Original Research

Intrathecal pethidine as a sole agent for spinal anesthesia and analgesia – a comparison with 5% lignocaine

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Abstract

Background: Spinal anesthesia is very safe, effective, and economical technique in anesthesia for a regional block. Various drugs are used for spinal anesthesia from which lignocaine is very popular since several decades. The discovery of opioid receptors in the central nervous system especially in spinal cord initiated interest in using them as intrathecal and extradural uses.

Objective: To evaluate the efficacy of intrathecal pethidine as a sole anesthetic agent and as a postoperative analgesia in the surgical procedure below the umbilicus. It was compared with commonly used drug like lignocaine.

Materials and Methods: The present study was carried out in patients of either sex belonging to American Society of Anesthesiology (ASA) grade I or II, in the age group of 16–70 years. Patients were undergoing elective lower abdominal, genitourinary or lower extremity surgery under spinal anesthesia at our hospital. Patients were divided into 2 groups of 50 patients each. Patients in group 1 (study group) were given 1 mg/kg preservative-free injection pethidine hydrochloride (5%) diluted up to 2cc with 0.9% normal saline intrathecal. Patients in group 2 (control group) were given 2 ml injection lignocaine (5%) in 7.5% dextrose intrathecal. Anesthesia was given in subarachnoid space in lateral or sitting position between L3–L4 interspace by using 25 gauge needles with all aseptic precautions. Sensory block was tested by using pin prick method. Time to onset of motor blockage was determined by modified Bromage scales of grade II. The degree of postoperative analgesia was carried out by visual analog scale.

Result: There was no incidence of sensory block failure in either group. Time of onset of sensory block was significantly ($p < 0.01$) faster in the case of lignocaine group (group 2). The difference between the time to regress sensory block by two segments was significant between 2 groups ($p < 0.01$). Duration of analgesia at L1 level was significantly different between both groups ($p < 0.05$). The difference between the total duration of sensory block was not significantly different between both groups ($p > 0.05$). The onset of motor block at knee joint was significantly prolonged in group 1 as compared to group 2 ($p < 0.01$). The mean duration of motor block was shorter in group 1 as compared to group 2 ($p < 0.01$). In group 1, 4 out of 50 patients developed incomplete motor block. In this study mean duration of analgesia was 14 hours in group 1 and 2 hours in group 2. This showed a significant difference ($p < 0.01$). The patients in group 1 required analgesia once in 24 hours postoperatively while in group 2 patients required analgesia two to three times in 24 hours postoperatively.

Conclusion: This study showed that intrathecal pethidine in the dose of 1 mg/kg produced comparable effects produced by subarachnoid administration of local anesthetics such as lignocaine including sensory, motor, and sympathetic block. It also showed fewer side effects than lignocaine. It also showed lesser requirements of analgesics postoperatively and early ambulation.

KEY WORDS: Spinal anesthesia, Pethidine, Lignocaine.

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Introduction

Spinal anesthesia is very safe, effective, and economical technique in anesthesia for a regional block. Various drugs are used for spinal anesthesia from which lignocaine is very popular since several decades. Lignocaine was discovered by a professor of anesthesiology, named Torsten Gordh of Sweden.[1] It's an amide group of local anesthetic. Lignocaine

is a choice of local anesthetic because it is safe to use and short duration of action allowing timely recovery and discharge which is of great importance in ambulatory surgery. But since last decade important side effects of lignocaine are coming into picture. Direct neurotoxicity is a serious side effect which leads to permanent neurological damage including paraplegia.[2,3,4] Recent investigation showed lignocaine causes apoptosis of neurons in culture in vitro.[5,6]

The discovery of opioid receptors in the central nervous system especially in spinal cord initiated interest in using them as intrathecal and extradural uses.[7] Various agents such as morphine, pethidine, buprenorphine, and fentanyl are used for an analgesic. Complication like respiratory depression, urinary retention, itching, nausea, and vomiting was frequently reported. In 1982 Mircea et al and in 1983 Sandu et al showed pethidine showed lesser side effects than morphine and produced similar effects as subarachnoid administration of local anesthetic.[8,9]

The present study was carried out to evaluate the efficacy of intrathecal pethidine as a sole anesthetic agent and as a postoperative analgesic in surgical procedures below the umbilicus. It was compared with commonly used drug like lignocaine.

Materials and Methods

The present study was carried out in patients of either sex belonging to American Society of Anesthesiology (ASA) grade I or II, in the age group of 16–70 years. Patients were undergoing elective lower abdominal, genitourinary or lower extremity surgery under spinal anesthesia at our hospital. A Proper history and systemic examination were done by the investigator. Patients having a history of drug allergy, narcotic abuse or where operative procedure exceeding 1.5 hours were excluded from the study. The study procedure was explained to all the patients and written informed consent were taken prior to the administration of anesthesia. Patients were divided into 2 groups of 50 patients each. Patients in group 1 (study group) were given 1 mg/kg preservative-free injection pethidine hydrochloride (5%) diluted up to 2 cc with 0.9% normal saline intrathecal. Patients in group 2 (control group) were given 2 ml injection lignocaine (5%) in 7.5% dextrose intrathecal. All routine drugs for premedication (such as atropine, glycopyrrolate, and metoclopramide) were given to patients. Anesthesia was given in subarachnoid space in lateral or sitting position between L3–L4 interspace by using 25 gauge needles with all aseptic precautions. Sensory block was tested by using pin prick method. Time to onset of sensory block, time to the highest level of sensory block, the time taken for two segment regression and time taken for regression to L1 dermatome were noted. Patients failed to achieve analgesia above L1 dermatome within 30 minutes after injection were considered spinal block failure. Time to onset of motor blockage was determined by modified Bromage scales of grade II.[10] The degree of postoperative analgesia was carried out by visual analog scale. Patient's vital signs were monitored time to time. Data of both the groups were compared by using unpaired *t*-test in MS Excel. The *P* value less than 0.05% was considered as significant difference.

Result:

The present study was conducted on 100 patients selected randomly from the routine operation list. The mean age of patients in group 1 was 33.6 years and in group 2 was 32.56 years. Mean weight of patients in group 1 and group 2 was 44.8 kg and 45.6 kg, respectively. In group 1, 43 (86%) were male and 7 (14%) were female patients. In group 2, 28 (56%) were male and 22 (44%) were female patients. In our study 75 patients were posted in general surgery, 20 for gynecological surgery and 5 were in orthopedic surgery.

Table 1 shows results of the assessment of sensory block. There was no incidence of sensory block failure in either group. Time of onset of sensory block was significantly ($p < 0.01$) faster in the case of lignocaine group (group 2). The difference between the time to regress sensory block by two segments was significant between both groups ($p < 0.01$). Duration of analgesia at L1 level was significantly different between both groups ($p < 0.05$). The difference between the total duration of sensory block was not significantly different between both groups ($p > 0.05$).

Table 2 shows assessment of motor block at knee joint by modified Bromage scale. The onset of motor block at knee joint was significantly prolonged in group 1 as compared to

Table 1: Assessment of sensory block by pin prick method

Parameters	Group 1 (mean ± SD) Minutes	Group 2 (mean ± SD) Minutes
Onset of sensory block	4.94 ± 1.43	3.4 ± 0.6
Time to reach the highest level of block	7.46 ± 2.01	6.3 ±1.12
Time to regress block by two segments	61.86 ± 9.63	71.86 ± 5.29
Duration of analgesia at L1 level	79.7 ± 11.62	86.3 ± 6.12
Total duration of sensory block	95.73 ± 16.96	100.3 ± 6.5

Table 2: Assessment of motor block by modified Bromage scale

Parameters	Group 1 (mean ± SD) minutes	Group 2 (mean ± SD) minutes
Time to onset of motor block (grade II)	6.08 ± 1.42	4.22 ± 0.64
Duration of motor block (grade II)	54.24 ± 14.75	80.7 ± 5.05

Grade 0: No motor block
Grade 1: Inability to raise extended leg but able to move knees and feet
Grade 2: inability to raise extended leg and move knee but able to move feet
Grade 3: Complete motor block of the lower limb

group 2 ($p < 0.01$). The mean duration of motor block was shorter in group 1 as compared to group 2 ($p < 0.01$). In group 1, 4 out of 50 patients developed incomplete motor block.

In our study measurements of vital signs showed in group 1, there was a gradual reduction in pulse rate and in group 2 significant rise in pulse rate. Not a single patient developed bradycardia. Systolic BP was reduced in both the groups. The incidence of significant hypotension was less in group 1 (4%) as compared to group 2 (8%). Respiratory rate, tidal volume, and minute volume did not show any significant change in both the groups. No patient developed respiratory depression in our study.

In this study mean duration of analgesia was 14 hours in group 1 and 2 hours in group 2. This showed a significant difference ($p < 0.01$). The patients in group 1 required analgesia once in 24 hours postoperatively while in group 2 patients required analgesia two to three times in 24 hours postoperatively. Patients were given injection diclofenac sodium (1.5 mg/kg) as analgesia postoperatively when required.

Discussion

Local anesthetics were commonly used as spinal anesthetic agent but since a decade various studies found that spinal anesthesia with intrathecal 5% heavy lignocaine showed transient irritation, neurological symptoms, and severe leg pain. Another disadvantage of intrathecal lignocaine was a short duration of action which will cause early administration of analgesics in the postoperative period.[11] These problems prompt researchers to find out other suitable spinal anesthetic agent.

With the discovery of opioid receptors in spinal cord opens the door for opioids for spinal anesthesia. Opioid was commonly used intrathecal and epidural as analgesics. Pethidine as compared to morphine produce lesser side effects at therapeutic doses.[7] Pethidine is phenylpiperidine derivative which resembles lignocaine in many ways. Molecular weight and pKa values of lignocaine and pethidine were very close to each other. In relation to pharmacological actions, pethidine produces similar peripheral sensory and motor block as lignocaine.[12,13] Intrathecal pethidine, due to its high lipid solubility, rapidly absorbed by lipid tissues of spinal roots which leading to rapid development of axonal block. Apart from axonal block its prolonged postoperative analgesic actions were because of its action on nociceptive synaptic junctions in spinal cord.[14]

In this study, the investigator had compared intrathecal pethidine and lignocaine as a spinal anesthetic agent. Results in this study showed a significant difference in onset of the sensory block between lignocaine and pethidine group. It was more rapid in lignocaine group. Time to two segment regression of sensory block was shorter in pethidine group as compared to lignocaine group. The difference in total duration of sensory block was insignificant between 2 groups. Results of this study were comparable with other studies.[13,14,15,16,17]

In this study mean time to onset of grade II motor block was significantly shorter in lignocaine group as compared to pethidine group. A significant difference was observed in duration of motor block also which was shorter in pethidine group as compared to lignocaine group. These results were comparable with other studies.[13,14,15,16,17]

In this study, pulse rate was increased in lignocaine group and decreased in pethidine group. But none of the patients developed bradycardia. Other study done by Antoine showed a significant decrease in pulse rate in pethidine group. Study of Frances observed bradycardia in 6 out of 14 patients and study conducted by Mohamed noted bradycardia in 1 out of 5 patients receiving pethidine as spinal anesthetic agent.[18] Reasons for development of bradycardia by pethidine is that it depresses vital centers in the medulla oblongata and stimulates the vagal system.[15] In this study, systolic BP was reduced in both the groups. The incidence of significant hypotension was less in pethidine group as compared to lignocaine group. These findings were well correlated with the study done by Divekar DS who found a decrease in blood pressure in 4 out of 70 patients within 20 minutes of the block and were managed by intravenous fluids.[14] Results of this study showed no significant change in respiratory rate, tidal volume, and minute volume in both the groups. Pethidine showed less respiratory depression as compared to morphine. Use of hyperbaric solution also reduce chances of development of respiratory depression.[14]

In this study, a significant difference was observed in duration of postoperative analgesia. The total duration of analgesia was more with pethidine group as compared to lignocaine group. These findings were in correlation with a study done by Sangarlangkarn S et al who found 14 out of 20 patients not required anesthesia in pethidine group. Another study by Tauzin-Fin P et al observed 24 patients out of 30 experienced complete analgesia only 6 patients required a single dose of postoperative analgesia for pain relief. On more study done by Divekar DS et al mentioned 80% of patients did not require analgesia with pethidine group. Pethidine produces prolonged postoperative analgesic actions by acting on nociceptive synaptic junctions in dorsal horn of spinal cord.[13,14,16]

Conclusion

This study showed that intrathecal pethidine in the dose of 1 mg/kg produced comparable effects produced by subarachnoid administration of local anesthetics such as lignocaine including sensory, motor, and sympathetic block. It also showed fewer side effects than lignocaine. It also showed lesser requirements of analgesics postoperatively and early ambulation.

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