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EVALUATION OF EFFICACY OF DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE DURING INTRAVENOUS REGIONAL ANAESTHESIA

Anaesthesiology

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ABSTRACT

Background and Aim- Intravenous regional anaesthesia (IVRA) is technically, reliable, simple and safe method of providing anaesthesia for minor surgical procedures over the upper extremities. Various local anaesthetic agents like lignocaine, bupivacaine, mepivacaine and procaine have been used for IVRA. The purpose and aim of the present study was to assess the efficacy of 0.5µg/kg dexmedetomidine as an adjuvant to lignocaine during IVRA with regard to Onset & duration of sensory block and motor block ,Efficacy , duration of analgesia,Degree of sedation , Incidence of tourniquet pain , Haemodynamic variables and patient acceptance .

Method-Total 60 patients of ASA grade I&II scheduled for elective surgery of upper limb, were randomized into two groups for IVRA .Group L Patients were received 0.9% normal saline plus 3mg/kg lignocaine (0.5%) diluted with normal saline upto total dose of 40 ml and Group LD Patients were received 0.5µg/kg dexmedetomidine plus 3mg/kg lignocaine (0.5%) diluted with normal saline up to total dose of 40 ml. All patient in two groups were assessed for sensory block, motor block, sedation and monitored for hemodynamics, intraoperative and postoperative analgesia using VAS score and side effect if any.

Results- VAS Score was significant lower, when compared both groups, there was a significant shorter sensory onset and longer recovery time observed in LD group and onset of motor block faster and regression of motor block was slower in LD group in IVRA. Sedartion Score more in group LD significantly and number of rescue analgesia given in postop was lower in group LD.

Conclusion- Dexmedetomidine addition to lignocaine in IVRA improved the quality of both sensory and motor block with good quality of analgesia. It enhanced the duration of postoperative analgesia and was not associated with haemodynamic instability or any other complications.

KEYWORDS

Lignocaine, Dexmedetomidine, IVRA, VAS score

INTRODUCTION

Intravenous regional anaesthesia (IVRA) was first described by August Bier in 1908. He observed that when local anaesthetic was injected intravenously between two tourniquets in a limb, a rapid onset of anaesthesia occurred in the area between the tourniquets and a slower onset occurred beyond the distal tourniquet. The technique did not come popular until the 1960 when it was reintroducd by the Holmes.[1]Today the technique is slightly modified using either a single or a double tourniquet at one site and injecting local anaesthetic as distal as possible to the cuff. IVRA is technically, reliable, simple and safe method of providing anaesthesia for minor surgical procedures over the upper extremities[2] . There are some limitations of intravenous regional anaesthesia using plain lignocaine which includes tourniquet pain, short duration of block and absence of postoperative analgesia[3].To overcome these effects and improve the quality of block, several drugs such as NSAIDS,[4,5] opioids[6], neostigmine[7] and muscle relaxants[8]have been used as an adjuvant to lignocaine for intravenous regional anaesthesia. α2 adrenergic receptor agonist have been the drug of interest for their sedative, analgesic, perioperative sympatholytic & cardiovascular stabilizing effects with reduced anaesthetic requirements.Dexmedetomidine is a potent α2 adrenergic receptor agonist which is approximately eight times more selective towards the α2 adrenergic receptors than clonidine. It is known to reduce the anaesthetic agent requirement when given intravenously[9-13]. During our literature search we found very few studies evaluating dexmedetomidine at low dose of 0.5µg/kg as an adjuvant to intravenous regional anaesthesia. Thus we designed this study to evaluate the efficacy of 0.5µg/kg dexmedetomidine to lignocaine in intravenous regional anaesthesia on the quality of block, incidence of tourniquet pain, sedation and duration of postoperative analgesia.

SUBJECT AND METHODS

After approval from the institutional ethical committee 60 patients of ASA grade I and II,aged 20–60 years, weighing 50to 90 kg, posted for elective short duration surgery of upper limb were selected and randomly allocated into two groups of 30 patients each by using 'Chit in box' technique. Group L patients were received 0.9% normal saline plus 3mg/kg lignocaine(0.5%) diluted with normal saline upto total dose of 40 ml and Group LD patients were received 0.5µg/kg dexmedetomidine plus 3mg/kg lignocaine (0.5%) diluted with normal saline up to total dose of 40 ml. Patient suffering from any neurological disorders, known allergy to drugs which are to be used, ASA grade III-IV, known systemic diseases like hypertension, diabetes etc were excluded from the study.

On arrival in the operation theatre, fasting status, consent and pre anaesthetic checkup were checked. Baseline parameters like SpO_2, pulse rate, systolic blood pressure, diastolic blood pressure and electrocardiography were recorded. Prior to administration of IVRA an infusion of 0.9% normal saline was started in the normal limb. A 22 G IV cannula was inserted on the dorsum of the operating hand.A cotton pad was applied to the arm to protect the skin. Two tourniquets were placed over the cotton pad. The operative arm was elevated for 3 minutes to allow gravitational drainage of blood. Then arm was exsanguinated by using an Esmarch bandage. The proximal cuff was inflated to 100 mm Hg more than systolic BP to minimum of 250mmHg and the esmarch bandage was removed. Circulatory isolation of the arm was verified by inspection, absent of radial pulse and loss of pulse oximetry tracing of the ipsilateral index finger .The study drug solution was injected for 90 second by an anaesthesiologist blinded to the composition of injected drug solution. The distal tourniquet was inflated to 250 mm Hg after the achievement of sensory & motor block. The proximal tourniquet was released and surgery was allowed to commence. Tourniquet will not deflated before 30 minutes even if the surgery finished and will not kept inflated for >1.5 hr. After the completion of surgery, tourniquet deflation was performed by the cyclic deflation technique. Intraoperatively bolus of 1µg/kg inj. fentanyl i.v given for tourniquet pain treatment when VAS score>3. Onset of sensory block was determined by pin prick method with 22G hypodermic needle, distal to the tourniquet at 20 second interval .Assessment of pain was done by scale like; Scale 0:- Sharp pain, Scale1:- Touch only ,Scale2:- Cannot feel touch Motor functions were assessed by asking the patient to flex/ extend wrist and fingers every 30 seconds and complete motor block was considered when no voluntary movements of wrist and fingers was possible.

Intraoperative and postoperative tourniquet pain was assessed on the basis of visual analogue scale (VAS) 0-10. Duration of analgesia was considered as time from deflation of tourniquet upto first administration of injection diclofenac. Intraoperative and postoperative sedation was assessed based on Ramsay sedation score.Vital parameters(NIBP, pulse rate and SpO_2) were checked continuously and recorded preoperatively and at 2, 5, 10, min. and thereafter at 10 min. interval after the tourniquet inflation and just after tourniquet deflation. Patients were observed postoperatively for 24 hours and vital parameters were recorded at hours 2, 4, 6, 12 and 24.

Statistical Analysis

Statistical analysis was performed with the SPSS, version 21 for

Windows statistical software package (SPSS inc., Chicago, IL, USA).All the quantitative data were summarized in the form of Mean ± SD. The Categorical data was presented as numbers (percent) and were comparmong groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by students t-test. The levels of significance and α - error were kept 95%and 5%respectively, for all statistical analysis P values <0.05 were considered as Significant (S) and P value > 0.05 as statistically Non Significant(NS).

RESULTS

A total 60 patients were induced into the study. There were no statistically significant differences in the demographic parameters such as Age, Sex, Weight, ASA physical status and baseline vitals (Table 1) The patients were in the age group of 20-60yrs, in weight group of 50-90kgs.

Table 1: Demographic parameters and baseline vitals

Particulars	Group L	Group LD	P value
Age(years) (Mean±SD)	37.8±11.22	37.73±9.9	>0.05
WEIGHT	66.1±8.34	65.9_+8.21	>0.05
Basal pulse rate (before App of first torniqt)	87.03±5.2	84.63±4.59	>0.05
Baseline mean arterial pressure	87.7±4.57	88.46±5.6	>0.05
Baseline SPo2	98.53±.99	98.23±1.20	>0.05

Table 2 Changes in VAS score at Various Time Intervals

Time	Group L		Group LD	
	Mean	SD	Mean	SD
Before App. of Ist Torniqt.	8.9	0.6	8.8	0.8
After App. of Ist Torniqt.	9.0	0.58	8.97	0.7
After Adm. of Test Drug at 1 Minute	6.53	0.95	5.53	1.80
2 Minute	2.47	0.42	2.47	0.61
3 Minute	1.48	0.49	1.0	0
After App. Of 2nd Torniqt at 1 min.	1.26	0.44	0	0
2 Minute	0.7	0.46	0	0
5 Minute	0.67	0.47	0	0
15 Minute	0.53	0.49	0	0
45 Minute	0.3	0.46	0	0
1 Hour	0.23	0.42	0	0
Postoperative vitals at 0 minute	0.8	1.4	0	0
5 minute	1.1	1.64	0	0
15 minute	1.53	1.7	0	0
30 minute	2.53	1.6	0	0
1 hour	4.06	1.89	0	0
3 Hour	2.63	0.50	1.07	0.25
6 Hour	3.53	2.45	1.17	0.52
12 Hour	5.6	0.84	3.56	0.88
24 Hour	6.27	0.71	5.53	1.76

Table 2 shows the changes in the VAS at different intervals. Before the application of tourniquet, the VAS was 8.9±0.6 and 8.8±0.8 in group L & group LD respectively. After administration of study drug, VAS started to decrease in both groups. VAS decreased significantly within 2 min. After study drug administration and remained significantl at lower level throughout the procedure. On intergroup comparision, the fall in VAS score was significantly more in group LD as compared to group L during the study period.

Figure 1: Changes in vas score

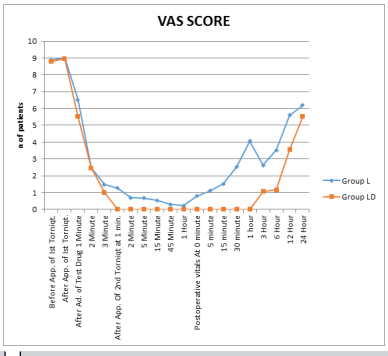

Table 3 ; Changes in Sedation score at Various Time Intervals

Time	Group L		Group LD	
	Mean	SD	Mean	SD
Before App. of Ist Torniqt.	1.03	0.18	1.06	0.24
After App. of Ist Torniqt.	2.0	0.45	1.0	0
After Adm. of Test Drug 1 Minute	2.1	0.43	2.21	0.76
2 Minute	2.16	0.84	2.43	0.67
3 Minute	2.3	0.90	2.6	0.62
After App. Of 2nd Torniqt at 1 min.	2.31	1.06	2.63	0.48
2 Minute	2.28	0.76	2.62	0.49
5 Minute	2.45	0.55	2.37	0.44
15 Minute	2.43	0.62	2.57	0.27
45 Minute	2.17	0.43	2.65	0.3
1 Hour	1.97	0.39	2.71	0.2
Postoperative vitals At 0 minute	1.8	0.55	2.72	0.43
5 minute	1.96	0.71	2.73	0.47
15 minute	2.18	0.74	2.73	0.44
30 minute	2.01	1.62	2.75	0.28
1 hour	1.83	0.37	2.74	0.86
3 Hour	1.77	0.42	2.61	0.84
6 Hour	1.66	0.47	2.12	1.11
12 Hour	1.56	0.49	2.11	1.03
24 Hour	1.03	0.18	1.48	0.57

Table 3 Shows, The changes in the Sedation score at different time intervals. Before 1st tourniquet application Sedation score was 1.03± 0.18 and 1.06±0.24 in group L and group LD respectively. After administration of drug, sedation score started to increase in group LD significantly.

Sensory Onset Time

It was significantly higher than the sensory onset time of Group LD which was 2.83±0.89 minutes with a 'p' value of 0.0001.

Motor Onset Time

It was significantly higher than the motor onset time of Group LD which was 10.87±0.39 minutes with a 'p' value of 0.0001.

The sensory block recovery time

It was significantly delayed in Group LD. In group L sensory recovery time was 9.0±1.03 minutes as compared to 19.23±3.88 minutes in Group LD.

The motor block recovery time

It was significantly delayed in Group LD. In group L motor block recovery time was 6.03±0.75 minutes as compared to17.2±1.8 minutes in Group LD. The duration of analgesia was 58.34±11.30 minutes in group L which was significantly lower than 558.68±88.16 minutes in group LD with a 'p' value <0.05. The number of rescue analgesics needed in first 24 hrs postoperatively. The number of diclofenac (75 mg) tablet as rescue analgesic needed, was 3.26±0.44 in group L and 1.7±0.82 in group LD. The requirement of rescue analgesic was significantly less in group LD as compared to Group L.

DISCUSSION

Intravenous regional anaesthesia, a venous technique founded by August Bier in 1908, acts at the peripheral nerve ending and at the same time anaesthetizes the major nerve trunks. Therefore, this could be best described as a "peripheral nerve block". Traditionally, lignocaine 3mg/kg as a 0.5% solution is used for IVRA. Lignocaine in the dose of 1-2 mg/kg is considered as a safe I.V dose in an intensive care. This

reduced dose of lignocaine administered as 0.25% solution is insufficient for IVRA. To complete or prolong the analgesia , different methods have been proposed like alkalinization of the local anaesthetic or addition of opioids like morphine, pethidine, NSAIDS like ketorolac[14] & ketamine[17]. But different side effects such as delayed respiratory depression, pruritis, nausea and very short of analgesia, after release of tourniquet have necessitated continued study of newer additives to the IVRA. Recently α_2 adrenergic receptor agonist have been the drug of interest because their sedative, analgesimc, perioperative sympatholytic & cardiovascular stabilizing effects with reduced anaesthetic requirements Dexmedetomidine is a potent α_2 adrenergic receptor agonist . It is known to reduce the anaesthetic requirements when given I.V. In view of these facts, we had undertaken this study to evaluate the efficacy of 0.5µg/kg dexmedetomidine to lignocaine in IVRA on the quality of block, incidence of tourniquet pain, sedation and duration of postoperative analgesia.

In group L sensory block onset time was ranges from 3 to 6 minutes with mean time for achieving sensory block was 5.53±0.80 minutes and sensory block recovery time was 9.0±1.03 minutes. In group LD sensory block onset time was ranges from 2 to 4 minutes with mean time for achieving sensory block was 2.83±0.89 minutes and sensory block recovery time 19.23±3.88 minutes. The sensory block onset time was significantly shorter with significantly longer sensory recovery time was observed in patients who received dexmedetomidine with lignocaine as compared to patients who received lignocaine.

In group L motor block onset time was ranges from 10 to 15 minutes with mean time for achieving motor block onset was 14.8±3.56 minutes and motor block recovery time was 6.03±0.75 minutes. In group LD motor block onset time was ranges from 6 to 11 minutes and mean time for achieving motor block onset was 10.87±2.39 minutes and motor block recovery time 17.2±1.8 minutes. Similarly the onset of motor block was faster and regression of motor block was slower in group LD which were found to be statistically significant as compared to group L This was in concurrence with the studies Memis et al[15] and Esha et al[18], where the addition of dexmedetomidine 0.5µg /kg to IVRA had shortened motor onset and prolonged the recovery of the motor block. Our results also coincides with the results of Esha et al[18] and Jewlikar S et al[19].

VAS score was assessed during preoperative, intraoperative and 24 hr postoperative period. The left side (0) no pain and right side (10) labeled the worst pain. VAS score was significantly lower in group LD because dexmedetomidine is a potent α_2 adrenoreceptor agonist and these receptors located at nerve endings may have a role in the analgesic effect of the drug by preventing norepinephrine release.

Sedation score was assessed during preoperative, intraoperative and 24 hr postoperative period. It was assessed using Ramsay Sedation Score. Sedation score was recorded at different time intervals along with VAS score. Group LD sedation score was significantly higher than group L during study period. Results of our study are in accordance with the study done by Jewlikar S et al[19].

Duration of analgesia was considered as the time from deflation of 2nd tourniquet upto first administration of injection diclofenac 75 mg I.M. Mean duration of analgesia was significantly higher in group LD (558.68±88.16) minutes as compared to group L (58.34±11.30) minutes.

Quality of analgesia was determined by number of rescue analgesics given in postoperative period. For rescue analgesia postoperatively, patients were given inj. Diclofenac 75mg I.M. when VAS >3. Number of rescue analgesic in 24 hrs postoperatively in Group L was 3.26±0.44 and in Group LD it was 1.7±0.82 . It was significantly lower in Group LD .This quality of analgesia was found to be better in group LD as compared to group L.This result of this study is similar to the other studies.Esmaoglu et al[16] employed dexmedetomidine in the dose of 1 µg/kg whereas Memis et al[15] and Esha et al[18] used it in the dose of 0.5µg/kg Dexmedetomidine was effective in both doses. However, Gupta B et al[20]. who compared two different doses of dexmedetomidine found it to be superior in terms of onset of sensory, onset of motor block, and duration of analgesia when dexmedetomidine was used in the dose of 1 µg/kg when compared to 0.5 µg/kg. No side effects like nausea, vomiting, hypertension, bradycardia and aarythmias were observed in the study in both the groups.

The use of dexmedetomidine 0.5 µg/kg as adjuvant to lignocaine for IVRA provides better quality of block, leads to earlier onset of sensory and motor block, and prolongs the duration of postoperative analgesia without any significant side effect.

CONCLUSION

The present study evaluation of efficacy of dexmedetomidine as an adjuvant to lignocaine during intravenous regional anaesthesia concluded that addition of dexmedetomidine to lignocaine in IVRA improved the quality of both sensory and motor block with good quality of analgesia. It enhanced the duration of postoperative analgesia and was not associated with haemodynamic instability or any other complications.

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