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Paediatric Spinal Anaesthesia - With and Without Clonidine as adjuvant

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Abstract: ***Introduction: This study was done to compare the efficacy and safety of spinal anaesthesia, duration and quality of post operative analgesia using intrathecal bupivacaine alone and bupivacaine plus clonidine. Objective: A prospective randomised single blinded study was carried out in 60 ASA - 1 paediatrics patients between the age group of 1year to 18 years undergoing surgeries below T8 dermatome up to 2 hrs duration. Patients were randomly allocated in two groups. Method: Group - A received 0.5% bupivacaine heavy (0.4mg/kg for 5 - 15kg or 0.3mg/kg for >15 kg) and Group - B received bupivacaine 0.5%heavy (0.4mg/kg for 5 - 15kg or 0.3mg/kg for >15kg) and preservative free clonidine (1 mcg/kg), comprising 30 patients each. Time of onset of sensory block, maximum level of sensory block, duration of sensory block, duration of post - op analgesia was observed. Results: Mean duration of sensory blockade (147.68±7.28 vs 260.33±9.03min; P<0.001) and motor blockade (132.5±10.06 vs 233.33±8.58min; P < 0.001) and duration of analgesia (172±10.61 vs 324.50±26.55min; P < 0.001) were significantly prolonged in the clonidine group. In the control group, most patients needed three analgesic doses over 24hr while in the clonidine group, the majority needed two doses. Adverse effects were infrequent in both groups. Conclusions: Clonidine as an adjuvant to 0.5% bupivacaine heavy significantly prolonged the duration of analgesia with improved quality of anaesthesia while maintaining safety. We recommend the routine use of clonidine 1 µg/kg dose as an adjuvant to 0.5% bupivacaine in paediatric Spinal Anaesthesia.***

Keywords: Paediatric anaesthesia, clonidine. Bupivacaine, spinal anaesthesia, analgesia, pre - medication, adjuvant

1. Introduction

Pain is a major concern of human kind since our beginning and object of ubiquitous efforts to understand and to control it. Pediatric pain management is challenging and one of the frontiers of modern anesthesia. The first report on paediatric spinal anesthesia was published by AUGUST BIER in 1899, when the technique was performed with cocaine in an 11 - year - old boy for ischium abscess drainage.

Spinal anaesthesia is advantageous in that it uses small dose of anesthetic, is easy to perform and offers a rapid onset, reliable surgical analgesia, and good muscle relaxation. Advantages sometime offset by relatively short duration of action and complaints of post operative pain when it wears off. Spinal anaesthesia with hyperbaric bupivacaine hydrochloride is popular for longer procedure due to its prolonged duration but there is need to intensify and increased duration of sensory blocked without increasing the intensity and duration of motor blocked and thus prolong the duration of post operative analgesia.

SA in children shares the list of advantages observed in adults with an added advantage of minimal cardio - respiratory disturbance with lesser incidence of complications like Post - Dural Puncture Headache (PDPH). 2 SA is a well - known technique for lower abdominal, urogenital, and orthopaedic surgeries. It is easy to perform, rapid in onset with effective sensory and motor block. The main deterrent to its application in children is its shorter duration due to the highly vascular pia mater.

Various studies have shown that 1mcg/kg clonidine provides a significant improvement in spinal anaesthesia quality, duration and reduces the need of post - operative analgesic requirement without a significant side effects. There is adequate evidence that α - 2 adrenergic agonist clonidine given intrathecally produces anti nociceptive effects without any neurotoxicity and useful in the treatment of somatic pain. However, unlike spinal opioides clonidine does not produce pruritis and respiratory depression.

The rationale behind intrathecal administration of clonidine is to achieve a high drug concentration in the vicinity of α - 2 adrenoreceptors in spinal cord by blocking pain conduction of C and A - delta fibres. It increases potassium conductance in isolated neurons in vitro and intensifies conduction block of local anaesthetic [7]. Aδfibres are myelinated afferent sensory nerve fibres which conduct pain, cold temperature and touch sensation, and C fibres are nonmyelinated postganglionic sympathetic fibres which conduct pain, warm temperature and touch sensation. Clonidine is now an acceptable adjuvant to local anaesthetic for epidural route nevertheless clinical trial provide evidence that less clonidine is needed intrathecally than epidural to produce same analgesic effect with fewer side effects.

2. Methods

After approval from local ethical committee of institute and written valid informed consent from parents/guardians of all the patients with grade ASA I of physical status weight age 1 - 18 years and surgeries below T8 were enrolled for the study except those patients with known sensitivity to the drugs, gross spinal deformity, and peripheral neuropathy.

Patients were randomly allocated into two groups of sixty patients each, in a double blinded fashion based on computer generated code. Group - A (0.5% hyperbaric bupivacaine 0.4 mg/kg for 5 - 15 kg or 0.3mg/kg for >15kg) and Group - B (0.5% hyperbaric bupivacaine 0.4 mg/kg for 5 - 15 kg or 0.3mg/kg for >15 with 1 mcg/kg preservative free clonidine).

Detailed preoperative evaluation carried out in all patients and vital parameters noted. Routine investigations like complete blood count, BT, CT were done. Patients were properly monitored in operation theatre and baseline

parameters were noted. Monitoring commenced with pulse - ox meter (spo2), and NIBP.

A peripheral venous access with 22/24 G cannula was secured on the dorsum of the hand but there was no fluid preloading. They were premedicated with Inj. Ketamine 2mg/kg iv before lumbar puncture.

Lumbar puncture was done in the L4/L5 interspaces' with 27G B. D. Needle. Correct needle position confirmed by free CSF flow and the calculated dose of drug i. e. either bupivacaine alone (Group - A) or bupivacaine plus clonidine (Group - B) injected intrathecally. Patients then were immediately placed in supine position with slight head elevation.

Intra - operative fluid was given by using 4 - 2 - 1 formula. i. e. Holliday and Segar. After blocked following parameters related to sensory level were noted. The sensory block was assessed with pinprick using a blunted hypodermic needle (caudal to cephalic), while the motor block was assessed using a modified Bromage scale. They were recorded bilaterally at 30 seconds for the first 3 minutes and then every 2 minutes for 10 minutes. The adequacy of SA was determined by the absence of facial grimacing on gentle pinprick and the presence of profound motor block at the level of hips.

The vital parameters and sedation score were periodically monitored and recorded at the 5 - minute interval for the first 30 minutes, at the 15 - minute interval for the first 60 minutes and 30 - minute interval for the next 2 hours. After that, it was done at hourly intervals for 6 hours and again at 12 hours. All preparations were made to treat vomiting, respiratory depression, urinary retention, and high spinal, should they occur. In case of failure, GA was kept as a backup.

Postoperative pain evaluation:

BLOOD PRESSURE (MAP mm Hg)	Scale
+10 of Pre op	0
+20 of Pre op	1
+30 of Pre op	2
CRYING	
No crying	0
Crying but Responding	1
Crying but not Responding	2
MOVEMENT (leg)	
None	0
Restless	1
Thrashing around	2
AGITATION	
Patient Asleep	0
Mild Agitation	1
Hysterical	2
VERBAL EVALUATION	
Asleep (No pain)	0
Mild pain (Cannot localize)	1
Moderate Pain (Can localize)	2

Adverse effects such as hypotension, bradycardia, postoperative nausea and vomiting (PONV), respiratory depression, urinary retention and headache were recorded postoperatively.

Sample size calculation:
The duration of analgesia was our primary outcome measure of interest. A previous study by Kaabachi et al. Documented the mean (SD) for the duration of analgesia to be 330 (138) minutes in children undergoing surgery under spinal anaesthesia. Assuming that the addition of clonidine will improve the duration of analgesia by 30%, with the permitted alpha error of 0.05 and beta error of 0.2 and the study power of 80 %, a minimum sample size of 30 patients were required per group. Hence, we decided to recruit a total of 60 patients.

Statistical analysis
The quantitative variables are expressed in terms of mean ± SD and compared between groups using unpaired t - test. Qualitative variables are expressed as percentages and compared between groups using Chi - square test. A p - value < 0.05 was considered statistically significant. The data were tabulated using MS Excel package while statistical analysis was performed on SPSS version 16.0 software.

3. Results

Sixty children were assessed for eligibility and we included these patients who fulfilled the study's inclusion criteria. None of the patients required conversion to GA during the study. The patient characteristics in terms of age, gender and weight were comparable among the patients in both groups. Mean duration of sensory blockade (147.68±7.28 vs 260.33±9.03min; P<0.001) and motor blockade (132.5±10.06 vs 233.33±8.58min; P < 0.001) and duration of analgesia (172±10.61 vs 324.50±26.55min; P < 0.001) were significantly prolonged in the clonidine group. In the control group, most patients needed three analgesic doses over 24hr while in the clonidine group, the majority needed two doses. Adverse effects were infrequent in both groups.

4. Discussion

The present study demonstrated that the use of clonidine in a dose of 1µg/kg when added to hyperbaric bupivacaine intrathecally, resulted in a statistically significant increase in the duration of sensory and motor block as well as effective postoperative analgesia when compared to bupivacaine alone.

The subarachnoid block is a well - established technique for infra - umbilical surgeries. SA is technically simple, produces rapid onset profound and uniformly distributed analgesia with effective neuromuscular blockade and minimal risk of toxicity.
Spinal Anaesthesia has been recommended as an alternative anaesthetic in the paediatric population ranging from infants to adolescents.

Bupivacaine is the most common local anaesthetic for spinal anaesthesia in children, but hyperbaric bupivacaine produces short - lasting spinal anaesthesia in children which may be insufficient for the planned procedure. Clonidine is an alpha - 2 adrenergic receptor agonist, has remarkable synergistic

effects as an additive and increases the efficacy of sensory and motor block in a dose - dependent manner.

The analgesic effect following intrathecal administration is mediated spinally through activation of postsynaptic alpha - 2 receptors in substantia gelatinosa of the spinal cord.

Intrathecal clonidine achieves a higher drug concentration in the vicinity of alpha 2 adrenoceptor in the spinal cord. It acts by blocking the conduction of C and A - delta fibres, particularly by motor neuron hyperpolarization and hence intensify conduction blockade by LAs.

It also reduces calcium conduction in cells, thus inhibiting neurotransmitter release. Doses 1 µg/kg and 2 µg/kg have been studied in various age groups.

As an adjunct to spinal anaesthesia clonidine 1µg/kg used in previous studies also, showed that clonidine provides a significant improvement in spinal anaesthesia quality, increases the duration of analgesia and reduces the need of postoperative analgesic requirements without undesirable side effects similar to our study.

The age group of 5 - 12years is vulnerable to perioperative anxiety and less likely to cooperate for the lumbar puncture and the surgery. We used Inj. Ketamine 2mg/kg as a safe, effective, and acceptable premedication. This ensured cooperation, greater comfort, and motor control during the procedure. Inadvertent patient movement can also lead to harm to neural structures while the needle tip is in subarachnoid space and excessive spread of the block.

In this study, we used hyperbaric bupivacaine 0.5% at a fixed dose of 0.4 mg/kg which is the recommended dose for 5 - 15kg children. The total volume of the drug combination was kept identical in both the groups.

The main limitation of spinal anaesthesia is a variable and relatively short duration of the block with a single shot of LA.2 In children, SA iscommonly accepted for procedures with a duration of 60 - 75 minutes, up to a maximum duration of 90 minutes.

One of the side effects of clonidine is bradycardia. The stimulation of alpha - 2 receptors in the medullary vasomotor centre after systemic absorption is responsible for a decrease in sympathetic outflow and cardiovascular side effects.

5. Conclusion

Clonidine as an adjuvant to 0.5% hyperbaric bupivacaine significantly prolonged the duration of analgesia and also improved the quality of anaesthesia while maintaining safety. We recommend the routine use of clonidine 1 µg/kg dose as an adjuvant to 0.5% bupivacaine in paediatric SA.

References

[1] Abajian JC, Mellish RW, Browne AF, Perkins FM, Lambert DH, Mazuzan JE Jr. Spinal anesthesia for surgery in the high - risk infant. AnesthAnalg 1984; 63 (3): 359 - 362.
[2] Walker SM, Yaksh TL. Neuraxial analgesia in neonates and infants: A review of clinical and preclinical strategies for the development of safety and efficacy data. AnesthAnalg 2012; 115 (3): 638 - 662.
[3] Bier A. Experiment regarding the cocainization of the spinal cord. DtschZChir 1899; 51: 361 - 369
[4] Spinal Anaesthesia for Inguinal Hernia Repair in Neonates Can J. OfAnaes. Vol - 38, 281 - 286, 1991
[5] Spinal Anaesthesia with Bupivacaine in Former Preterm, Infants Anaes Anal 2004; 98: 1280 - 83
[6] Spinal Anaesthesia in Infants for Inguinal Hernia BJA Vol - 97, No.3, 380 - 384, 2006
[7] Cham Soma C, Ramtani U, Kamble S, Cham C. Spinal Anaesthesia in children: Comparative study of isobaric Levobupivacaine 0.5% with or without Clonidine. Indian J Clin Anaesth 2015; 2 (3): 141 - 146
[8] Jambure. Intrathecal Bupivacaine Vs. Bupivacaine and Clonidine in PaediatricsAge Group: A Comparative Evaluation. The Internet Journal of Anesthesiology 2013; 31 (1): 1 - 7.
[9] Kaabachi O, Ben Rejeb A, Mebazaa M, Safi H, Jelel C, Ben Ghachem, Ben Ammar MS. Spinal anesthesia in children: comparative study of hyperbaric bupivacaine with or without clonidine. Ann Fr AnesthReanim 2002; 21 (8): 617–621.