8. Increased intracranial pressure.
9. Structural and functional cardiac abnormalities.
10. Severe spinal deformity.

**Materials and Method**

**Study design:** It's a hospital based, prospective, single blinded randomized controlled trial.

**Place of study:** Department of Anaesthesiology and Critical care, Silchar Medical College and Hospital, Silchar, Assam. The study was done after obtaining institutional ethical committee clearance.

**Duration of study:** One year

CTRI number: CTRI/2023/07/055167

**Sample size:** 120 ASA I & II, age of 18-60 years; divided into three groups by envelope method having 40 participants in each group i,e.

- Group BC- Bupivacaine heavy + Normal saline (control).
- Group BD- Bupivacaine heavy+ Dexmedetomidine.
- Group BB- Bupivacaine heavy+ Buprenorphine.

All patients were examined and investigated a day prior to surgery. They were advised fasting for six hours and received anxiolytic as premedication on the night before surgery. On arrival to operation theatre, the patient connected to all standard monitors and systolic blood pressure, diastolic blood pressure, heart rate, oxygen saturation, and baseline ECG recorded. I.V access achieved by 18G cannula and preloaded with 500 ml of ringer's lactate. Premedication done with 4mg of inj. ondansetron and 40mg inj.pantoprazole. The study solutions were prepared in a five ml syringe which contain,

a) 3ml (15mg) of 0.5% Bupivacaine heavy+ 0.5ml of normal saline(control)

b) 3ml (15mg) of 0.5%Bupivacaine heavy + dexmedetomidine (5µg) I n 0.5ml N.S

c)3ml(15mg) of 0.5%Bupivacaine heavy+ 0.5ml of buprenorphine(75µg)

Total volume of solution injected 3.5 ml. Under strict aseptic precautions subarachnoid block performed by 25G Quincke Babcock spinal needle in the L3-L4/ L4-L5 interspace in lateral decubitus position. The loaded drug injected over 10-15 seconds following free flow of cerebrospinal fluid (CSF). The time at which injection administration completed considered as time zero (T0) of the study and all measurements were recorded from this point.

Following subarachnoid block, patient made to lie supine and haemodynamic variables and oxygen saturation were recorded thereafter.

**Statistical Analysis:** All recorded data were analyzed using SPSS version-21 and Microsoft excel 2010.

Descriptive statistics were shown using tables and bar diagram. Based on normality assumption, Anova or Kruskal-wallis test were used for comparison. Categorical data were analyzed using chi square test or Fisher's exact test. All data were presented in terms of Mean ± SD and in percentage. P value < 0.05 is significant and P value ≥ 0.05 is not significant.

## Results

Demographic variables including age, sex, height, weight, ASA physical status were comparable in both groups and were statistically not significant. Onset of sensory and motor blockades showed no statistical difference. However, Group BD exhibited considerably longer sensory (438.88±31.27min) and motor (447.9±34.23min) blocks compared to Group BC (204.7±28.63min; 307.98±16.11min) and Group BB (279.88±16.58min; 305.2±11.1min) ($p<0.0001$). Group BD also displayed prolonged post-operative analgesic request time (459.13±37.11min), surpassing other groups ($p<0.0001$). Although Group BC had the highest sympathomimetic need (65%), Group BD demonstrated superior hemodynamic stability ($p<0.022$) despite transient bradycardia in fewer subjects.

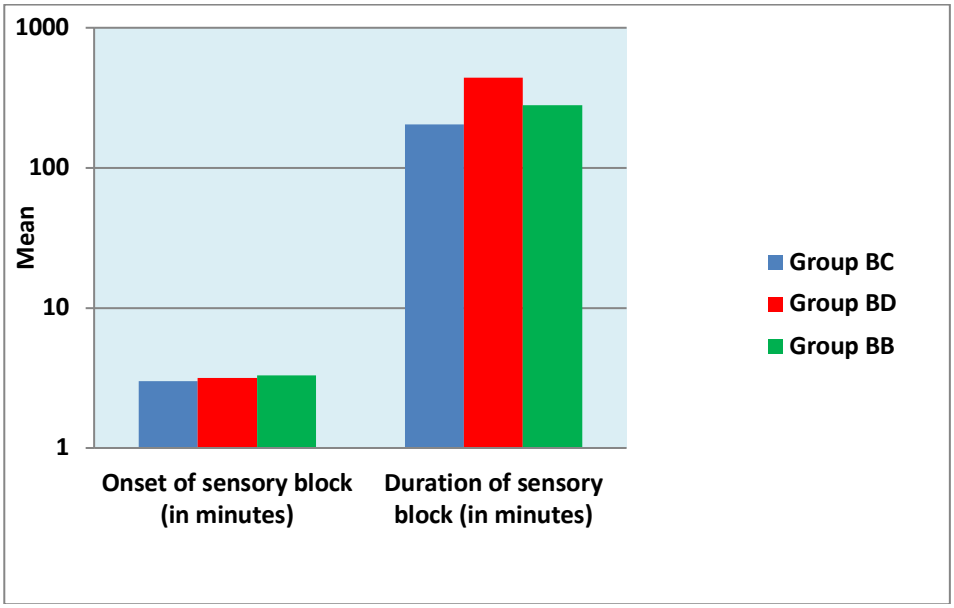


**Figure 1: Sensory block**

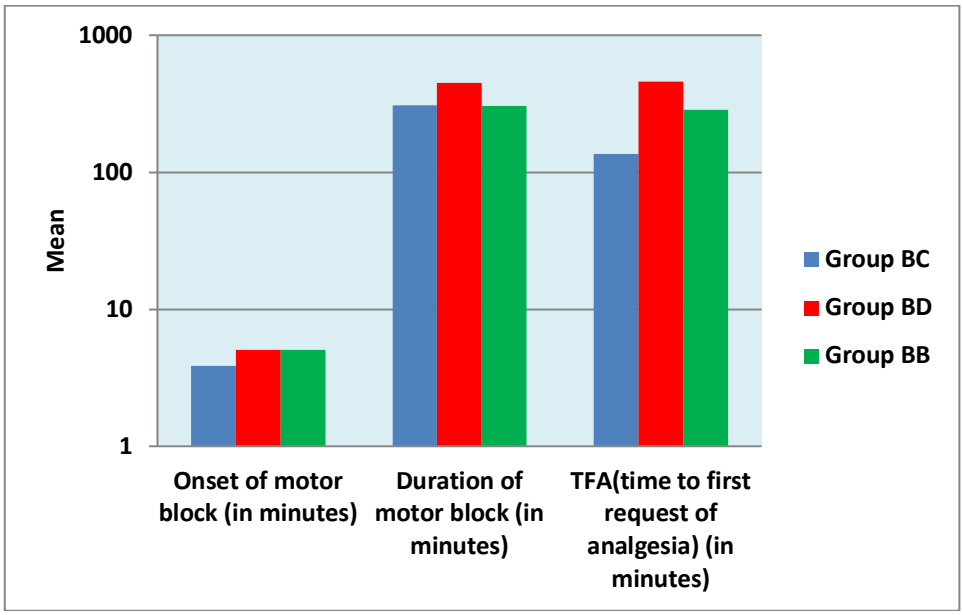


**Figure 2: Motor block**

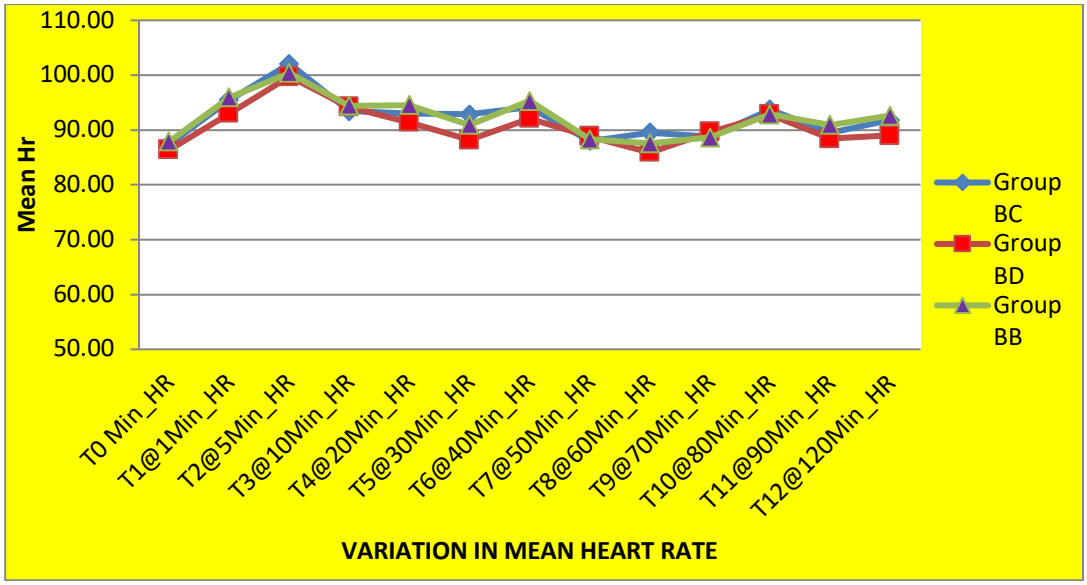


**Figure 3: Variation in mean heart rate**

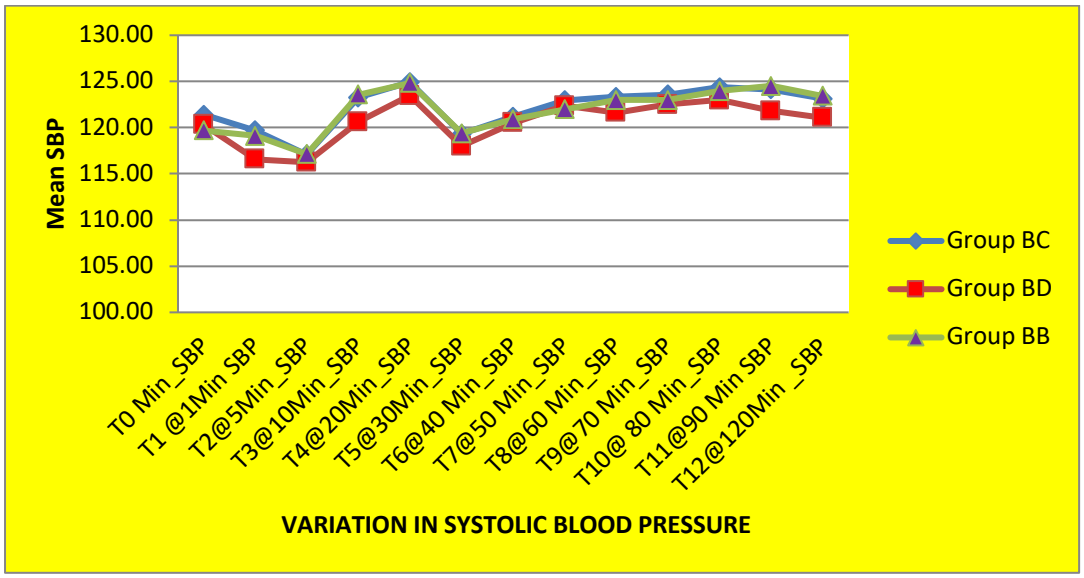


**Figure 4: Variation in systolic blood pressure**

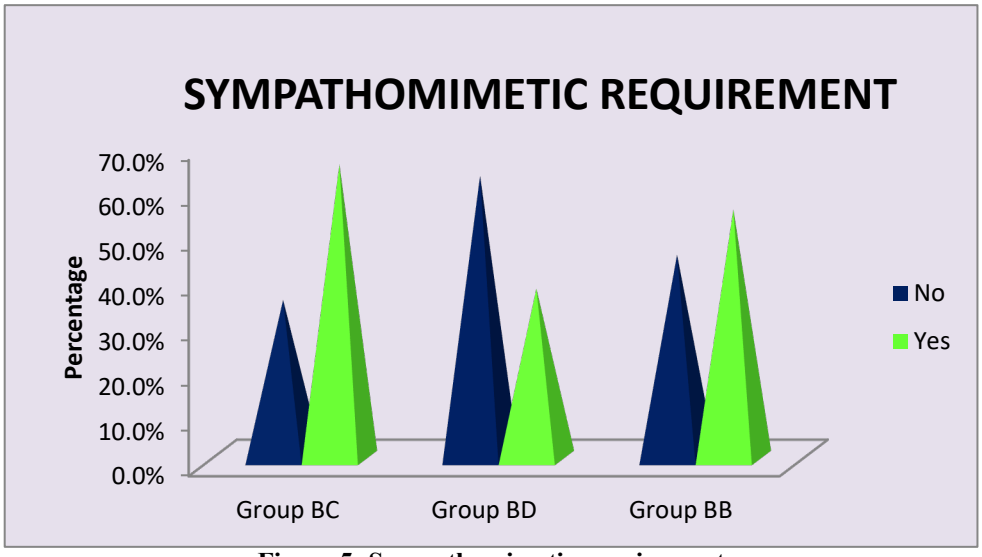


**Figure 5: Sympathomimetic requirement**

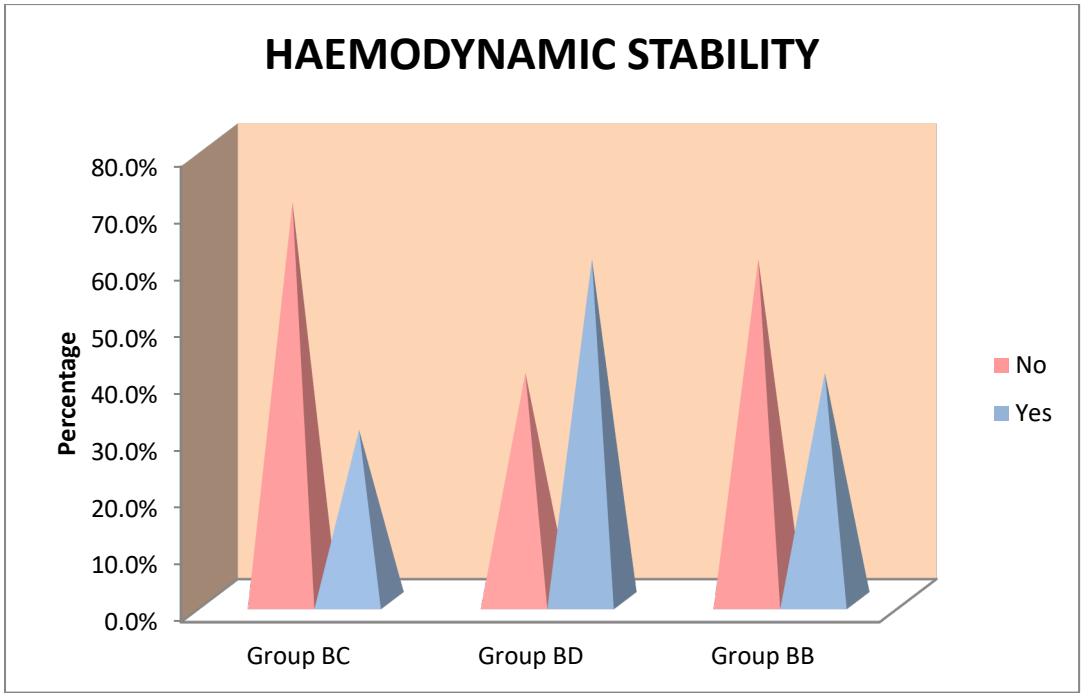


**Figure 6: Haemodynamic stability**

**Table 1:**

| Parameters | Group BC | Group BD | Group BB | P Value |
|---|---|---|---|---|
| **Onset of sensory block (in minutes)** | 3.01±0.63 | 3.16±0.54 | 3.28±0.50 | 0.089 |
| **Onset of motor block (in minutes)** | 3.85±0.51 | 5.06±0.5 | 5.03±0.5 | <0.001 |
| **Duration of sensory block (in minutes)** | 204.7±28.63 | 438.88±31.27 | 279.88±16.58 | <0.001 |
| **Duration of motor block (in minutes)** | 307.98±16.11 | 447.9±34.23 | 305.2±11.1 | <0.001 |
| **Time of sensory regression to S1 (in minutes)** | 212.1±25.96 | 366.45±15.47 | 291.02±17.75 | <0.001 |
| **Total duration of analgesia (in minutes)** | 136.35±10 | 459.13±37.11 | 286.98±12.94 | <0.001 |

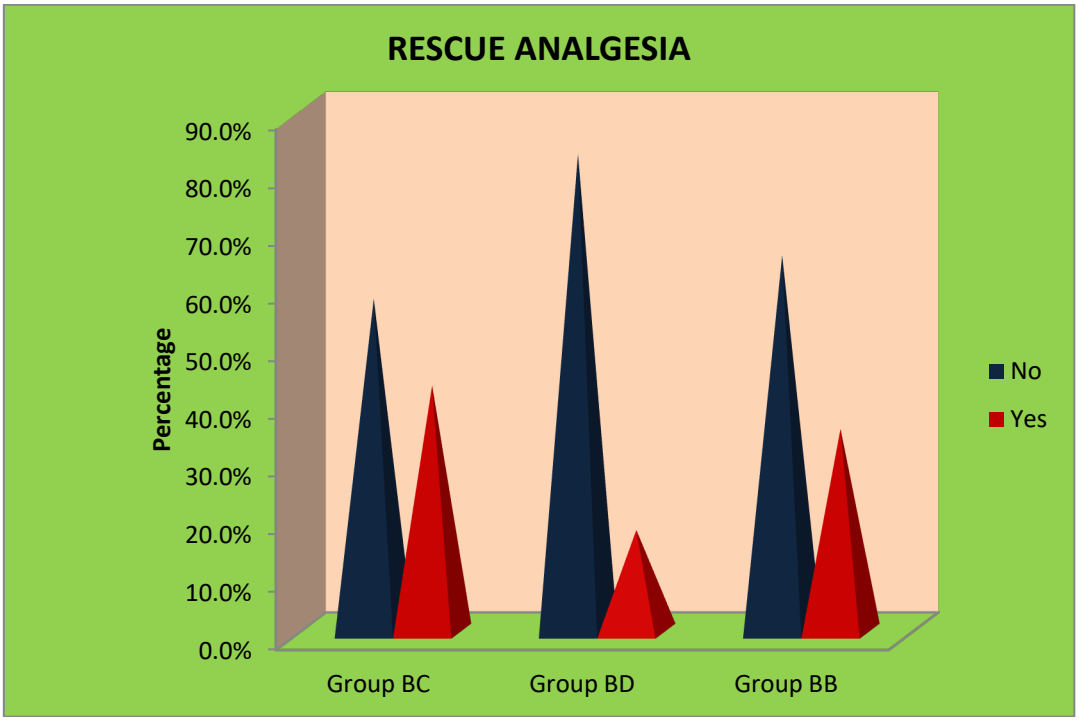


**Figure 7: Rescue analgesia**

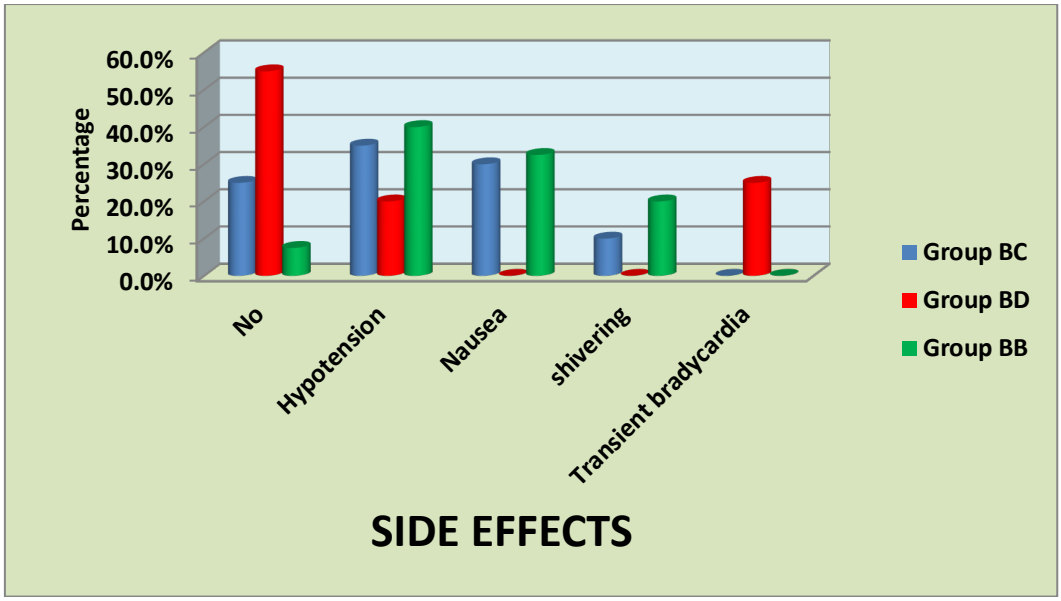


**Figure 8: Side Effects**

## Discussion

Few studies have been conducted with a higher dosage of buprenorphine. Capogna *et al* , Mahima gupta *et al*, and sapkal Praveen S *et al* , have chosen 60µg of buprenorphine as an additive to intrathecal bupivacaine and showed to have a significant prolonged duration of analgesia along with nausea and vomiting that were not statistically significant. Mahima gupta *et al.* also shown the duration of sensory blockade was 289.6 minutes in buprenorphine group and 493.6 minutes in dexmedetomidine group. In this study, 75µg of buprenorphine was used instead of 60µg to evaluate whether the increased dosage of 15µg buprenorphine would help in further prolongation of duration of analgesia with a minimal side effects.

In this study, Dexmedetomidine group had prolonged duration of analgesia compared to Buprenorphine group. Mahima Gupta *et al* have shown similar results but the duration of motor block in Mahima gupta *et al.* study was 205.17 minutes which is significantly lower than our study and it lacks the control group to compare effect of drug separately which we have included in our study along with haemodynamic variability.

The duration of analgesia in the dexmedetomidine group in the study conducted by Mahima gupta *et al* was 493 minutes. In our study, the total duration of analgesia was 459.13 ± 37.11minutes in dexmedetomidine group and 286.98 ±12.94 in buprenorphine group. Mahima gupta *et al* in their study noted that the sedation score was higher in patients belonging to dexmedetomidine group as compared to buprenorphine group which is similar to our study. This was due to the action of dexmedetomidine on α2 receptors on locus ceruleus. In a study conducted by Mahima gupta *et al*, the mean duration for sensory regression to S1 in buprenorphine group was 225.9 min which was lower than the same group in our study. But in dexmedetomidine group it was 451.4 min that was higher than the same group in our study.

## Conclusion

Dexmedetomidine (5µg) as an intrathecal adjuvant with 0.5% hyperbaric bupivacaine prolong the sensory and motor blockade duration. It increases the time to rescue analgesia, minimizes side effects, and provides sedation compared to other groups.

## References:

1. Gupta M, Shailaja S, Hegde KS. Comparison of intrathecal dexmedetomidine with buprenorphine as adjuvant to bupivacaine in spinal anaesthesia. Journal of clinical and diagnostic research: JCDR. 2014 Feb;8(2):114.
2. Amitha S, Pradeep R. Comparison of dexmedetomidine and buprenorphine as an adjuvant to bupivacaine during spinal anaesthesia for tibial interlocking nailing surgeries. International Journal of Advances in Medicine. 2017 Nov;4(6):1653.
3. Kaur N, Goneppanavar U, Venkateswaran R, Iyer SS. Comparative effects of buprenorphine and dexmedetomidine as adjuvants to bupivacaine spinal anaesthesia in elderly male patients undergoing transurethral resection of prostrate: a randomized prospective study. Anesthesia, Essays and Researches. 2017 Oct;11(4):886.
4. Shaikh SI, Kiran M. Intrathecal buprenorphine for post-operative analgesia: A prospective randomised double-blind study. J Anaesth Clin Pharmacol. 2010; 26:35-8.

5. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to bupivacaine. J Anaesthesiol Clin Pharmacol. 2011; 27:339-43.
6. Tarbeeh GA, Mohamed AA. Effects of intrathecal bupivacaine–fentanyl versus bupivacaine–dexmedetomidine in diabetic surgical patients. Egyptian J Anaesth. 2013; 29:13-8.
7. Mohamed AA, Fares KM, Mohamed SA. Efficacy of intrathecally administered dexmedetomidine verses dexmedetomidine with fentanyl in patients undergoing major abdominal cancer surgery. Pain Physician. 2012; 15:339-48.
8. Capogna G, Celleno D, Tagariello V, Loffreda-Mancinelli C. Intrathecal buprenorphine for postoperative analgesia in the elderly patient.Anaesthesia 1988;43:128-30.
9. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM,Ammari BA, Awwad ZM, et al. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. Saudi Med J. 2009; 30:365-70.
10. Kararmaz A, Kaya S, Turhanoglu S, Ozyilmaz MA. Low-dose Bupivacaine-fentanyl spinal anaesthesia for transurethral prostatectomy Anaesthesia 2003; 58:526-30.
11. Abdelhamid SA, El-lakany MH (2013) Intrathecal dexmedetomidine: Useful or not? J Anesth Clin Res. 2013; 4:351.
12. Pradeep R, Thomas J. Comparison of dexmedetomidine, buprenorphine and fentanyl as an adjunct to bupivacaine spinal anaesthesia for hemiarthroplasty. J Evid Based Med Healthc 2016; 3:4474-8.