|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 5, Issue 11; November: 2021; Page No. 140-144

STUDY OF COMPARATIVE OUTCOME OF 0.5% BUPIVACAINE AND 0.5% BUPIVACAINE WITH CLONIDINE (50µg)FOR SPINAL ANAESTHESIA

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Article Info: Received 12 October 2021; Accepted 24 November 2021
DOI: https://doi.org/10.32553/ijmbs.v5i11.2319
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Conflict of interest: No conflict of interest.

Abstract

Background: bupivacaine is the most commonly used drug for spinal anesthesia. To improve upon the quality of analgesia and prolong the duration of its action, many adjuvants have been tried. Intrathecal clonidine an α2 adrenceptor agonist has potent central antinoceptive properties with analgesic effect at spinal level mediated by postsynaptically situated adrenoreceptor in dorsal horn of spinal cord.

Material and Methods: 100 ASA grade I/II patients aged between 18-60 years undergoing elective lower abdominal, urologic, lower limb surgeries were selected and divided into two groups of 50 each. Bupivacaine Group B received intrathecally 2.5 mL of heavy Bupivacaine+0.5mL normal saline, whereas clonidine Group BC received intrathecal 2.5 mL of heavy Bupivacaine with 50µg clonidine. (total 3mL).

Conclusion: Clonidine potentiates bupivacaine spinal anesthesia by increasing the duration and improving the quality of analgesia without significant hemodynamic side effects and with mild sedation.

Keywords: Spinal anesthesia, Clonidine, Bupivacaine, Complete and effective analgesia.

Introduction

Spinal anaesthesia was introduced into clinical practice by Karl AugustBier in 1898[1]. More than a century has passed and even today, it is one of themost popular techniques for both elective and emergency surgical procedures particularly Caesarean sections, lower abdominal surgeries, orthopedic and urological surgeries just to name a few. Spinal anesthesia, defined, as 'the regional anesthesia obtained by blocking nerves in the subarachnoid space' is a popular and common techniqueused worldwide. The advantages of an awake patient, simple to perform, offers rapid onset of action, minimal drug cost, relatively less side effects and rapid patient turnover has made this the choice of many a surgical procedure. These advantages are sometimes offset by relatively short duration of action and uncomfortable postoperative period when its action wears off. Other methods like epidural anesthesia require technical expertise, larger amount of drug usage and sometimes even ending up with failed epidural analgesia. Further, Transcutaneous electrical nerve stimulator does not stand up against drug therapies as a sole treatment for anything other than mild post operative pain. In order to extend intraoperative analgesia into postoperative perioda number of spinal adjuvants like opioids, clonidine, ketamine, morphine and buprenorphine and so on have been added to prolong intrathecal bupivacaine action. However, each drug has its own limitations, and a need for alternativemethods or drugs always exist. Central neuraxial opioids, intrathecal as well as epidural, offer the benefit of analgesia but however the related side effects include sense of dizziness, nausea, vomiting, pruritis, urinary retention and even cases of respiratory depression have been reported. Recently clonidine which is an α_2 adrenergic agonist has been tried as an adjuvant to prolong the action of local anesthetics. Intrathecal clonidine produces dose dependent analgesia and has been successfully used as a sole analgesic via the intrathecal route. this study was designed to evaluate the effectiveness of adding 50µg clonidine to bupivacaine for spinal anesthesia and to compare its use withthat of bupivacaine.

Objectives

Sensory and motor blockade - Onset, Time to peak sensory blockade, highest level of sensory block. Recovery parameters - Time to two segment

regression, time to complete sensory and motor recovery. Analgesia - Duration of complete and effective analgesia, time tofirst pain medication, Quality of intra operative analgesia.

Review of Literature

The first spinal anaesthesia was performed in the year 1885, J. Leonard Corning**,** a New York Neurologist. He injected cocaine into the subarachnoid space by accidentally piercing the dura while experimenting on a dog. Later he deliberately repeated the intradural injection for 60 minutes of 3% cocaine and suggested its use in surgery. *"Be the destiny of this observation, what it may,it had seemed to me, on the whole worth recording",* were his words. Heinrich Iraneus Quinke of Keil in Germany standardized the lumbar puncture as a simple procedure in 1891. In the same year, Essex Wynter described lumbar puncture in England. On 16th of August, 1898, in Keil, August Bier performed the first planned spinal anesthesia in man. He injected 3 ml of 0.5% cocaine into the subarachnoid space of a 34 years old laborer for the operation on the lower limb. After using it on six patients, he and his assistant injected cocaine intoeach other's theca. Goodison, R.R. 1982 states hyperbaric bupivacaine produces predictable and adjustable level of blocks which contrasts to isobaric mixture. Hyperbaric bupivacaine has rapid onset and longer duration ofaction. Sundens KO, et al., 1982: In their double blind study compared the effects of 0.5% bupivacaine, 1.5,2.0 and 3 mL in 8% glucose in 30 patients undergoing spinal anaesthesia .The time of onset of sensory and motor blockade was faster in all three groups Chambers WA, 1982 : In their double blind study assessed the effects of the intrathecal administration of 3mL of 0.5%bupivacaine in 8% glucose either alone or with the addition of 0.2mL of 1:1000 epinephrine or 0.5mL of 1% phenylephrine . Chambers WA, 198**2 :** In their double blind study assessed the effects of the intrathecal administration of 3mL of 0.5%bupivacaine in 8% glucose either alone or with the addition of 0.2mL of 1:1000 epinephrine or 0.5mL of 1% phenylephrine . The intervertebral discs account for about one-fifth of the length of the vertebral column composed of the outer fibrous cover, the annulus fibrosus enclosing a core of soft gelatinous material, the nucleus pulposus. The disc provides flexibility to the column and act as shock absorber. Atrophy of the discs along with osteoporosis of the vertebra leads to decreased height & kyphotic deformity of old age. **Supraspinous ligament**: Is a continuation of ligamentum nuchae, strong thick fibrous band connecting the apices of spines from 7th cervical vertebrae to the sacrum This may become ossified in old age & render penetration with a spinal needle difficult. **Interspinous ligament**: It connects adjoining spinous processes. They fuse with the Supraspinous ligaments posteriorly and with ligamentum flavum anteriorly. **Ligamentum flavum**: It stretches from the lower border & inner surface of one lamina to the upper border and outer surface of the lamina below.It is composed of yellow elastic fibers. It comprises over half of the posterior wall of the vertebral canal, the bony laminae accounting for the remainder. Ligamentum flavum is thinnest at cervical region and thickest at lumbar region. Functionally these ligaments are muscle spares, assisting in recovery of the effect of posture after bending and in maintaining erect posture. All nerve fibres are affected by local anaesthesia fiber, but within any one fiber type, there is tendency for small, slower conducting fibres to be more readily blocked than large, fast conducting fibres.Myelinated preganglionic B fibres which have a faster conduction time are about 3 times more sensitive to local anesthetics than the slower non myelinated postganglionic C fibres. Large A fibres are the most resistant local anaesthetics, it is Aδ fibres, subserving pain and temperature are more sensitive than C fibres, although more rapidly conducting. Sensory Aα fibres appear to be more sensitive to blockade than motor Aα fibres, although of the same conduction velocity. This may be because sensory fibres conduct at a higher frequency. The order of sensitivity to blockade appears to be preganglionic, temperature, pain, touch, proprioception and motor fibres. Rate of injection: This is perhaps the most important factor in determining the height of anaesthesia. With slow injections, the levels are low. Very rapid injections may cause anaesthesia to reach well into the thoracic area.

Material and Methods

This clinical study was conducted on 100 adult patients of ASA physical status 1 & 2 in the age group of 18 years to 60 years, of either sex, posted for elective lower limb, lower abdominal, gynaecological and urological surgeries under spinal anaesthesia after taking informed consent at Anugrah Narayan Magadh medical college and Hospital Gaya, Bihar. Study duration of one year. After approval from the hospital ethical committee,a comparative study was carried out on 100 adult patients.

Inclusion criteria:

ASA grade 1 and 2 patients, Age group of 18 –60 yrs, Patients giving valid informed consent. Those patients scheduled to undergo elective lower abdominal, lower extremity, gynecological or urological surgeries under subarachnoid block

Exclusion criteria:

Patient refusal, Patients belonging to ASA grade 3 and grade 4, Patients physically dependant on narcotics, Patients with history of drug allergy, Patients with

gross spinal abnormality, localized skin sepsis, hemorrhagic diathesis or neurological.

Pre anesthetic check up was carried out pre operatively with a detailed history, general physical examination and systemic examination. Airway assessment and spinal column examination were done. Patient was shifted to the OT table; IV access was obtained on the forearm with 18 Gauge IV cannula and Lactated Ringer's solution 500 mL was infused intravenously before the block. The monitors connected to the patient included non invasive B.P, oxygen saturation using pulse oximeter. Baseline PR, BP and RR, SpO2 was recorded.

Results

A total of 100 patients belonging to ASA grade I and II posted for lower abdominal and lower limb surgeries were randomly selected. The patients were divided into 2 groups of 50 each.GroupB (bupivacaine group) received 0.5% hyperbaric Bupivacaine 12.5 mg PROCEDURE BEING PERFORMED

(2.5 ml) +0.5mL normal saline (Total volume of 3mL) Group BC (Clonidine group) received 0.5% hyperbaric Bupivacaine 12.5 mg (2.5 ml) + clonidine 50µg intrathecally (Total volume made to 3mL

Table 1: DEMOGRAPHIC PROFILE

Parameter	Group B	Group BC	P Value
Age (Years)	42.3±10.5	40.4 ± 12.4	0.43
Sex Male/Female	26:24	25:25	0.8
Height (Ft)	5±0.43	5.53±0.32	0.75
Weight (Kgs)	56.7±8.4	57.1±1.1	0.49

Values are expressed as Mean +SD.

The mean age of the patient in group BC was 40.4 + 12.4 years and in groupB was 42.3±10.5 years. In group BC, there were 25 males and 25 females, and in groupB there were 26 males and 24 females. The mean heightof the patient in groupBC was 5.53 + 0.32 and in groupB was 5± 0.43.The mean weight of the patient in groupBC was 57.1 ± 1.1 and in groupB 56.7 ± 8.4kgs. There was no statistically significant difference between the two groups with regards to age, sex, height and weight (p>0.05). The mean time for onset of motor block in group BC was 165.1 seconds and in group B was 231.80 seconds.

Table 2: HIGHEST LEVEL OF SENSORY BLOCK

	Group B (%)	Group BC (%)
T4	1(2)	7(14)
T6	10 (20)	28(56)
T8	23 (46)	13(26)
T10	16(32)	2(4)

Values are expressed as n (%).

With regard to the highest sensory level attained, patients of groupBC, 56% attained T6 level, 26% achieved T8 level, 14% achieved T4 level and 4% achieved T10 level. In group B, 46% achieved T8 level followed by32% T10 l vel, 20% T6 level and 2% T4 level. This implied groupBC achieved highest l vel of sensory block. The mean duration of complete analgesia in group B was 165.1(min) and in group BC was 240.2(min) The mean duration B was 212.6 (min) and in group BC was 332.64 minutes. 0.001, The mean DBP in group B decreased from baseline value of 82 mmHg to 72 mmHg at 10 minutes and 73 mmHg at 20 minutes and 30 minutes then increased to Discussion 75 mmHg by the end of 2 hours. The mean DBP in group BC

Discussion

Spinal anesthesia with hyperbaric bupivacaine 0.5% is a popular method. The duration of spinal analgesia can be prolonged by the adjuvants like vasoconstrictors, opioids, neostigmine, ketamine, midazolam, etc. Vasoconstrictors (epinephrine, ephedrine and phenylephrine) prolong the duration of action of the local anesthetic by decreasing systemic absorption but have been found to induce neurological signs and symptoms due to reduced blood supply to the spinal

cord. Intrathecal midazolam produces sedation, ketamine results in psychomotor symptoms and neostigmine causes excessive nausea and vomiting. Clonidine is a selective partial agonist for α_2 - adrenoreceptors. It is known to increase both sensory and motor block of local anesthetics. The analgesic effect following its intrathecal administration is mediated spinally through activation of postsynaptic α_2 receptors in substantia gelatinosa of the spinal cord and it works by blocking the conduction of C and A delta fibers, increases potassium conductance in isolated neurons invitro and intensifies conduction block of local anesthetic. Roh et al recently suggested that one of the mechanisms for the enhanced potency of intrathecal clonidine administration in a rat model of neuropathic pain is its ability to suppress phosphorylation of NMDA receptor subunit NR_1 in spinal dorsal horn neuron of rats . The aim of this study was to evaluate the effects of clonidine added to hyperbaric bupivacaine for spinal anaesthesia. Our study design consisted of 100 patients aged between 18 - 60 years, ASA physical status I, II undergoing elective lower abdominal, urological, lower limb surgeries under spinal anesthesia were randomly divided into two groups after taking informed consent. GroupB (bupivacaine group) patient's received intrathecally 0.5% hyperbaric Bupivacaine 12.5 mg (2.5 mL) +0.5mL normal saline. Total 3mL Group BC (Clonidine group) received intrathecal 0.5% hyperbaric Bupivacaine 12.5 mg (2.5 mL) with clonidine 50µg. Total volume made to 3mL. The mean time to achieve peak sensory level in group BC compared to group B was 6.93 minutes vs 11.55 minutes. ($p<0.05$) by chi square test. This implied that groupBC achieved highest level of sensory block. In patients of group BC, 56% attained T6 level, 26% achieved T8 level, 14% achieved T4 level and 4% achieved T10 level. Whereas in group B, 46% achieved T8 level followed by 32% T10 level, 20% T6 level and 2% T4 level. **Gurudatta et al** in his study clonidine group attained a cephalad block of T4level in 18 patients, T6 level in 7 patients. In bupivacaine group, a block up toT4 level was obtained in 9 patients, T6 level in 16 patients. p value was 0.021. B.S.Sethi etal, in his study evaluated the effect of clonidine 1µg/kg added tohyperbaric bupivacaine and found that the highest level of sensory analgesiawas clinically and statistically significant among the clonidine group. From the above study, we conclude that addition of clonidine intrathecalto hyperbaric bupivacaine results in higher level of sensory blockade and faster onset when compared to bupivacaine. **Gurudutta et al**, His study concluded that sensory recovery in group BC was 327 minutes and in groupB was 207 minutes . The motor blockade ingroup BC, was 290.8minutes and in group B was 150.0 minutes.

B.S.Sethi et al In his study found that the duration of complete sensory recovery in clonidine group was 614 minutes and in control group 223 minutes. **Analgesia** - We found that the duration of complete analgesia in groupBC was 240.8 min and in 165.1 min in groupB. Effective analgesia was 332.64 minutes in group BC and 212.6 minutes in group B. The time for first request of rescue analgesic postoperatively was considerably delayed in group BC by 140-150 minutes compared to group B (362.84 vs 221.4 minutes), thereby reducing the requirement of analgesics in the early postoperative period. The quality of analgesia was better as the VAS was lower in group BC than in group B. **Kaabachi** etal in his study concluded that intrathecal clonidine at 1µg/kg prolonged spinal anaesthesia without causing severe adverse effects. **B.S. Sethi etal,** The results of their study showed that addition of 1µg.kg-1of clonidine to intrathecal bupivacaine is safe and likely to be as effective as higher dosages minimizing the side effects.

Conclusion

On the basis of the present clinical comparative study, we can conclude that the addition of 50µg clonidine to 0.5% hyperbaric Bupivacaine 12.5 mg (2.5mL) in spinal anesthesia significantly decreases the onset time, prolongs the duration of both sensory and motor blockade. It prolongs the duration and improves the quality of postoperative analgesia with better hemodynamic stability and good sedation as compared to bupivacaine alone.

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