

Postoperative Analgesia With Intrathecal Neostigmine; Two Different Doses Of 75 µgms And 50 µgms With Heavy Bupivacaine.

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Citation

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Abstract

This study was conducted to compare post operative analgesia and side effects of intrathecal neostigmine with two different doses of 75 µgms and 50 µgms with bupivacaine heavy 0.5 % (15mg). 90 patients of ASA grade I and II were randomly selected from a routine list of general surgery, plastic surgery, gynaecology and orthopaedic units of the hospital under spinal anaesthesia were randomly allocated to three groups of 30 patients each. 75 µgms neostigmine groups had prolonged post operative analgesia (less number of rescue analgesia and longer time to first analgesia) compared to other two groups ($p < 0.001$). The time to first analgesia in 75 µgms groups is 236.2 ± 1.6 min (Mean \pm SD), in 50 µgms groups is 183.9 ± 3.36 min (Mean \pm SD), in control group is 138.5 ± 5.1 min (Mean \pm SD). Nausea and vomiting was more in 75 µgms groups (30%) compared to 50 µgms neostigmine group (16%). Bradycardia was more frequent in the 75 µgms group (26%) compared to 50 µgms neostigmine group (13%). Hypotension was also more frequent in the 75 µgms group (36%) compared to the 50 µgms neostigmine group (20%). This study concludes that though post operative analgesia is better with 75 µgms neostigmine group compared to 50 µgms neostigmine group, side effects are also more frequent in the 75 µgms neostigmine group.

INTRODUCTION

To augment postoperative analgesia various pharmacological adjuvants such as opioids, clonidine, ketamine and midazolam were administered intrathecal with variable results. In an attempt to avoid respiratory depression and sedation associated with opioid, intrathecal neostigmine is tried as an alternative. Postoperative analgesic effect of Intrathecal neostigmine was first reported by Hood DD et al in 1995. Doses ranging from 50-200 µg intrathecal neostigmine have been studied previously for postoperative pain relief. Volunteer studied the threshold dose for analgesia of approximately 50 µg. Intrathecal neostigmine inhibit metabolism of spinal released acetylcholine & produce analgesia in animals and human.

The cholinergic system plays an important inhibitory pathway for pain modulation. Cholinomimetic drugs, including cholinergic receptor agonists and acetylcholinesterase inhibitor known to produce analgesia in various species.⁽¹⁻⁹⁾ Experimental use of cholinesterase inhibitor have been tried for acute and chronic pain. Neostigmine is reversible acetylcholinesterase inhibitor with quaternary ammonium compound used as Cholinomimetic

analgesia in human. Autoradiographic studies have revealed the presence of muscarinic binding sites in dorsal horn⁽¹⁰⁻¹²⁻¹³⁾ reported that maximum concentration of choline acetyltransferase is located in substantia gelatinosa of spinal cord.

METHODS

Following approval of the institutional ethics committee 90 patients of ASA CLASS I And II belonging to either sex, of age 16-55 were randomly selected from routine list of gynaecology, plastic surgery, general surgery and orthopaedics in three different groups. The following patients were excluded from study

Emergency cases

Sepsis

H/O motion sickness

Mentally retarded and drug addicts

Any contradiction to regional anaesthesia (coagulation disorders, spine deformity)

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The informed written consent was obtained from patients preoperatively as per hospital rules and regulations.

Group I – Received intrathecal injection. Bupivacaine heavy (0.5%) 3 ml.

Group II – Received intrathecal injection of Neostigmine 50 µg + injection

Bupivacaine heavy (0.5%) 3 ml.

Group III- Received intrathecal injection of Neostigmine 75 µg+ injection

Bupivacaine heavy (0.5%) 3 ml.

The patient's vital data including temperature, pulse rate, blood pressure, and respiratory rate were noted. All routine investigations were received and recorded in all the cases. Visual Analogue Scale (VAS) was shown to the patient and the procedure of postoperative measurement was explained in detail. Patients were carefully questioned regarding duration of pain free period, type and severity of pain if occurred and amount of analgesia required and the data was recorded. The severity of postoperative pain was measured using a 10–cm visual analogue scale (VAS) (0=no pain, 10=the worst possible pain) during cough or movement at 2-hr intervals or whenever the patient requested analgesia. Postoperative analgesia was provided by intramuscular diclofenac sodium 75 mg. if necessary (if the VAS score was ≥ 4). All patients received inj. Ranitidine 100mg and inj. Atropine 4 µg/kg (0.2mg) i.v., inj phenargan 0.5 mg/kg i.m 30 minutes before anaesthesia as a premedication .Recording of vital data was done 15 minutes before and after premedication and just before giving spinal anaesthesia. After preloading with ringer lactate solution 10ml/kg, subarachnoid puncture was performed at L₃-L₄ inters pace with 25G spinal needle with patients in sitting or lateral position under all strict aseptic and antiseptic precautions. After clear and free flow of CSF, chosen study solution was injected slowly after CSF aspiration.

The rostral dermatome level of sensory anaesthesia to pinprick was determined and motor blockade using Modified Bromage Scale was recorded, viz.

0 - Ability to raise extended legs, no blockade

1 - Inability to raise extended leg and knee flexion is decreased, but full flexion of

Feet and ankle present, partial blockade 33%

2 - Inability to raise legs or flex knee, flexion of ankle and feet is present, Partial

Blockade 66%

3 - Inability to raise leg, flex knee or ankle or move toes. Complete paralysis.

Patients in whom sensory blockade did not reach T6 were excluded from the study. Hypotension, defined as systolic blood pressure ≤ 90 mm Hg or less than 70% of pre-anaesthetic value, was treated with ephedrine (5-10mg) intravenously. Bradycardia (≤ 50 beats/min) was treated with intravenous atropine (0.5 mg). Nausea and vomiting were treated with intravenous metoclopramide (10 mg).

Sedation score also calculated from

Sedation score, Chernik et al₁₄

Awake 0

Sleeping comfortably, easily arousable 1

Deep sleep but arousable 2

Deep sleep but not arousable 3

Temperature, pulse, blood pressure, respiratory rate, oxygen saturation, ECG were monitored and measured immediately before spinal anaesthesia, 15 minutes after spinal blockade and then at 15 minutes interval till 60 minutes .

Pulse rate, BP, respiratory rate, SPO₂ were measured at 30min, 60 min, 90min, 120min, 3 hour, 6 hours, 9 hours, and 12 hours.

The level of sensory and motor block during the postoperative period was assessed every 15 minutes until sensory block reached L₅ dermatome and the Bromage scale reached grade 0 for residual anaesthesia effect.

The regression of two segments of spinal level was taken as "0" hours .Postoperatively when patients were shifted to ward, vital data were recorded at 3hour, 6hour, 9 hour and at 12 hours and analgesic requirement during first twenty four post operative hours was recorded. Patients were also observed for side effects like nausea, vomiting, bradycardia, tachycardia, hypotension, drowsiness, and headache.

Patients were carefully questioned regarding duration of pain

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free period, type and severity of pain if occurred and amount of analgesia required and the data was recorded. The severity of postoperative pain was measured using a 10-cm visual analogue scale (VAS) (0=no pain, 10=the worst possible pain) during cough or movement at 2-hr intervals or whenever the patient requested analgesia. Postoperative analgesia was provided by intramuscular diclofenac sodium 75 mg. if necessary (if the VAS score was ≥ 4). Hypotension, defined as systolic blood pressure ≤ 90 mm Hg or less than 70% of pre-anesthetic value, was treated with ephedrine (5-10mg) intravenously. Bradycardia (≤ 50 beats/min) was treated with intravenous atropine (0.5 mg). Nausea and vomiting were treated with intravenous metoclopramide (10 mg). The time to first analgesia (TFA) and any postoperative side effects were noted with special reference to nausea and vomiting.

All data are expressed as number or mean \pm S.D or S.E. Continuously distributed variables were analyzed using one-way analysis of variance with SPSS15. $P < 0.05$ was considered statistically significant.

RESULTS

The mean age, weight, heights, duration of surgery or ASA status were comparable in all three groups. There was no significant difference in onset of sensory or motor blockade in all groups. All patients had adequate spinal level of T6 and intraoperative hemodynamics was stable and comparable in all three groups. [TABLE: 1]

Figure 1

Table 1 Demographic data

	Group I	Group II	Group III
Total no of patients	30	30	30
Age (years)	16-55	16-55	17-50
Mean age (years)	36.27 \pm 10.47	34.70 \pm 10.86	35 \pm 10.45
Height (cms)	160.33 \pm 7.42	157.30 \pm 8.90	154.63 \pm 6.72
Duration of surgery (mins)	105.67 \pm 24.99	98.83 \pm 23.62	88.17 \pm 14.94
Ratio :	8:7	7:8	8:7
Male : Female			

The onset of sensory blockade in seconds as judged by loss of pinprick sensation, bilaterally at shin of tibia in Group I was 145.8 \pm 0.5 second Group II was 216 \pm 0.6 seconds, Group III was 216 \pm 0.6 seconds. [TABLE: 2]

Figure 2

Table 2 Results

	Group I	Group II	Group III
Number of patients (n)	30	30	30
Onset of sensory blockade (sec)	145.8 \pm 0.5	216 \pm 0.6	216 \pm 0.6
Onset of motor blockade (sec)	190.2 \pm 0.4	280.2 \pm 0.6	283.8 \pm 0.58
Duration of sensory blockade (min)	155.6 \pm 26.0	211.2 \pm 31.7	233.4 \pm 34.7
Duration of motor blockade (min)	153 \pm 16.8	169.3 \pm 20.7	193.93 \pm 24
Time to first analgesia	138 \pm 5.1	183 \pm 3.3	236 \pm 1.6

The duration of sensory blockade in Group I was 155.6 \pm 26, Group II 211.2 \pm 31.7, Group III 233.4 \pm 34.7. The duration of motor blockade in Group I was 153 \pm 16.8, Group II was 169.3 \pm 20.7, and Group III was 193.9 \pm 24.

The time to first analgesia in Group I was 138.5 \pm 5.1, Group II was 183 \pm 3.3 and Group III was 236.2 \pm 1.6. The total doses of rescue analgesia required for Group III was low as compared to Group I and Group II.

Patients in groups II and III demonstrated a highly significant increase in the incidence of nausea, vomiting, bradycardia and hypotension.

Before premedication mean pulse rate in all patients was 84.93 \pm 8.30 (mean \pm S.D.) minutes in group I, 83.87 \pm 6.96 (mean \pm S.D.) per minute in group II and 85.67 \pm 5.63 (mean \pm S.D.) per min in group III which was statistically non significant ($P > 0.05$). After pre medication in all the patients, mean pulse rate increased in all the three groups. There were instances of decrease in pulse rate marked in group III intraoperatively at around 45,60,75,90mins. There was no bradycardia (i.e. pulse rate < 60 /min). [GRAPH 1 AND GRAPH 2]

Figure 3

Fig: 1 showing changes in heart rate

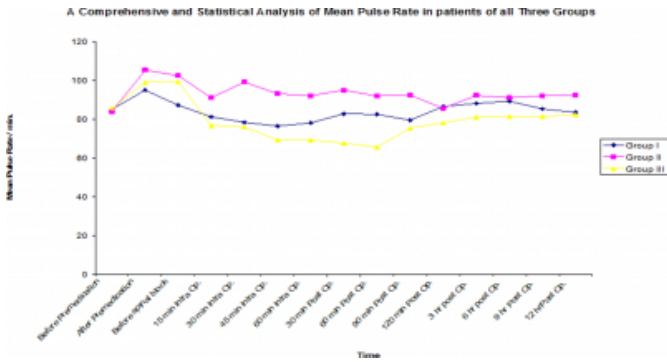
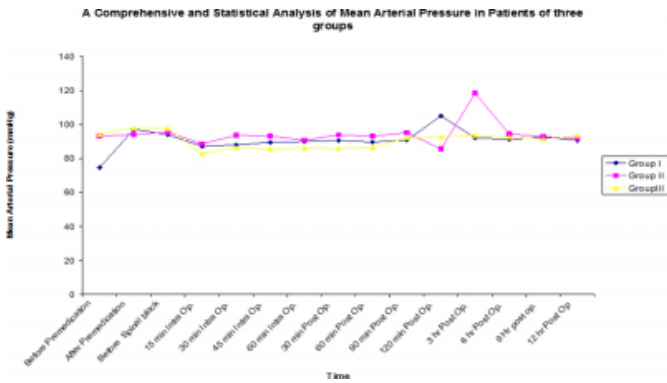


Figure 4

Fig: 2 showing changes in mean arterial pressure



After premedication there is slight increase in M.A.P, followed by decrease in M.A.P. The M.A.P is lowest in group III, The M.A.P. in group I&II was almost comparable.

This table shows incidence of side effects in preoperative period in all three groups. In group I, 1(3.33%) patients had nausea and vomiting, 2(6.66%) and hypotension. There was no bradycardia, tachycardia and sedation in group I. In group II, 2 patients had nausea and vomiting, 2 patients had bradycardia, 5 patients had developed hypotension while none had tachycardia, sedation. In group III, 9 patients had nausea & vomiting, 8 had bradycardia and 10 had hypotension. [Table:3]

Figure 5

Table 3 Postoperative complications

Events	Group I (no of patients)	Group II (no of patients)	Group III (no of patients)
Nausea vomiting	1(3.33%)	5(16.6%)	9(30%)
Bradycardia	1(3.33%)	4(13.3%)	8(26.6%)
Respiratory depression	0(0%)	0(0%)	0(0%)
Hypotension	2(6.66%)	6(20%)	10(33.3%)
Sedation	0(0%)	0(0%)	0(0%)

Table 4 is showing time to first analgesia and all the groups were statistically significant.

Figure 6

TABLE: 4 TIME TO FIRST ANALGESIA

TIME TO FIRST ANALGESIA[MIN]	GROUP 1	GROUP 2	GROUP 3
180-239[MIN]	0	30	30
MIN DURATION	135	180	232
MAX DURATION	150	191	238
MEAN	138.50	183	236.27
S.D.	±5.11	±3.36	±1.61
	P<0.001 HS	P<0.001 HS	P<0.001 HS

Gr.1 v/s Gr.2 t=-40.677 Gr.2/Gr.3 t=-76.823 Gr.1/Gr.3 t=-99.892
P<0.001 HS P<0.001 HS p<0.001 HS

DISCUSSION

Intrathecal administration of cholinergic receptor agonist or cholinesterase inhibitors produces antinociceptive effect which is mediated by spinal muscarinic receptors in animals and human beings¹⁵. Intrathecal administration of neostigmine inhibits the metabolism of spinally released acetylcholine that produces analgesia without neurotoxicity in animals and humans^{6, 16}. ,and enhanced the onset of sensory block^{17, 18}. However, we didn't observe any enhancement of onset of sensory block. In our study, two segment regression of block was prolonged in the 75µg neostigmine group as compared to control group and the 50µg neostigmine group.

The duration of motor block was statistically significantly prolonged in 75 µg which indicates that motor block could be dose dependant(P<0.01) The threshold dose for post operative analgesia found to be approximately 50µg^{4, 17}. We found that greatly enhanced analgesia in 75µg dose as

evident by less consumption of rescue analgesics in form of I/M diclofenac sodium. In this study visual analogue scores were significantly lower than in the neostigmine group. The time to first analgesia is longer in the 75 µg compared to the 50µg group ($P < 0.01$)¹⁸. Intrathecal neostigmine directly stimulates preganglionic sympathetic neurons in spinal cord and can counteract the hypotension caused by intrathecal injection of local anaesthetics^{19,20}. Bradycardia was more frequent in the 75µg(26%) than the 50µg(13%) neostigmine groups, but all patients responded to injection atropine 0.3-0.6 mg IV. Neostigmine 50µg caused bradycardia of 65-80 per minutes after administration of spinal anaesthesia and it was successfully treated with atropine²¹.

Intrathecal neostigmine produces nausea in dose dependent manner. In clinical studies we also observed a significantly higher incidence of nausea and vomiting associated with Intrathecal neostigmine which due to cephalad migration of neostigmine to brain stem, accumulation of acetylcholine at chemoreceptor trigger zone induces vomiting. To minimize cephalad spread and reduce the incidence of nausea and vomiting, injection of neostigmine in a hyperbaric dextrose solution while maintaining the patients in a head up position.

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The incidence of nausea and vomiting was more frequent in the 75µg neostigmine (30%) compared to the 50µg (16%) group. Nausea and vomiting started within 30 minutes and lasted for more than one hour in patients in spite of metoclopramide or droperidol²². However most of patients in our study responded to injection metoclopramide (10 mg) or injection ondansetron (4-8 mg) in controlling vomiting

CONCLUSION

To conclude Intrathecal neostigmine in a dose of 75µg provides better analgesia than 50µg with less consumption of rescue analgesia. The duration of sensory block and a motor block was prolonged in the 75µg group.

We observed enhanced analgesia by intrathecal neostigmine in 75µg dose as is shown by less consumption of intramuscular diclofenac sodium. In present study the visual analogue score were significantly lower in the neostigmine group as compared to the control group.

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