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Original Research Article

Evaluation of the Efficacy of Dexmedetomidine as an Adjuvant to Epidural Lidocaine

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ABSTRACT

Introduction: Efforts to find a better adjuvant in regional anesthesia are underway since long. Many agents were proved to be effective in providing a same pharmacological benefit by different mechanisms of action. In this study we sought to investigate the effect of Alpha-2 adrenergic agonists added to a local anesthetic in epidural space. Objective: To evaluate the efficacy of Dexmedetomidine as an adjuvant to Lidocaine in epidural anesthesia.

Methodology: Sixty patients scheduled for lower limb trauma orthopaedic surgeries under epidural anesthesia were divided into two groups D and C with 30 in each. Patients in group D received 12.5ml of 2% Lidocaine + Dexmedetomidine 0.5mcg/kg in 1.5ml solution making a total volume of 14ml. Patients in group C received 12.5ml of 2% Lidocaine + 1.5ml Normal saline making a total volume of 14ml. Onset, time for peak sensory level, time for two segment regression and the total Mephentermine consumed to maintain the hemodynamics were recorded, tabulated and statistically analysed.

Results: The onset of sensory block was significantly fast, the time for two segment regression was significantly more and the Mephentermine consumption was significantly high in group D than in group C.

Conclusion: Dexmedetomidine is effective in hastening the onset and prolonging the duration of blockade when used as an adjuvant to epidural Lidocaine, but at the same time it has a propensity to cause frequent hypotension.

Key words: Dexmedetomidine, Lidocaine, Epidural

INTRODUCTION

Interruption of pain is central to the anesthetic practice. Development of epidural analgesia played a significant role in man's triumph over pain, which undoubtedly is one of the most fascinating chapters in the history of medicine. Onset, duration and the quality of neuraxial blockade in epidural anesthesia depend on the type of local anesthetic agent used and are significantly influenced by the addition of an adjuvant. Efforts to find a better adjuvant in regional anesthesia are underway since long. Sedation, stable hemodynamics and an ability to provide smooth and prolonged post operative analgesia are the main desirable qualities of an adjuvant in the neuraxial anesthesia. Alpha-2 Adrenergic Receptor

[AR] agonists have been the focus of interest for their sedative, analgesic, peri-operative sympatholytic, anesthetic sparing and hemodynamic stabilizing properties. [1,2] Dexmedetomidine is a highly selective alpha-2 AR agonist having all the said properties and is devoid of respiratory depression. [3,4] Thus in this study we sought to evaluate the efficacy of Dexmedetomidine as an adjuvant to Lidocaine in epidural anesthesia.

Objectives:

To evaluate the efficacy of Dexmedetomidine as an adjuvant to epidural Lidocaine in terms of onset of sensory block, time for attaining peak sensory level, time for two segment regression from the peak level and requirement of vasopressor by comparing with a placebo.

MATERIALS AND METHODS

Approval from the institutional ethics committee was obtained before starting the study. Written informed consent was obtained from all the patients who were enrolled in the study. In this randomized, double blinded prospective study, all adult patients belonging to the ASA status 1 and 2 with recent[less than 48 hours] lower limb trauma scheduled for orthopaedic surgeries from January 2013 to June 2013 were included. Patients with gross spinal abnormality, localized skin infection, neural disease, severe valvular heart disease, shock, hypertension, diabetes mellitus, pulmonary/hepatic/renal diseases, peripheral neuropathy, psychiatric disorders, coagulation abnormalities, dysrrhythmias and patients on beta blockers were excluded from the study. Patients were randomly allocated into two groups D and C using a computer generated randomization programme. In the operating room, after connecting standard monitors and securing intravenous [IV] access, base line blood pressure and heart rate were recorded and preloading was done with 500ml crystalloid solution. Epidural space was engaged in sitting position in L_{4-5}/L_{3-4} inter vertebral space with 18G Tuohy needle using 'loss of resistance to air' technique under strict aseptic precautions. 20G epidural catheter was threaded and fixed at 3 to 5 cm in the epidural compartment after excluding intravascular and intrathecal placement by giving test dose with 2% lidocaine with adrenaline (1:200000). Patients in group D received 12.5ml of 2% Lidocaine + Dexmedetomidine 0.5mcg/kg in 1.5ml solution making a total volume of 14ml. Patients in group C received 12.5ml of 2% Lidocaine + 1.5ml of Normal saline making a total volume of 14ml. The study drugs were drawn by an anesthetist who was blinded to the study, coded and handed over to another anesthetist who was blinded to the drug for administration. After administering the drug, the time point when the pain at the movement of the fracture site disappeared was taken as onset of sensory block. The peak sensory level attained was recorded with pin prick and the time was documented. The time for two segment regression from the peak sensory block was also recorded. Mean arterial pressure [MAP] and heart hate[HR] were documented every 5minutes. Hypotension of more than 20% of the baseline was treated with 6mg boluses of IV Mephentermine and the total consumption was documented. All the observations were tabulated and analysed statistically.

Statistical analysis:

Over all power of the study was calculated by using 'Online power and sample size calculator for K means'. Power of the study for comparison between two groups was calculated using online power calculator for difference between two means. Summarization of the data was done with the help of measures of central

tendency and dispersion [Mean and Standard deviation]. Differences between average values of different parameters under study were calculated with the help of t-test of difference between two independent sample means. Z-test of proportions was used to test the differences in proportions of males and females between the groups. t-test and Z-test were done with the help of ' In-Silico project support for life sciences online calculator'.

RESULTS

A total of 64 patients were enrolled in the study, out of which 3 patients encountered accidental dural puncture and one patient refused epidural anesthesia. Thus 60 patients were included in the study with 30 in each group. Power of the study for the said sample size was calculated to be 90%. The demographic profile was comparable between the two groups [Table-1 and 2]. The average onset of sensory block was quicker in group D as compared to that in group C and the difference was statistically highly significant [Table-1]. The average time for attaining peak sensory level was also quicker in group D than in group C which was statistically significant [Table-1]. The average time for two segment regression was significantly more in group D as compared to that in group C[Table-1]. However the average requirement of Mephentermine was significantly more in Dexmedetomidine group than in control group [Table-1].

Table 1. Analysis of comparable parameters

	Control	Dex			
	Mean ± SD	Mean ± SD	t-value	P-value	Result
Age	52.77 ± 8.66	47.94 ± 15.30	1.52	0.13	No significant difference
Onset of sensory blockade (Sec)	642 ± 232.73	120.32 ± 53.32	11.97	<0.0001	Highly statistically Significant
time for peak sensory level(min)	23.33 ± 9.29	16.45 ± 7.98	3.0983	0.0015	Significant
2 segment regression(min)	49.93 ± 17.52	75.16 ± 28.24	-4.2075	0.0001	Highly Significant
Mephentermine consumed(mg)	6 ± 7.22	12.19 ± 14.49	-2.1218	0.0197	Significant

Table 2. Analysis of gender

Dex Vs Control	Difference in proportions			
	Z-value	P-value	Result	Conclusion
Females	0.6174	0.537	Not significant	There is no significant difference in proportion of females between the two groups
Males	0.682	0.4952	Not significant	There is no significant difference in proportion of males between the two groups

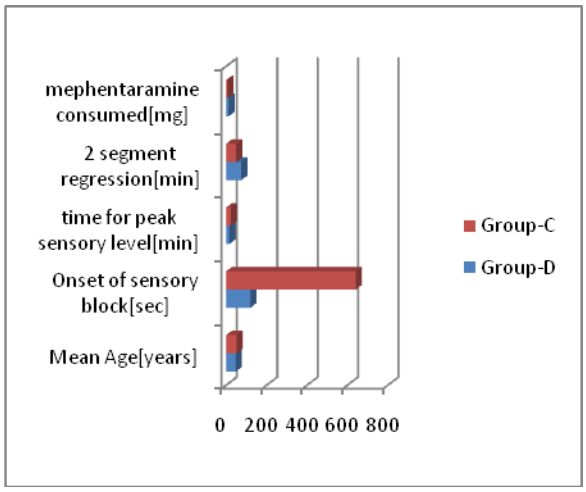

Figure 1: Dexmedetomidine vs Control

DISCUSSION

The advantage of epidural anesthesia over spinal anesthesia is the liberty of titrating the dose of local anesthetic to the effect along with the freedom of extending the duration of anesthesia when surgery is getting prolonged. Absence of dural puncture and post operative analgesia are the other benefits of epidural anesthesia over spinal anesthesia. Early onset is one important aspect where the sub arachnoid block has an edge over epidural anesthesia which usually takes 20 to 30 minutes to act. Addition of an adjuvant to the local anesthetic can minimize this delay. An ideal

adjuvant should not only hasten the onset of action of local anesthetic but also facilitate reduction in it's dosage along with providing hemodynamic stability and an optimal sedation. Literature reveals several clinical trials studying the role of various pharmacological agents viz Opioids, [5] Benzodiazepines, [6] Dexamethasone, [7] Neostigmine, [8] Magnesium sulfate, [Error! Reference source not found.] Sodium bicarbonate and Alpha-2 adrenergic agonists as adjuvants to local anesthetics in epidural compartment.

The central Alpha-2 adrenergic agonists inhibit nociceptive impulses by activating post junctional Alpha-2 adrenoceptors in the dorsal horn of the spinal cord. This kind of receptors are located on primary afferent terminals (both at peripheral and spinal endings), on neurons in the superficial laminae of the spinal cord and within several brainstem nuclei implicated in analgesia. They block the conduction of C and A-delta fibers and increase potassium conductance, thus intensifying conduction block. They also cause local vasoconstriction, thereby reducing vascular uptake of local anesthetic from around the neural structures. [9] There are few studies done previously in which Dexmedetomidine was found to be effective in hastening and improving the quality of epidural anesthesia when added to a local anesthetic. [11-13]

In our study we observed that the onset of action in Dexmedetomidine group was quicker [average 120.32 sec] than in control group[average 642sec]. The speed of onset observed is almost on par with that in spinal anesthesia. The average time for two segment regression was observed to be more in Dexmedetomidine group [75.16minutes] when compared to control group[49.93minutes] suggesting that Dexmedetomidine can effectively prolong the duration of action when added to epidural Lidocaine. However, the requirement of Mephentermine to maintain the blood pressure was observed to be more in Dexmedetomidine group than in control group suggesting a higher incidence of hypotension with Dexmedetomidine when used as an adjuvant to epidural Lidocaine. In this study, we used 12.5ml of 2% Lidocaine for epidural anesthesia as all the surgeries were on lower limb. Higher volumes are certainly required for abdominal procedures wherein the concentration of the local anesthetic needs to be reduced to avoid toxicity which may jeopardize the quality of sensory and motor blockade. There is a lot of scope for further research in this area where the role of the adjuvants can be investigated in minimizing the local anesthetic dose in epidural anesthesia.

CONCLUSION

We conclude that Dexmedetomidine is effective in hastening the onset and prolonging the duration of blockade when used as an adjuvant to epidural Lidocaine, but at the same time it has a propensity to cause frequent hypotension.

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