

A Comparative Study of Intrathecal Neostigmine and Dexmedetomidine as Adjuvant to Bupivacaine Spinal Analgesia in Sub Umbilical Regional Surgeries

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Abstract

Background: Spinal anesthesia is the most commonly used technique for lower abdominal surgeries as it is very economical and easy to administer. This study aims to determine the effect of intrathecal administration of Neostigmine and Dexmedetomidine as adjuvants on the onset and duration of sensory and motor block and postoperative analgesia produced by spinal Bupivacaine. **Subjects and Methods:** prospective randomized clinical study was carried out on 100 patients belonging to ASA grade I and II, posted for elective Sub umbilical surgeries under spinal anaesthesia, The study was designed to compare neostigmine 50mcg and Dexmedetomidine 10mcg along with 15mg 0.5% bupivacaine, in subarachnoid block. 100 patients were divided into two groups using randomized double blind method with 50 patients in each group. **Results:** The time of onset of peak sensory block is higher in Group D as compared to Group N. Mean Time for onset of peak sensory block in Group N was 5.48 ± 0.43 min and Group D was 7.31 ± 0.44 min. p value is < 0.01 (statistically significant). Time for two segment regression was significantly higher in Dexmedetomidine group as compared to Neostigmine group. The onset of motor block in group N is earlier as compared to group D. The duration of analgesia is significantly higher in group D as compared to group N. **Conclusion:** Our study concludes that the use of intrathecal Neostigmine 50 mcg added to 15mg hyperbaric bupivacaine significantly hastens the onset of sensory and motor block. Dexmedetomidine(10mcg) when used intrathecally along with Bupivacaine significantly prolongs the duration of motor blockade, two segment regression and duration of effective post-operative analgesia.

Keywords: Neostigmine, Dexmedetomidine, Bupivacaine.

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Introduction

Spinal anesthesia is the most commonly used technique for lower abdominal surgeries as it is very economical and easy to administer. However, postoperative pain control is a major problem because spinal anesthesia using only local anesthetics is associated with relatively short duration of action, and thus early analgesic intervention is needed in the postoperative period. A common problem during lower abdominal surgeries under spinal anesthesia is visceral pain, nausea, and vomiting.^[1]

Local anesthetic lignocaine was used for shorter procedures that can be lasted for 1.5 hours or less. It is associated with shorter duration of action and it was later replaced by Bupivacaine. Bupivacaine is the most commonly employed local anaesthetic for sub arachnoid block. Though bupivacaine is longer acting than lignocaine it has its own demerits like cardio toxicity and its duration of action lasts only for 3 hours, so early need for rescue analgesic in post operative period.^[2]

Many adjuvants are commonly used to prolong the duration

of analgesia. The additions of opioids to local anesthetic solution have disadvantages, such as pruritus and respiratory depression. So our concern is to choose an adjuvant with bupivacaine which provides early onset of sensory and motor blockade, stable intra operative condition and prolonging the post operative analgesia with minimal side effects.^[3]

Uncontrolled postoperative pain may produce a range of detrimental acute and chronic effects. Transmission of nociceptive stimuli from the periphery to the CNS results in the neuro endocrine stress response.^[4] Supra segmental reflex responses to pain result in increased sympathetic tone, increased catecholamine and catabolic hormone secretion and decreased secretion of anabolic hormones. The effects include sodium and water retention and increased levels of blood glucose, free fatty acids, and ketone bodies.

Neostigmine is an anticholinesterase agent, which inhibits the hydrolysis of acetyl choline. Spinal neostigmine apparently activates descending pain inhibitory systems that rely on a spinal cholinergic interneuron, probably exacerbating a cholinergic tonus that is already activated during the post operative period and seems to be extremely efficient for alleviating somatic pain.^[5]

Dexmedetomidine, a new highly selective α_2 -agonist, acts by binding to presynaptic C fibers and postsynaptic dorsal horn neurons. Their analgesic action is a result of depression of the release of C-fiber transmitters and hyper polarisation of postsynaptic dorsal horn neurons. The prolongation of effect may result from synergism between local anesthetic and α_2 -adrenoceptor agonist, while the prolongation of the motor block of spinal anesthetics may result from the binding of α_2 -adrenoceptor agonists to motor neurons in the dorsal horn.^[6] This study aims to determine the effect of intrathecal administration of Neostigmine and Dexmedetomidine as adjuvants on the onset and duration of sensory and motor block and postoperative analgesia produced by spinal Bupivacaine.

Aims and Objectives

1. To observe the onset time of sensory and motor blockade
2. To compare the efficacy of intrathecal Neostigmine with intrathecal Dexmedetomidine on duration of sensory and motor block and prolonging the duration of postoperative analgesia.
3. To study the side effects associated with these drugs.

Subjects and Methods

Type of study - prospective randomized clinical study

Sample size - 100 patients belonging to ASA grade I and II, posted for elective Sub umbilical surgeries , under spinal anaesthesia

Study design- to compare Neostigmine 50mcg and Dexmedetomidine 10mcg along with 15mg 0.5% Bupivacaine, in subarachnoid block.

Inclusion criteria:

1. ASA group I and II
2. Age between 18 to 75 years of both sexes

Exclusion criteria:

1. Patient refusal
 2. Mass lesion in abdomen including pregnancy
 3. Contraindications for spinal anaesthesia
- 100 patients were divided into two groups using randomized double blind method with 50 patients in each group
1. Group N: Patients received 3.0ml of hyperbaric solution of 0.5% bupivacaine + 50mcg (0.5ml) of Neostigmine.
 2. Group D: Patients received 3.0ml of hyperbaric solution of 0.5% bupivacaine + 10mcg (0.5ml) of Dexmedetomidine.

Results

Both the groups were comparable and there was no statistically significant difference with regards to mean age, sex, weight and height of the patients.

Group N has earlier onset of sensory block as compared to Group D. The mean time for onset of sensory block in Group N was 1.43 ± 0.53 min and Group D was 2.319 ± 0.44 min. P value is <0.001 (statistically significant)

The time of onset of peak sensory block is higher in Group D as compared to Group N. Mean Time for onset of peak sensory block in Group N was 5.48 ± 0.43 min and Group D

was 7.31 ± 0.44 min. p value is < 0.01 (statistically significant).

Time for two segment regression was significantly higher in Dexmedetomidine group as compared to Neostigmine group, the mean time for two segment regression in group N was 124.98 ± 21.48 min and group D was 165.24 ± 14.45 min and p value was < 0.001 was statistically significant.

The onset of motor block in group N is earlier as compared to group D, the mean time for onset of motor block was 3.079 ± 0.44 min in group N and 4.0454 ± 0.38 min in group D and p value was <0.001 statistically significant.

Duration of motor block in Dexmedetomidine group is significantly more as compared to Neostigmine group and the mean duration of motor block in group N was 191.58 ± 26.81 min and 324 ± 36.8 min in group D and p value was < 0.001 statistically significant.

The total duration of analgesia that is time of injection of spinal drug to the time for first rescue analgesia was 311.23 ± 34.43 min in group N and 390.21 ± 25.33 min in group D. p value is <0.001 . The duration of analgesia is significantly higher in group D as compared to group N.

Table 1 : ?

	Group N	Group D	P VALUE
Time of onset of sensory block (min)	1.43 ± 0.53	2.319 ± 0.44	< 0.001
Time of onset of peak sensory block (min)	5.48 ± 0.43	7.31 ± 0.44	<0.001
Time for two segment Regression	124.98 ± 21.48	165.24 ± 14.452	<0.001
Onset of motor block(min)	3.079 ± 0.44	4.045 ± 0.386	<0.001
Duration of motor block(min)	191.58 ± 26.816	324 ± 36.8 min	<0.001

The sedation score in group D was higher as compared to group N. The mean sedation score in group N was 1.03 ± 0.10 and group D was 2.07 ± 0.11 and p value was <0.005 statistically significant.

Seven patients in group N had nausea or vomiting, whereas only two patients in group D had nausea. Bradycardia was seen in 5 patients of group D whereas two patients in group N had bradycardia. 2 patients in group N had hypotension whereas 4 patients in group D had hypotension.

Table 2: Sedation score

Group	Sedation score
Group N	1.03 ± 0.10
Group D	2.07 ± 0.11
P value	0.0032(S)

P value 0.0032 (statistically significant)

Table 3: Side effects

Side effects	Group N	Percentage	Group D	Percentage
Nausea	7	14%	2	4%
Bradycardia	2	4%	5	10%
Hypotension	2	4%	4	8%

Discussion

The aim of good postoperative analgesia is to produce a long lasting, continuous effective analgesia with minimum side

effects. Subarachnoid block has been most extensively used for lower abdominal and lower limb surgeries because of its simplicity, speed, reliability and minimal exposure to depressant drugs.^[7]

Adding, an intrathecal additive to local anaesthetics forms a reliable and reproducible method to prolong the duration of anaesthesia and to prolong post-operative analgesia. A number of adjuvants to local anaesthetics for spinal anaesthesia like opioids (fentanyl and buprenorphine), benzodiazepines (midazolam), ketamine and neostigmine have been used. The most common agents used are opioids and they have formed a cornerstone option for the treatment of post-operative pain.^[8]

Spinal opiates prolong the duration of analgesia, but they do have drawbacks of late and unpredictable respiratory depression, pruritus, nausea, vomiting and urinary retention, which require constant postoperative monitoring and urinary catheterization. Hence there is a requirement of an adjuvant to be used along with local anaesthetics which can produce prolonged analgesia without the above said side effects of opioids.^[9]

Intrathecal Neostigmine has been used as an adjuvant to spinal anaesthesia (SA) for the prevention of acute perioperative pain. Intra thecal injection of Neostigmine produces analgesic effects. A tonic cholinergic activity is an important prerequisite for the effectiveness of neostigmine.^[10]

Dexmedetomidine is a highly selective α_2 – adreno receptor agonist recently introduced to anesthesia. It produces dose-dependent sedation, anxiolysis, and analgesia (involving spinal and supraspinal sites) without respiratory depression.

Both the groups were comparable and there was no statistically significant difference with regards to mean age, sex, weight and height of the patients.

Onset of sensory block using pin prick method was noted in both groups. The mean time for onset of sensory block in group N is 1.42 ± 0.53 min and group D was 2.31 ± 0.44 min with a p value < 0.001 which is statistically significant.

This observation was comparable to study done by N YogaNarasimha et al,^[11] in 2014 who compared intrathecal clonidine 75 μg or neostigmine 50 μg added to intrathecal hyperbaric bupivacaine, with regards to sensory characteristics, motor characteristics, haemodynamic stability and side effects for patients undergoing lower abdominal surgeries. It was found that onset of sensory block of neostigmine is 1.38 ± 0.4 min which is similar to our study.

Safiya I. Shaikh et al,^[12] in 2014 studied the effect of intrathecal administration of dexmedetomidine 5 μg and 10 μg , as an adjuvant to bupivacaine 0.5%, they noted that mean time to achieve maximum motor block is 4.70 ± 0.33 min and 4.25 ± 0.47 min for 5mcg and 10 mcg Dexmedetomidine which is similar to our study.

Time taken to recovery from motor block that is bromage scale 3 to 0 in Neostigmine group is 193 ± 40 min and Dexmedetomidine is 324 ± 36.8 min p value is < 0.001 this statistically highly significant P value indicates that using 10 mcg Dexmedetomidine prolongs the duration of motor blockade for group D. Mubasher Ahmad Bhat et al,^[13] in 2011 compared intrathecal bupivacaine plus normal saline, intrathecal bupivacaine with 50mcg neostigmine and

intrathecal bupivacaine with 150mcg neostigmine found out that mean time taken for complete regression of motor block is 189.83 ± 5.64 min for normal saline, 197 ± 7.01 min and 220.3 ± 9.70 min for 50mcg Neostigmine and 150mcg Neostigmine respectively. It concurs with our study.

Conclusion

Our study concludes that the use of intrathecal Neostigmine 50 mcg added to 15mg hyperbaric bupivacaine significantly hastens the onset of sensory and motor block.

Dexmedetomidine(10mcg) when used intrathecally along with Bupivacaine significantly prolongs the duration of motor blockade, two segment regression and duration of effective post op analgesia. Although the present study has indicated that addition of 50 mcg of Neostigmine to 15mg hyperbaric Bupivacaine significantly hastens the onset of sensory and motor block, use of Dexmedetomidine as adjuvant to hyperbaric Bupivacaine in spinal anaesthesia as compared to Neostigmine is recommended especially in those surgeries requiring longer duration , because in surgeries of longer duration it is more beneficial to the patient if duration of sensory analgesia is increased rather than time of onset of analgesia. Hence this study recommends the use of Dexmedetomidine as an adjuvant to Bupivacaine in subarachnoid block.

References

1. Rajni Gupta et al: A Comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to Bupivacaine: Journal of Anaesthesiology Clinical Pharmacology.2011; Volume: 27, Issue: 3, Page: 339-343
2. David L. Brown: spinal, Epidural, and Caudal Anesthesia: Miller's anesthesia: 7th edition: chapter 51: 1611 -1638
3. Dr.Yoga Narasimha N et al: A clinical study of perioperative effectiveness of adjuvant Neostigmine with intrathecal Bupivacaine for lower abdominal surgeries: IOSR Journal of Dental and Medical Sciences: Volume 2, Issue 3 (Nov- Dec2012), PP 35-39
4. Robert W. Hurley : Acute Postoperative Pain: Miller's anesthesia : 7th edition : chapter 87 : page : 2757-2780
5. Calvey TN et al : Pharmacokinetics and pharmacological effects of neostigmine in man : Br J Clin Pharmacology : 1979 Feb;7(2):149-55
6. Panzer O et al : Pharmacology of sedative-analgesic agents – Dexmedetomidine, remifentanyl, ketamine, volatile anaesthetics and The role of Mu antagonists: Critical Clin : 2009;25:451-69
7. Harish BG et al: A Comparative Study of Intrathecal Dexmedetomidine 10mcg and Fentanyl 25mcg as Adjuvants To 0.5% Hyperbaric Bupivacaine in Spinal Anaesthesia with a Control Group : IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) : Mar. 2015; Volume 14, Issue 3 PP 108-115.
8. Kanazi GE et al : Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block: Acta Anaesthesiol Scand: 2006 Feb;50(2): 222-7
9. Deepika Shukla et al : Comparative study of intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine : JOACP: 2011; Vol: 27, Issue : 4, Page : 495-499
10. Dr. Mrugank Bhavsar et al: Combined Use of Intrathecal Fentanyl and Neostigmine as an Adjunct to Bupivacaine for Postoperative Analgesia after Abdominal Hysterectomy: Gujarat Medical Journal : 2014; Vol 69, No 2
11. N Yoganarasimha et al : A comparative study between intrathecal clonidine And neostigmine with intrathecal bupivacaine for lower abdominal surgeries : Indian Journal of Anaesthesia: 2014; Vol 58, Issue :1 , Page : 43-47
12. Safiyya I Shaikh et al: Dexmedetomidine as an adjuvant to hyperbaric spinal bupivacaine for infra-umbilical procedures: An International

Journal of Anesthesiology, Pain Management, Intensive Care &
Resuscitation: 2014; 18(2):180-185

different doses added to bupivacaine for postoperative analgesia : Sri
Lankan Journal of Anaesthesiology Vol.19(1) 2011 pp.33-38

13. Mubasher Ahmad Bhat et al : Evaluation of intrathecal neostigmine in

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