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TO STUDY THE DOSE RELATED EFFICACY OF INTRATHECAL DEXMEDETOMIDINE FOR PROLONGATION OF SPINAL ANAESTHESIA WHEN ADDED TO HYPERBARIC BUPIVACAINE IN COMPLEX LOWER LIMB ORTHOPEDIC SURGERIES

Anesthesiology

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ABSTRACT

INTRODUCTION – Spinal anaesthesia is the most commonly employed technique in surgeries below umbilicus. The commonly used local anaesthetic is hyperbaric bupivacaine, disadvantage of which is their short duration of action and early requirement of rescue analgesia post operatively. Alpha-2 agonists like clonidine have been proven to enhance the quality and duration of spinal anaesthesia. In this study we have used dexmedetomidine, higly selective alpha-2 agonist with a high ratio of alpha2/alpha1 activity .**MATERIALS AND METHODS –** Ninety patients randomized into three groups; each group containing thirty patients. The patient received 3.0 ml of hyperbaric bupivacaine plus either 0.5ml of 5 microgram dexmedetomidine (group D1) ,10 microgram dexmedetomidine (group D2) or 0.9% normal saline (group C). **RESULTS** – dexmedetomidine prolonged the time to two segment regression, motor regression to bromage 0 and the time to rescue analgesic. All these effects were in the order D2 > D1 > C and statistically significant($p<0.005$). All patients were hemodynamically stable. **CONCLUSION –** Intrathecal dexmedetomidine 5mcg and 10 mcg prolongs anesthetic and analgesic effects of hyperbaric bupivacaine and 10 mcg dose is more beneficial for prolonged surgeries.

KEYWORDS

Alpha-2 adrenoceptor agonist, intrathecal dexmedetomidine, spinal anesthesia

INTRODUCTION

Spinal anaesthesia is the most commonly employed technique of anaesthesia required in surgeries involving lower parts of body. Since the discovery of local anaesthetic drugs, anaesthesiologists have become increasingly involved in the provision of postoperative analgesia. In this context a number of adjuvants have been used to prolong the duration of spinal anaesthesia. Opioids like morphine, fentanyl, sufentanyl and even tramadol have been used extensively, they act by G-protein coupled receptor mechanism causing hyperpolarisation of the afferent sensory neurons. The troublesome effects like nausea, pruritis, vomiting and respiratory failure specially in elderly limited their use as adjuvants. This led to the use of other adjuvants and the alpha-2-agonists stole the limelight with their excellent effects on prolongation of anesthesia and analgesia. Clonidine has been successfully used with minimal cardiorespiratory perturbations and has increased segmental spread of sensory block and delayed the regression of such blocks along with decrease in failure rate and supplemental analgesics. Dexmedetomidine shows a high ratio of specificity for the α2 receptor (α2/α1 1600:1) compared with clonidine (α2/α1 200:1), making it a complete α2 agonist. Dexmedetomidine exerts analgesic action at α2 receptors in the locus ceruleus and spinal cord. Brain, spinal cord, and peripheral mechanisms all seem operant. The most important of these sites may be the spinal cord, where the activation of 2C-receptor subtype seems to accentuate the analgesic actions by attenuating the transmission of nociceptive signals to brain centers. This study was aimed at comparing two different doses of dexmedetomidine as an adjuvant to hyperbaric bupivacaine, to note the onset and duration of sensory and motor block achieved in orthopaedic surgeries and the duration of post operative analgesia.

MATERIALS AND METHODS

The study was conducted on ninety patients admitted to Dr. DY Patil medical college, Pune (thirty in each group D1,D2 and C) in ASA grade I and II, of either sex between 18-65 years of age, undergoing elective surgery under spinal anaesthesia. Prior permission of institutional ethics committee was obtained . Informed written consent obtained and all patients were subjected to pre anaesthetic evaluation. Standard monitoring with electrocardiography , pulse oximetry and noninvasive blood pressure was done. Under all aseptic precautions subarachnoid block was given using 26 G quincke's spinal needle into L3-L4 space in sitting position and depending upon the group, respective agents were injected intrathecally. Patients were made to lie down immediately after the injection. The patient received 3.0 ml of hyperbaric bupivacaine plus either 0.5ml of 5 microgram dexmedetomidine (group D1) ,10 microgram dexmedetomidine (group D2) or 0.9% normal saline (group C). Parameters such as heart rate, blood pressure, onset of both sensory and motor block, time to two segment sensory regression, motor regression to modified bromage 0 and time to first rescue analgesic as well as no. of analgesic doses required was noted. The verbal rating pain scores, sedation scores and adverse effects of the drugs used were also noted.

RESULTS

The time of sensory block to reach T10 dermatome were similar in all groups. All patients achieved modified Bromage 3 block. There was a dose dependent prolongation of the duration of sensory and motor block by the addition of intrathecal dexmedetomidine. No statistical significance among groups in time for sensory block to reach T10 dermatome. However time to two segment regression and regression to Bromage 0 were significantly prolonged in D2 than D1 and C and in D1 than C. ($P<0.05$). The number of doses in group D2 is significantly lower than in group B and D1 ($p<0.05$). Preoperatively there was no significant difference in the pain scores among the groups but they were significantly lower in group D2 and D1 than C at 8h and 12h and scores were significantly lower at 24hours in D2 than in D1 and C. 4 patients in group C and 4 in group D2 had nausea. There was no sign of pruritis seen. The mean values of MBP and HR were comparable between the three groups. 4 patients from group C, 6 from D1 and 4 from D2 received mephentermine and dose was not statistically different among the groups. Patients in group D2 had median Ramsay Sedation Score(RSS) of 3.5, 60 min after the block and RSS of 3 at 45 min, 160 min, 180 min which is significantly higher than group C and D1. All patients had peripheral oxygen saturation greater than 95% at all times and did not require additional oxygen. No patient had respiratory rate below 10/min. Complete recovery of sensory and motor function was observed in all patients.

TABLE 1:ACHIEVEMENT AND REGRESSION OF BLOCK IN 3 GROUPS

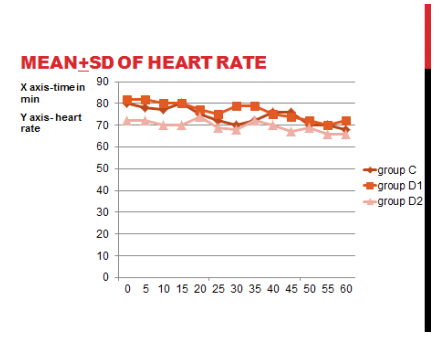
	Group C	Group D1	Group D2
The mean time of sensory block to reach T10	7.7 + 3.2 min	6.7 + 3.5 min	7 + 2.3 min
The mean time of motor block to achieve Bromage 3	20 + 2.9 min	15 + 3.0 min	12.4 + 3.0 min
Time to 2 segment regression	66 + 25 min	92.1 + 26.9 min	189.7 + 29 min
Regression to Bromage 0	35.5 min	273.7 + 40 min	329.7 + 52 min

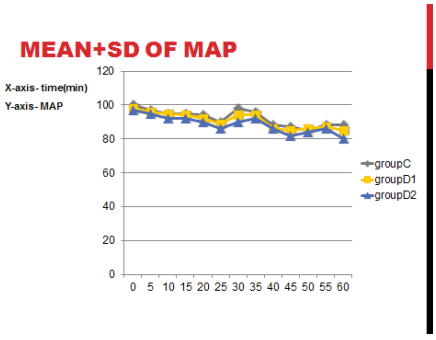
TABLE 2: TOTAL DOSES OF DICLOFENAC IN THE FIRST 24 HOURS

	GROUP C	GROUP D1	GROUP D2
Number of doses	60	52	40

TABLE 3: TIME TO PAIN ONSET

	GROUP C	GROUP D1	GROUP D2
Time to first pain onset (min)	320.7 + 120	471.5 + 230.8	1142.5 + 374.08





DISCUSSION

Since 2004 when Dexmedetomidine was first used as an adjuvant to intravenous regional anesthesia, its use has evolved with considerable evidence of utility in such situations. It displays specific and selective alpha-2 adrenoceptor agonism, with a high ratio of alpha-2 / alpha-1 selectivity that is 1620:1 as compared to 220:1 for clonidine. Alpha-2 adrenoceptors are located over the primary afferent terminals of neurons in the superficial lamina of the spinal cord and in the nuclei of brainstem, the effect is therefore both peripheral and central. Analgesic effect is thought to be due to inhibition of release of pro-nociceptor transmitter, substance P and glutamate from the afferent terminals and by hyperpolarising spinal interneurons via G-protein mediated activation of potassium channels. Subsequently there have been studies in supraclavicular, interscalene and cervical plexus block where it has been seen to increase quality and duration of the block produced by local anesthetics like bupivacaine and ropivacaine. Neuro toxicity has been a concern when used in these areas but since it has evidence of potential neuroprotective effect. Hence its profile seems suitable with known complications like hypotension and bradycardia which are responsive to conventional therapies.

CONCLUSION

Intrathecal dexmedetomidine significantly prolongs the anaesthetic and analgesic effects of spinal hyperbaric bupivacaine in a dose-dependent manner. 10 microgram may be of benefit for prolonged complex lower limb surgical procedures.

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