

A Comparative Study Between Intrathecal Dexmedetomidine and Buprenorphine as an Adjuvant to Ropivacaine for Infraumbilical Surgery

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Abstract:**Background:** Spinal anesthesia utilizing local anesthetics is frequently employed for infraumbilical surgical procedures. The use of adjuvants into intrathecal local anesthetics improves the quality and duration of anesthesia and postoperative analgesia. Dexmedetomidine, an α_2 -adrenergic agonist, and buprenorphine, a partial opioid agonist, are commonly utilized as intrathecal adjuvants.**Aim:** To evaluate the efficacy and safety of intrathecal dexmedetomidine compared to buprenorphine as adjuvants to ropivacaine in patients undergoing infraumbilical surgery.**Methods:** Seventy-two adult patients (ASA I-II) designated for elective infraumbilical surgery under spinal anesthesia were randomly assigned to two groups. Group D was administered 0.75% hyperbaric ropivacaine along with 5 μ g of dexmedetomidine, whereas Group B received 0.75% hyperbaric ropivacaine with 60 μ g of buprenorphine. The characteristics of sensory and motor block, duration of analgesia, hemodynamic parameters, and side effects were evaluated.**Results:** Group D exhibited a markedly extended period of sensory and motor blockade, as well as prolonged postoperative analgesia, in comparison to Group B ($p < 0.05$). Hemodynamic stability was equivalent in both groups, exhibiting minor detrimental effects.**Conclusion:** Intrathecal dexmedetomidine is a more effective adjuvant to buprenorphine when used with ropivacaine for infraumbilical procedures, offering extended analgesia, stable hemodynamics, and reduced side effects.**Keywords:** Dexmedetomidine, Buprenorphine, Ropivacaine, Spinal Anesthesia, Infraumbilical Surgery.**DOI:** 10.25258/ijcpr.18.1.270

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Introduction

Pain is defined as "an unpleasant sensory and emotional experience linked to actual or potential tissue damage or articulated in relation to such damage." Spinal anaesthesia utilizing local anaesthetic drugs is widely employed for infraumbilical surgical procedures [1]. Spinal anesthetic is commonly used for infraumbilical procedures because of its quick onset, efficient sensory and motor blockage, and lower systemic drug exposure. A primary disadvantage is the restricted period of blockade provided by local anesthetics [2]. To address this, numerous adjuvants have been tested and utilized effectively. Buprenorphine demonstrates analgesic properties at both spinal and supraspinal levels. It has regularly demonstrated the ability to extend the duration of anesthesia. At elevated doses, it induces pruritus, sedation, nausea, and emesis. Dexmedetomidine is a selective α_2 adrenergic agonist [3]. It was initially administered intrathecally in humans for transurethral resection of the prostate. It extends

both sensory and motor blockade and exerts nociceptive effects on both visceral and somatic pain. It is currently under evaluation as a potential adjunct to local anesthetic drugs [4].

Ropivacaine, an amide local anesthetic, is preferred because to its reduced cardiotoxicity and specific sensory blockade in comparison to bupivacaine. The efficacy of spinal anesthesia utilizing solely local anesthetics is constrained in length to address this issue, several intrathecal adjuvants have been employed [5]. Buprenorphine, a lipophilic opioid, extends postoperative analgesia but is linked to adverse effects including nausea, vomiting, and itching. Dexmedetomidine, a highly selective α_2 -agonist, augments spinal anesthesia by obstructing nociceptive transmission and extending sensory and motor blockade while causing minimal respiratory depression [6]. This study intends to evaluate the efficacy of intrathecal dexmedetomidine versus

buprenorphine as adjuvants to ropivacaine in infraumbilical surgical procedures

Methodology

Study design: It will be a randomized single blinded controlled trial.

Study setting and timelines: The present randomized, single blinded controlled trial will be carried out in igims (a tertiary care teaching hospital of Bihar).

Timelines: 12 months after approval of synopsis by the University.

Place of study: Igims, Department of Anaesthesiology, Department of Surgery and respective Operation Theatre Complex.

Period of study: 12 months after approval of synopsis by the University.

Study population: A total number of 72 patients of either sex with American Society of Anaesthesiologists physical status I & II between age 18 to 60 years undergoing elective lower abdominal surgeries under spinal anaesthesia at igims.

Sample size: 72 calculations: Group B (n=36) will receive 0.75% hyperbaric ropivacaine 3ml with 60 mcg of buprenorphine intrathecally.

Group D (n=36) will receive 0.75% hyperbaric ropivacaine 3ml with 5 mcg of dexmedetomidine intrathecally.

σ (Pooled SD) = 44.71

δ (Difference of Means) = 132.

However, we calculated a sample size to detect a difference as low as 30 minutes.

Type I error (α) = 5%, Z_α (Value of Standard Normal Distribution for α = 5%) = 1.96

Type II error (β) = 20%, Power (1 - β) = 80%, $Z_{1-\beta}$ = 0.842

Based on the formula given above, using the mentioned values, the sample size required is:

$\text{Sample size (N)} = 1 + \frac{2(1.96 + 0.842)^2 44.71^2}{30.00^2} = 35.8 \approx 36$
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Thus, assuming 80% Power and 95% Confidence interval, the minimum calculated sample size for each arm is **36** (total = 72).

$1 + \frac{2(Z_\alpha + Z_{1-\beta})^2 \sigma^2}{\delta^2}$

Inclusion Criteria

- ASA physical status I & II
- Age- 18-60 years
- Sex- both male and female
- Patients undergoing elective lower abdominal surgery under spinal anaesthesia

Exclusion criteria

- Patients with known contraindication for spinal anaesthesia.
- Patients with coagulation disorders or on anticoagulation therapy.
- Patients with cardiac disease, nuerological, hepatic and renal impairment.
- Patients with betablockers and alpha antagonists.

Statistical Analysis: Statistical analysis will be done by statistician. Student's t test, chi-square test, Fischer's exact test, ANOVA and other relevant tests will be done accordingly. P value less than 0.05 will be significant.

Results

Demographic Data: There was no statistically significant difference between the two groups with respect to age, weight, sex distribution, and duration of surgery.

Block Characteristics and Analgesia

Table 1:

Parameter	Group D (Dexmedetomidine)	Group B (Buprenorphine)	p-value
Time to reach T 10 sensory block level	3.4 ± 0.5	3.8 ± 0.6	>0.05
Time to reach highest sensory level	6.2 ± 1.1	8.5 ± 1.3	<0.001
Time to reach modified Bromage- 3 motor block (min)	4.2 ± 0.6	4.8 ± 0.7	>0.05
Duration of sensory block (min)	340 ± 15	250 ± 18	<0.001
Regression time to modified Bromage -0	314 ± 10	230 ± 19	<0.001
Duration of analgesia (min)	410 ± 13	310 ± 16	<0.001

Duration of Analgesia (minutes)

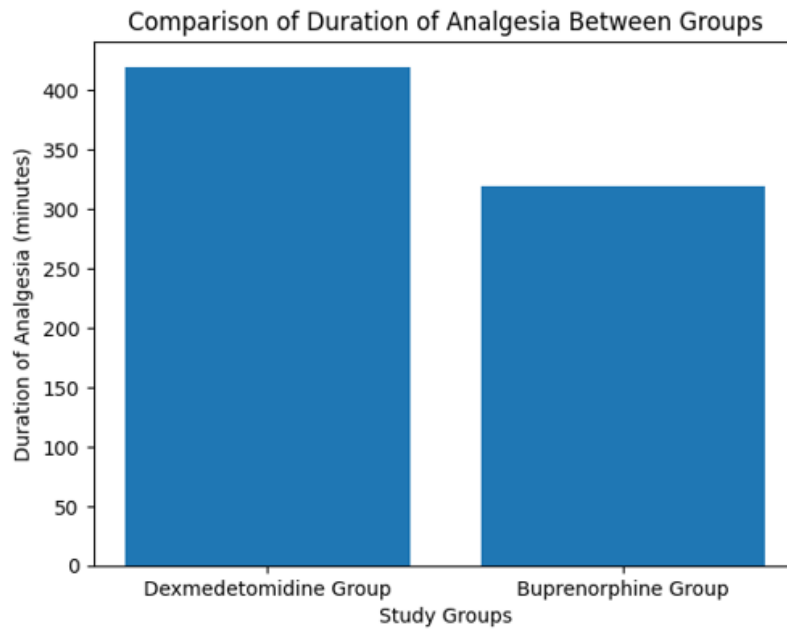


Figure 1: Comparison of Duration of Analgesia Between Groups

Table 2: Adverse Effects

Side Effect	Group D	Group B
Hypotension	2	4
Bradycardia	3	1
Nausea/Vomiting	1	5
Pruritus	2	4

Discussion

This study shows that intrathecal dexmedetomidine combined with ropivacaine greatly extends sensory and motor block, as well as postoperative analgesia in comparison to buprenorphine. There was no significant difference between groups regarding demographic characteristics. Onset of sensory block, time to maximum sensory block at T6 and time to maximum motor block were lower in group D with compared to group B. These results align with prior research done by Dr Archana Vaghela et al indicating improved spinal anesthesia through the use of α_2 -

agonists. Time to two segment regression, time to regression to bromage scale 1 and regression time to sensory S1 were significantly longer in group D compared with group B. In group D patients, duration of analgesia were prolonged and so need for inj. Diclofenac sodium 75 mg is less than that of group B. Dexmedetomidine to ropivacaine prolongs the duration of postoperative analgesia (410 min) with prolonged duration of sensory and motor blockade. The addition of Buprenorphine 60 mcg also prolongs the duration of analgesia (310) but less duration than that of Dexmedetomidine.

Dexmedetomidine induces analgesia by hyperpolarizing interneurons and inhibiting the release of neurotransmitters from C-fibres. In contrast to opioids, it does not induce pruritus or respiratory depression. Buprenorphine, while helpful in extending analgesia, had a greater prevalence of nausea and pruritus in our trial. Hemodynamic stability was similar in both groups, with tolerable bradycardia noted in some individuals on dexmedetomidine [7].

Conclusion

Intrathecal dexmedetomidine is a more effective adjunct to buprenorphine when combined with ropivacaine for infraumbilical operations. It offers extended sensory and motor blocking, prolonged postoperative analgesia, and less opioid-related adverse effects, rendering it a superior option for spinal anesthesia.

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