



Original Research Article

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

Srivishnu Vardhan Yallapragada, Gopi Krishna Vutukuri, Nagendra Nath Vemuri, Mastan Saheb Shaik

Department of Anaesthesiology, NRI Medical College, Guntur, India

Corresponding author: Srivishnu Vardhan Yallapragada

Received: 20/01/2015

Revised: 12/02/2015

Accepted: 13/02/2015

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, dysrhythmias 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 L₄₋₅/L₃₋₄ 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 rate[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	t-value	P-value	Result
	Mean ± SD	Mean ± SD			
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

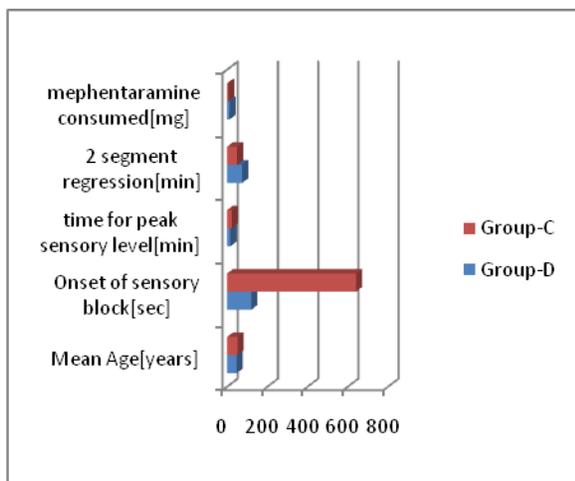


Figure 1: Dexmedetomidine vs Control

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

DISCUSSION

reduction in its 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.

ACKNOWLEDGEMENT

We thank all the patients who have consented to take part in the study. We thank Mrs K. Saritha for providing the statistical analysis. We thank Madhavi N for office assistance. We thank the faculty and post graduates of department of Anaesthesiology, NRI Medical College for their support.

REFERENCES

1. Khan ZP, Ferguson CN, Jones RM. Alpha-2 and imidazoline receptor agonists. Their pharmacology and therapeutic role. *Anaesthesia*. 1999;54: 146–65
2. Halaszynski- Dexmedetomidine-A look at a promising new avenue of use. *Saudi J of Anaesthesia* April –June 2012 vol 6 issue 2 ;105
3. Carollo DS, Nossaman BD, Ramadhyani U. Dexmedetomidine: A review of clinical applications. *Curr Opin Anaesthesiol*. 2008;21:457–61

4. Hall JE, Uhrich TD, Barney JA, Arain SA, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. *Anesth Analg.* 2000;90:699–705
5. Kaur J, Bajwa SS. Comparison of epidural butorphanol and fentanyl as adjuvants in the lower abdominal surgery: A randomized clinical study. *Saudi J Anaesth* 2014;8:167-71.
6. Ghai B, Makkar JK, Chari P, Rao KL. Addition of midazolam to continuous postoperative epidural bupivacaine infusion reduces requirement for rescue analgesia in children undergoing upper abdominal and flank surgery. *J Clin Anesth.* 2009 Mar; 21(2):113-9
7. Youn Yi Jo, Ji Hyun Yoo, Hyun Joo Kim et al. The effect of epidural administration of dexamethasone on postoperative pain: a randomized controlled study in radical subtotal gastrectomy. *Korean Journal of Anesthesiology.* Sep 2011; 61(3)233
8. Roelants F, Lavand'homme PM, Mercier-Fuzier V. Epidural administration of neostigmine and clonidine to induce labor analgesia: evaluation of efficacy and local anesthetic-sparing effect. *Anesthesiology.* 2005 Jun; 102(6):1205-10
9. Ghatak T, Chandra G, Malik A, Singh D, Bhatia VK. Evaluation of the effect of magnesium sulphate vs. clonidine as adjunct to epidural bupivacaine. *Indian J Anaesth* 2010;54:308-13
10. Christiansson, Lennart. "Update on adjuvants in regional anaesthesia." *Periodicum biologorum* 111.2 (2009): 161-170
11. A.L.El-Hennawy,A.m.Abd-Elwahab, A.M.Abd-Elmaksoud,H.S.E Ozairy, S.R.Boulis. Addition of clonidine or dexmedetomidine to bupivacaine prolongs caudal analgesia in children. *British J Anaesth* 2009; 103:268-74
12. Bajwa SJ, Bajwa SK, Kaur J, Singh G, Arora V, Gupta S, et al. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. *Indian J Anaesth* 2011;55:116-21
13. Sarabjit Kaur, Joginder Pal Attri, Gagandeep Kaur, Tejinder Pal Singh Comparative evaluation of ropivacaine versus dexmedetomidine and ropivacaine in epidural anesthesia in lower limb orthopedic surgeries *Saudi Journal of Anesthesia* Vol. 8, Issue 4, October-December 2014.

How to cite this article: Yallapragada SV, Vutukuri GK, Vemuri NN et. al. Evaluation of the efficacy of dexmedetomidine as an adjuvant to epidural lidocaine. *Int J Res Rev.* 2015; 2(2):30-34.
