Original Article

A Comparative Study of Two Different Doses of Dexmedetomidine as Adjunct to Lignocaine in Intravenous Regional Anaesthesia of Upper Limb Surgeries

Abhishek Gupta[1]
Mamta Mahobia[2]
Neeraj Narang[2]
Rekha Mahendra[3]

[1]Senior Resident, Department of Anaesthesiology, MAMC, New Delhi, India, [2]Assistant Professor, Department of Anaesthesiology, Netaji Subash Chandra Bose Medical College, Jabalpur, Madhya Pradesh, India, [3]Professor and H.O.D, Department of Anaesthesiology, Netaji Subash Chandra Bose Medical College, Jabalpur, Madhya Pradesh, India

Corresponding Author: *Dr. Mamta Mahobia, 56, Denning Road, South Civil Lines, Jabalpur, Madhya Pradesh, India - 482001. E-mail: mahobiadrmamta@gmail.com*

Abstract

Introduction: Intravenous regional anaesthesia is a simple and cost effective technique for surgery involving the distal arm. Dexmetomidine which is about eight times more potent than clonidine has been used in bier's block and was shown to improve the quality of anaesthesia, torniquet pain and postoperative analgesic requirement. The aim of present study is to compare two different doses of dexmedetomidine (0.5 µgm/kg and 1 µgm/kg) as adjunct to Lignocaine in intravenous regional anaesthesia for upper limb surgeries. Also to evaluate dose related responses of dexmedetomidine on onset and quality of block, tourniquet pain and post operative analgesia.

Material and Methods: This study included 60 patients of ASA class I and II of either sex aged between 17-70 years scheduled for various upper limb surgeries. Patients were randomly divided into two groups 30 each. They received 40 ml 0.5% lignocaine and either dexmedetomidine 0.5 µgm/kg (group A) or dexmedetomidine 1 µgm/kg (group B). None of the patient in 2 groups was premedicated sensory and motor block onset were noted. Postoperative pain score was recorded by using Visual analogue scale (VAS). Diclofenac was given I.M as rescue analgesia when VAS values reached ≥4. Duration of postoperative analgesia was noted from deflation of torniquet to VAS score of 4. Assessment of sedation was done using Ramsay sedation score at 30 minute, 60 minute and 90 minute intervals following torniquet deflation.

Results: The onset of sensory and motor block in group B was significantly shorter than group A. Both the groups showed comparable low level of sedation. VAS score of group B was statistically lower than VAS score of group A. Quality of blockade among both groups was excellent.

Conclusion: We concluded that addition of 1 µgm/kg dexmedetomidine to lignocaine for IVRA improves quality of anaesthesia and postoperative analgesia in comparison to 0.5 µgm/kg dexmedetomidine.

Keywords: Biers block, Dexmedetomidine, Intravenous regional anaesthesia, Lignocaine, Regional anaesthesia

INTRODUCTION

The Taxonomy committee of International Association for Study of Pain (IASP) defines pain as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."[1]

Pain being subjective phenomenon is perceived only by sufferer. Due to differences in the neuro endocrine mechanism of pain relief, men require more analgesics then women. Postoperative pain is due to surgical trauma with an inflammatory reaction & initiation of an afferent neuronal damage. Severe postoperative pain starts a cascade of endocrine-metabolic and inflammatory events which later on leads to organ dysfunction, morbidity, increased hospital stay and mortality. There are chances of deep venous thrombosis, pulmonary atelectasis, muscle wasting and urinary retention in postoperative period, due to pain related immobility of patient.[2] Besides this restlessness caused by severe pain may contribute to postoperative hypoxemia.[3]

The peripheral neural activation together with central neuroplastic changes associated with postoperative pain may in some patients continue into a chronic pain state.[4,5]

Assessing postoperative pain is very important. The aim of assessment is to determine the intensity, quality and duration of pain, to help decide on the choice of therapy and to evaluate the relative effectiveness of different therapies.

Approaches to the measurement and assessment of pain include verbal and numerical rating scales, visual analogue scale (VAS), behavioural observation scales and psychological responses. Of these the VAS is the most frequently used self rating score. The most common VAS consists of a 10 cm horizontal or vertical line with the two end points labelled 'No pain" and 'Worst pain ever'. Patients are required to place a mark on the 10 cm line at a point that corresponds to the level of pain intensity they presently feel. The distance in centimetre from the low end of VAS to the patient's mark is used as a numerical index of the severity of pain. Advantages include ease and brevity of administration and scoring, its minimal intrusiveness, its greater sensitivity to detect intervention-based changes in pain and its conceptual simplicity.[6]

MANAGEMENT OF POST-OPERATIVE PAIN

1. Pharmacological measures*:* Include administration of drugs like opioids as well as non-opioids by various routes including oral, intra-muscular, intra-venous, per-rectal, epidural, intrathecal, sublingual, intra-articular, subcutaneous, etc.[7]
2. Non-pharmacological modalities: Transcutaneous electrical nerve stimulation (TENS) applied with a relevant strong sub noxious intensity and adequate frequency in the wound area may reduce analgesic consumption in the postoperative period.[8] Acupuncture is another non-pharmacological means which is proven to be of value in acute pain management especially in the postoperative period.[9]

The beginning of regional anaesthesia can be traced back to 1884 when Karl kollar reported efficacy of cocaine as local anaesthetic.

In 1908 August Karl Gustav Bier, Professor of Surgery at Berlin, described an unusual method of producing analgesia of a limb and named this technique VENOUS ANAESTHESIA i.e., use of vascular bed to bring anaesthetic agent to the nerve endings. He used an Esmarch bandage to exsanguinate the arm and injected procaine between two tourniquets to quickly produce anaesthetic and analgesic effects at the site.[10]

Though it proved effective, IVRA remained relatively unpopular until C McK Holmes reintroduced it in 1963. Today the technique is common due to its economy, rapid recovery, reliability, and simplicity.[11]

This technique begins by exsanguinating the limb as Bier did with an elastic bandage, squeezing blood proximally toward the heart. Pneumatic tourniquets are then applied to the limb and inflated to occlude all blood vessels. The local anaesthetic, typically lignocaine or prilocaine, is slowly injected as distally as possible into the exsanguinated limb. The anaesthetic sets in after approximately 20 minutes, at which point the tourniquets can be deflated and the surgery may begin. The wait time is important for avoiding toxic levels of anaesthetics in the systemic bloodstream. Alternatively, the tourniquets may remain inflated to maintain a bloodless field.[12,13]

The disadvantages of this type of block which includes less effective blockage, tourniquet pain and insufficient postoperative pain relief can be mitigated using drugs to potentiate local anaesthetics such as tramadol,[14] α2-agonists,[15] neostigmine,[16] or nonsteroidal anti-inflammatory drugs (NSAIDs).[17]

α2-Adrenergic receptor (adrenoceptor) agonists have been the focus of interest for their sedative, analgesic and perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements. Dexmedetomidine, a potent α-2 adrenoceptor agonist, is approximately 8 times more selective toward the α2- adrenoceptors than clonidine. Dexmedetomidine has been shown to decrease anesthetic requirements by up to 90% and to induce analgesia in rats, volunteers, and patients.[18-22]

The addition of clonidine to lignocaine during bier's block had shown to improve tourniquet pain tolerance but did not influence the speed and quality of bier's block. It's effect on prolonging post-operative analgesia is controversial. Reported side effects were post deflation sedation and hypotension.[15,23]

Dexemedetomidine which is about 8 times more potent than clonidine has been used in bier's block and was shown to improve the quality of anesthesia, torniquet pain and post-operative analgesic requirement. It's effect on speed of onset is controversial. This shows that dexemedetomodine is better adjuvent to lignocaine in bier's block than clonidine.

The aim of present study is to compare two different doses of dexemedetomidine (5 μg/kg and 1 μg/kg) as adjunct to lignocaine in intravenous regional anaesthesia for upper limb surgeries. To evaluate dose related responses of

dexemedetomidine on onset & quality of block, tourniquet pain and post-operative analgesia.

MATERIAL AND METHODS

The present study was undertaken in 60 patients attending to Surgery and Orthopaedics Department of N.S.C.B. Medical College and Hospital, Jabalpur during routine and emergency hours for various minor and major surgical procedures involving upper extremities.

Selection of Cases

An informed written consent was taken from all the patients in both groups after the approval of Institutional and Ethics Committee in patients of ASA class I and II of either sex aged between 17-70 years scheduled for various minor and major procedures involving upper extremities.

A detailed history, thorough physical examination, routine investigation and any special investigation if required was done for the study.

Criteria for Exclusion

1. Patient with known hypersensitivity to local anaesthetic.
2. Patient with Severe peripheral vascular disease and neurological disease.
3. Where use of tourniquet was either not possible or contraindicated.
4. Patient with Hemolytic diathesis specially sickle cell anemia, epilepsy, diabities mellitus, hypertension, cardiovascular disease like myocardial infarction, cardiac arrhythmias, heart block, altered mentation were not included and procedures lasting for more than 90 min were also not considered.
5. Patient with allergy to study medication.
6. Therapy with adrenergic receptor antagonist, calcium channel blocker and ACE inhibitors.

Design of Study

Patients were randomly divided into two groups (30 patients each).

Gr. A - received 40 ml,0.5% lignocaine (preservative free) with dexmedetomidine 0.5 μg/kg (original strength 100 μg/ml) in 1.0 ml to make final volume to 41ml.

Gr. B - received 40 ml, 0.5% lignocaine (preservative free) with dexmedetomidine 1 μg/kg (original strength 100 μg/ml) in 1.0 ml to make final volume to 41.0 ml.

Technique

Premedication: None of the patients in two groups were premedicated. Premedication with sedatives and narcotics was deliberately omitted so as to avoid any interference in the assessment of sensory and motor blockade.

Monitoring: The patients were asked frequently and monitored continuously for any discomfort during the surgery. Throughout the procedure tourniquet pressure was monitored and maintained. The pulse rate, BP, RR, were recorded every 10 min throughout the procedure.

Before starting the procedure it was ensured to keep resuscitation equipments and emergency drug to deal with any untoward effect. The patients were again assessed preoperatively. Pulse, BP and RR were noted. Intravenous line was secured in contralateral arm to assure an IV route.

A padded double cuff tourniquet was tested and positioned around the arm. A 22G butterfly needle was placed for injecting drug in a peripheral vein distal to the operative site, preferably over the dorsum of the hand and secured in position. Now the limb was elevated for exsanguination to 90 degrees for 3 min along with application of sterile bandage followed by inflation of proximal tourniquet cuff to 250 mmHg. This criterion was fixed for all cases of the study. Then a dose of 40 ml .5% lignocaine injected slowly either with dexmedetomidine .5 μg/kg or 1 μg/kg (in 1.0 ml)depending upon the group as mentioned earlier.

Assessment of Sensory Blockade

After injecting drug (considered as time 0), the time of onset of sensory blockade is determined by pinprick using fine hypodermic needle. Sites used for sensory assessment included the thenar eminence (median nerve), hypothenar eminence (ulnar nerve)and first web space (radial nerve). Loss of pinprick sensation in all three skin areas was considered as complete sensory blockade.

Assessment of Motor Blockade

Patients were asked to make finger movements. Inability to do so was taken as motor blockade.

After 30 minutes to drug injection, distal cuff inflated to 250 mmHg which is followed by deflation of proximal cuff, to avoid any tourniquet discomfort in every case. Throughout the procedure tourniquet pressure was monitored and maintained at 250 mmhg. Following completion of surgery, tourniquet cuff is deflated with repeated deflation re-inflation technique. For this cuff is deflated for 10 sec and then reinflated again for 1 min. This sequence is repeated 3 times with great care taken not to deflate the cuff within 30 min of local anaesthetic injection in any case to avoid local anaesthetic toxicity. Even if the surgical procedure is over within 30 min, the tourniquet

was not deflated before 30 min. This was strictly observed throughout the study.

Torniquet Time: Time from the inflation of distal cuff to deflation of cuff was designated as the total tourniquet time and it was recorded in every case. All the patients were observed for at least 30 min postoperatively in recovery for signs of any untoward reaction.

Assessment of Quality of Block

The quality of overall block was assessed according to the grading described by Ware R.J.(1979) as follows-

1. Excellent - complete anaesthesia (lack of any sensation to pin prick and no movements of wrist and fingers)
2. Good - complete anaesthesia (touch sensation may be preserved but no pain to pin prick and minor movements of fingers)
3. Fair - adequate anaesthesia (slight discomfort but tolerable without any supplementation
4. Poor - inadequate anaesthesia (requiring supplementation with either sedative systemic analgesics or general anaesthesia).

Assessment of Post Operative Pain

Postoperatively, the pain score was recorded by using visual analogue pain scale (VAS), between 0 to 10 (o-no pain, 10-most severe pain). Diclofenac was given I.M. as rescue analgesia when VAS values reached more ≥4. Duration of post operative analgesia was noted from deflation of tourniquet to VAS score of 4.

Assessment of Sedation

Ramsay sedation scale

Score	Response
1	Anxious or restless or both
2	Cooperative, orientated and tranquil
3	Responding to commands
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

Statistical Analysis

The data of the present study were recorded into the computer and after its proper validation, check for error, coding & decoding were compiled and analysed using the software SPSS 18 for windows. Appropriate univariate and bivariate analysis were carried out using the Student *t* test for the continuous variable (Age, SBP, DBP,HR etc) and two-tailed Fisher exact test or chi-square (χ^2) test for Categorical variables. All means are expressed as mean ± standard deviation. The critical levels of significance of the results were considered at 0.05 levels i.e., $P < 0.05$ was considered significant.

RESULTS

Patients of ASA class I and II of either sexes, between 17-70 years of age were included in the study.

Patients were randomly divided into two groups (30 patients each).

Gr. A - received 40 ml, 0.5% lignocaine (preservative free) with Dexmedetomidine 0.5 μg/kg (original strength 100 μg/ml) in 1.0 ml to make final volume to 41 ml.

Gr. B - received 40 ml, 0.5% lignocaine (xylocard) with Dexmedetomidine 1 μg/kg (original strength 100 μg/ml) in 1.0 ml to make final volume to 41.0 ml.

Table 1: Age wise distribution of patients

Age in years	Group A	Group B	Total
15-19	4	6	10
	13.3%	20.0%	16.7%
20-29	11	13	24
	36.7%	43.3%	40.0%
30-39	7	4	11
	23.3%	13.3%	18.3%
40-49	4	5	9
	13.3%	16.7%	15.0%
50-59	4	0	4
	13.3%	0.0%	6.7%
60+	0	2	2
	0.0%	6.7%	3.3%
Total	30	30	60
Mean±SD	31.93±11.399	30.37±13.353	31.15±12.334

P>0.05

Table 1 describes the trend of age among studied groups. The mean ages among both groups were comparable.

Table 2: Sex wise distribution of patients

	Group A	Group B	Total
Male	26	25	51
	86.7%	83.3%	85.0%
Female	4	5	9
	13.3%	16.7%	15.0%
Total	30	30	60

P>0.05

The majority of patients were males in both the groups. Out of 60 patients studied, 85% were males as compared to 15% females [Table 2].

Table 3: Weight wise distribution of patients

Wt. (kg)	Group A	Group B	Total
45-49	0	2	2
	0.0%	6.7%	3.3%
50-54	5	6	11
	16.7%	20.0%	18.3%
55-59	8	13	21
	26.7%	43.3%	35.0%
60-64	9	7	16
	30.0%	23.3%	26.7%
65-69	4	1	5
	13.3%	3.3%	8.3%
>70	4	1	5
	13.3%	3.3%	8.3%
Total	30	30	60
Mean±SD	60.30±6.154	56.80±5.301	58.55±5.962

P>0.05

Table 3 describes the trend of weight among studied groups. The mean weights among both groups were comparable.

Table 4 shows various surgeries performed in both group.

Table 5 show the variation in mean pulse rate in both the groups. Initially there was a rise in mean pulse rate in Group B which was statistically insignificant, later on after switching tourniquet there was a fall in mean pulse rate in both the group and finally pulse rate observed to fall back to near base line values which was also statistically insignificant.

Table 6 show the variation in mean systolic blood pressure in both the groups. There was an initial rise in mean systolic blood pressure which was followed by a gradual fall. The values than returned back to baseline gradually. None of the patients in either group developed hypotention.

Table 7 show the variation in mean diastolic blood pressure in both the groups. The changes in diastolic blood pressure were not significant in either of the groups.

Table 8 show the changes in mean respiratory rate in both the groups. There was no significant change in respiratory rate in either of the groups.

Table 9 show the mean onset of sensory block in studied groups. The mean onset of sensory block in Group B was significantly shorter than Group A.

Table 10 show the mean onset of motor block in studied groups. The onset of motor block in Group B was significantly shorter than Group A.

Table 4: Type of surgery

	A	B	Total
3RD metacarpal amputation	1	0	1
	3.3%	0.0%	1.7%
Alli's plate fixation	1	0	1
	3.3%	0.0%	1.7%
AV malformation	1	0	1
	3.3%	0.0%	1.7%
Bone biopsy	0	1	1
	0.0%	3.3%	1.7%
Contracture release	1	3	4
	3.3%	10.0%	6.7%
Curettage of RT ULNA	0	1	1
	0.0%	3.3%	1.7%
Debridement	2	2	4
	6.7%	6.7%	6.7%
Delta frame	1	1	2
	3.3%	3.3%	3.3%
Ganglion excision	2	0	2
	6.7%	0.0%	3.3%
Ganglion removal	0	2	2
	0.0%	6.7%	3.3%
Implant removal	2	3	5
	6.7%	10.0%	8.3%
Jess distractor	2	1	3
	6.7%	3.3%	5.0%
K wire fixation	0	4	4
	0.0%	13.3%	6.7%
K-wire fixation	7	0	7
	23.3%	0.0%	11.7%
Nailing	0	1	1
	0.0%	3.3%	1.7%
Orif	2	3	5
	6.7%	10.0%	8.3%
Radial head excision	0	1	1
	0.0%	3.3%	1.7%
Radial plating	1	0	1
	3.3%	0.0%	1.7%
SSG	2	2	4
	6.7%	6.7%	6.7%
Tendon repair	4	2	6
	13.3%	6.7%	10.0%
Thumb amputation	0	1	1
	0.0%	3.3%	1.7%
Ulnar plating	1	1	2
	3.3%	3.3%	3.3%
Venous flap of ring fingure	0	1	1
	0.0%	3.3%	1.7%
Total	30	30	60

Table 11 show mean duration of tourniquet time. The tourniquet time in both the groups was comparable.

Table 12 show median sedation scores of both the groups at 30, 60 and 90 minute intervals following tourniquet deflation. Both the group showed comparable low level of sedation as depicted by Ramsay Sedation Scale.

Table 5: Change in mean pulse rate±SD

Group	Preop	5 min. after initiation of surgery	Before switch over of tourniquet	After tourniquet deflation		
				5 min	10 min	15 min
A	78.80±7.327	78.53±7.181	78.80±7.058	77.40±6.729	77.13±6.761	78.27±7.158
B	79.13±6.922	80.53±6.146	80.67±6.712	78.00±6.787	78.73±6.247	79.47±6.078
Total	78.97±7.069	79.53±6.703	79.73±6.894	77.70±6.708	77.93±6.504	78.87±6.611

Table 6: Change in mean systolic blood pressure (mmhg)±SD

Group	Preop	5 min. after initiation of surgery	Before switch over of tourniquet	After tourniquet deflation		
				5 min	10 min	15 min
A	125.73±7.679	127.13±7.533	127.07±7.139	124.40±7.209	125.07±6.843	125.87±7.500
B	123.27±10.312	124.27±9.214	125.27±8.812	122.27±9.303	123.77±8.565	125.20±8.181
Total	124.50±9.099	125.70±8.468	126.17±8.002	123.33±8.321	124.42±7.714	125.53±7.788

Table 7: Change in mean diastolic blood pressure (mmhg)±SD

Group	Preop	5 min. after initiation of surgery	Before switch over of tourniquet	After tourniquet deflation		
				5 min	10 min	15 min
A	79.53±6.296	81.13±5.818	80.87±5.244	78.33±6.348	79.00±6.187	80.87±5.865
B	79.33±7.265	80.33±6.870	81.00±6.029	78.00±6.303	77.87±5.380	78.20±4.965
Total	79.43±6.741	80.73±6.324	80.93±5.602	78.17±6.274	78.43±5.777	79.53±5.552

Table 8: Changes in mean respiratory rate±SD

Group	Preop	5 min. after initiation of surgery	Before switch over of tourniquet	After tourniquet deflation		
				5 min	10 min	15 min
A	16.57±0.898	17.87±0.900	17.40±0.932	16.67±0.959	16.83±0.986	17.87±0.900
B	17.27±1.230	17.47±1.167	17.27±1.112	16.93±1.015	17.07±1.015	17.20±0.997
Total	16.92±1.124	17.67±1.052	17.33±1.020	16.80±0.988	16.95±0.999	17.53±0.999

Table 9: Mean onset of sensory block (minutes±SD)

Group	A	B
Onset (minutes±SD)	3.89±0.914	1.05±0.346
Total	30	30

P<0.0001

Table 10: Mean onset of motor block (minutes±SD)

Group	A	B
Onset (minutes±SD)	10.62±2.185	5.30±1.149
Total	30	30

P<0.0001

Table 11: Mean duration of tourniquet time (minutes±SD)

Group	A	B
Duration (minutes±SD)	51.60±5.157	53.80±4.773
Total	30	30

P>0.05

Table 12: Median sedation score (maximum-minimum)

Group	Sedation score (after tourniquet deflation)		
	30 min	60 min	90 min
A	2 (1-3)	1 (1-2)	1 (1-2)
B	2 (1-3)	2 (1-2)	1 (1-2)

P>0.05

Table 13: Median vas score (maximum-minimum)

Duration	Group A	Group B
1st Hour	1 (0-2)	0 (0-1)
2nd Hour	2 (1-4)	1 (0-2)
3rd Hour	4 (1-4)	1 (1-2)
4th Hour	3 (2-4)	2 (1-4)
5th Hour	4 (3-4)	3 (1-4)
6th Hour	4 (4-4)	4 (2-4)
7th Hour	-	3.5 (2-4)
8th Hour	-	4 (4-4)

Ramsay sedation scale

Score	Response
1.	Anxious or restless or both
2.	Cooperative, orientated and tranquil
3.	Responding to commands
4.	Brisk response to stimulus
5.	Sluggish response to stimulus
6.	No response to stimulus

Table 14: Mean duration of post-operative analgesia (minutes±SD)

Group	A	B
Duration of analgesia±SD	174.20±67.076	331.53±78.267
Total	30	30

t=–8.360; P<0.0001

Table 13 show median VAS scores of both the groups at hourly interval. At each hourly interval, median VAS score of Group B was statistically lower than median VAS score of Group A except at 6th hour.The study for Group A ended at 6th hour while the study of VAS for Group B was continued upto 8th hour in accordance to the end point of achievement of median VAS≥4.

Table 14 show the mean duration of post-operative analgesia in both groups. Mean duration of analgesia was significantly longer in Group B.

Table 15: Quality of block

Grading of quality of blockade	Group A	Group B	Total
Excellent	25	27	52
	83.3%	90.0%	86.7%
Good	4	3	7
	13.3%	10.0%	11.7%
Fair	1	0	1
	3.3%	0.0%	1.7%
Poor	0	0	0
	0.0%	0.0%	0.0%
Total	30	30	60

p>0.05

Table 15 shows the grading of quality of blockade among both groups. In majority of the cases it was excellent.

Table 16 show complication rates noted post-operatively in studied groups. Majority showed no complication attributed either to the drug or to technique.

DISCUSSION

Intravenous regional anaesthesia (IVRA) is a simple and reliable method of providing anaesthesia for extremity surgery. This technique begins with exsanguinating the limb with an elastic bandage and squeezing blood proximally toward the heart. Then Pneumatic tourniquets are applied to the limb and inflated to occlude the blood vessels. The local anaesthetic, typically lignocaine or prilocaine, is slowly injected as distally as possible into the exsanguinated limb. The administration of IVRA requires only the skill to perform a venipuncture. Limitation of IVRA has been tourniquet pain and the inability to provide postoperative analgesia as compared with peripheral nerve blocks.

Table 16: Complications

	Group A	Group B	Total
Dry mouth	1	2	3
	3.3%	6.7%	5.0%
Bradycardia	0	1	1
	0.00%	3.3%	3.3%
Tinnitus	0	1	1
	0.00%	3.3%	3.3%
Perioral numbness	0	1	1
	0.00%	3.3%	3.3%
Nil	29	25	54
	96.7%	83.3%	90%
Total	30	30	60

As mentioned above IVRA occasionally does not provide effective anaesthesia and postoperative analgesia. To improve the quality of IVRA as well as to prolong the duration of postoperative analgesia, the addition of various drugs to local anaesthetics found with controversial results such as tramadol,[14] clonidine,[15] neostigmine,[16] nonsteroidal anti-inflammatory drugs (NSAIDs).[17]

The use of an α2- agonist as an adjunct in pain management is attractive because of the potentiating that occurs through their action at the central and peripheral sites.[28] Two drugs belonging to the α2 adrenoceptor agonist namely clonidine and dexmedetomidine have been the focus of adjuncts in IVRA in recent clinical studies.

Gentili M et al (1999)[15] showed that clonidine 150 µg produced a significant increase in tourniquet tolerance in patients undergoing IVRA.

Lurie SD et al (2000)[27] reported the efficacy of 1 µg/kg clonidine added to IVRA lignocaine in decreasing the onset of severe tourniquet pain and found that it delayed the sensory onset time.

Reuben et al (1999)reported that the addition of 1 µg/kg clonidine to lignocaine, 0.5%, for IVRA in patients undergoing ambulatory hand surgery improves postoperative analgesia without causing significant side effects during the first postoperative day.

Kleinschmidt S et al (1997)[23] conducted a study to investigatethe effect of the addition of clonidine 2 μg/kg to prilocaine 0.5% for intravenous regional anaesthesia (IVRA) in the arm. There were no significant differences between the groups concerning the onset and recovery characteristics of sensory and motor blockade, post-operative pain or side effects.

Dexmedetomidine is a potent α2-adrenoceptor agonist with eight time's higher affinity for the receptors than clonidine. Dexmedetomidine produces sedation, analgesia and anxiolysis. Dexmedetomidine compared to Clonidine is a more selective α2-adrenoceptor agonist, which might permit its application in relatively high doses for sedation and analgesia without the unwanted vascular effects from activation of α1-receptors. In addition, dexmedetomidine is shorter-acting drug than clonidine and has a reversal drug for its sedative effect, Atipamezole. These properties make dexmedetomidine suitable for sedation and analgesia during the peri-operative period: As premedication, as an anesthetic adjunct for general and regional anesthesia, and as postoperative sedative and analgesic.

Study by Dilek Memis et al (2004)[24] found that the addition of dexmedetomidine 0.5 μg/kg to lignocaine for IVRA leads to significant decreases in sensory and motor block onset time compared with a control group. Later, AEsmaoglu et al (2005)[25] found that addition of 1 μg/kg dexmedetomidine to lignocaine for intravenous regional anesthesia leads to improved quality of anaesthesia and decreased analgesic requirements, but had no effect on the sensory and motor block onset and regression times.

Kol, Iclal O et al (2009)[26] conducted study on addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anaesthesia for hand or forearm surgery: A randomized controlled study. They suggested that addition of dexmedetomidine had a more potent effect, shortening sensory block onset time and prolonging sensory block recovery time more than lornoxicam.

No previous study has shown comparison between two different doses of dexmedetomidine in IVRA technique. The purpose of the present study is to compare two different doses. 5 μg/kg & 1 μg/kg of dexmedetomidine when added to lignocaine 0.5% in terms of onset of sensory & motor block, duration of post-operative analgesia & quality of block. So, as to come up with an optimal dose having favorable outcome with least side effects.

With this aim, we conducted 'A comparative study of two different doses of dexmedetomidine as adjunct to lignocaine in intravenous regional anesthesia for upper limb surgery' in 60 Patients of ASA class I and II of either sexes, between 17-70 years of age at N.S.C.B. Medical College and Hospital, Jabalpur.

Patients were randomly divided into two groups (30 patients each).

Gr. A - received 40 ml, 0.5% lignocaine (preservative free) with dexmedetomidine 0.5 μg/kg (original strength 100 μg/ml) in 1.0ml to make final volume to 41 ml.

Gr. B - received 40 ml, 0.5% lignocaine (preservative free) with dexmedetomidine 1 μg/kg (original strength 100 μg/ml) in 1.0 ml to make final volume to 41.0 ml.

The data of the present study were recorded into the computer and after its proper validation, check for error, coding & decoding were compiled and analysed using the software SPSS 18 for windows. Appropriate univariate and bivariate analysis were carried out using the Student *t* test for the continuous variable (Age, SBP, DBP,HR etc) and two-tailed Fisher exact test or chi-square (c2)test for Categorical variables. All means are expressed as mean ± standard deviation. The critical levels of significance of the results were considered at 0.05 levels i.e. $P < 0.05$ was considered significant.

The demographic data of this study show that all patients are within range of 17-70 years of age. The mean age of Group A subjects was 31.93 (±11.399)years and Group B cases was 30.37 (±13.353) years. They were comparable.

The mean body weight of Group A subjects was observed 60.30±6.154 kgs and Group B cases it was 56.80±5.301 kgs. They were comparable.

The majority of patients were males in both the groups. Out of 60 patients studied, 85% were males as compared to 15% females.

The type of surgery between both studied groups was comparable.

Mean duration of tourniquet was 51.60±5.157 min in Group A & 53.80±4.773 min in Group B which was also comparable.

Since all the groups were demographically similar ($p>0.05$ in all the comparisons), it can be presumed that the groups are comparable for the purpose of the study. No premedication was used in study population it can therefore be presumed that recording of parameters pertaining to sensory analgesia were consistently accurate. Thus, the patients of both the groups in study were comparable in regards to age, weight and sex distribution.

In this study, it was observed that initially there was a rise in mean pulse rate in Group B which was statistically insignificant, later on after switching tourniquet there was a fall in mean pulse rate in both the group and finally pulse rate observed to fall back to near base line values which was also statistically insignificant.

It was also seen that there was a initial rise in mean systolic blood pressure followed by gradual fall and then back to near base line values. None of the patients in either group developed hypotention. The changes in diastolic blood pressure were not significant in either of the groups.

The changes in respiratory rate were also not significant in either of the groups.

The mean onset of sensory and motor blockade in Group B was 1.05±.346 & 5.30±1.149 minutes while it was 3.89±.914 & 10.62±2.185 minutes in Group A. Difference in mean onset of sensory & motor block between Group A & B was statistically highly significant (P<0.0001). Dilek Memis et al (2004)[24] in his study also found that the addition of dexmedetomidine 0.5 μg/kg to lignocaine for IVRA leads to significant decreases in sensory and motor blocks onset time compared with a control group. Later, AEsmaoglu et al (2005)[25] found that addition of 1 μg/kg dexmedetomidine to lignocaine had no effect on the sensory and motor blocks onset times which is not in agreement with our study.

Median sedation score of Group A at 30, 60 and 90 minute (in terms of median with minimum and maximum values)were 2(1-3), 1(1-2), 1(1-2) and that of Group B were 2(1-3), 2(1-2), 1(1-2). Results showed low level of sedation as per Ramsay Sedation Scale with intergroup insignificance. Dilek Memis et al (2004)[24] in their study also foundno statistical difference between groups for sedation values at any intra-operative and post-operative period when compareddexmedetomidine. 5 μg/kg with control group. AEsmaoglu et al (2005)[25] in their study found higher sedation score levels post-operatively in dexmedetomidine 1 μg/kg group than their control group and it was in accordance to the sedation level of group B (1 μgm/kg) of present study.

Median VAS score at each hourly interval of Group B was statistically lower than median VAS score of Group A except at 6th hour at which the values were equal in both groups. The study for Group A ended at 6th hour while the study of VAS for Group B was continued up to 8th hour in accordance to the end point of achievement of median VAS≥4. The median VAS score was below 4 in the first two hours in Group A while it was below 4 for up till 6th hour in Group B. Dilek Memis et al (2004)[24] in their study using 0.5 μgm/kg dexmedetomidine as adjuvant also observed VAS below 4 in the first two hours.Which in accordance to the observation of our Group A (0.5 μgm/kg dexmedetomidine). A Esmaoglu et al (2005)[25] in their study using 1.0 μgm/kg dexmedetomidine as adjuvant observed VAS score of 0 during their two hours of observational postoperative period.

The mean duration of post-operative analgesia was 174.20±67.076 minutes in Group A and 331.53±78.267 minutes in Group B. Duration of analgesia was significantly longer in Group B than Group A which was statistically highly significant (P<0.0001). This result correlate well with the study conducted by Dilek Memis et al (2004)[24] & AEsmaoglu et al (2005),[25] they found significantly prolonged duration of analgesia with dexmedetomidine group when compared with control group.

Quality of blockade was excellent in 83.3% cases in Group A and 90% of cases in Group B. It was good in 13.3% of cases in Group A & 10% of cases in Group B. The quality of block was not found to be poor in any cases in either group. Dilek Memis et al (2004)[24] & AEsmaoglu et al (2005)[25] also found quality of blockade statistically better in dexmedetomidine group.

There were only few incidence of side effects encountered in our study like, dryness of mouth which was observed in 1(3.3%) case in Group A and 2(6.7%) cases in Group B, bradycardia, tinnitus & peri-oral numbness were noted in 3.3% cases only in Group B. All the results were statistically non significant (P>0.05%) among the groups and easily ameliorated by drugs or by mere observation which was in disagreement with the study of AEsmaoglu et al (2005)[25] who at a dose of 1 μg/kg dexmedetomidine did not observe any side-effect such as hypotension or bradycardia which required treatment.

To conclude, this study demonstrated that the addition of 1 μg/kg dexmedetomidine to lignocaine for IVRA showed significantly better improvement in the quality of anaesthesia and postoperative analgesia in comparison to. 5 μg/kg dexmedetomidine, without causing any significant side-effects. So, we prefer to use dexmedetomidine at a dose of 1 μg/kg as an adjunct to lignocaine in IVRA for upper limb surgeries.

REFERENCES

1. MerskyH.Pain terms: A list with definition and notes on usage. Recommended by the I*ASP subcommittee on Taxonomy. Pain*.1979; 6; 249-252.
2. Jorgen BD, Kehlet H. Postoperative pain and it's management. In: McMohan SB, Koltzenburg M, editors. *Wall and Melzack's Textbook of pain*. 5th ed. Elsevier Churchill Livingstone: Philadelphia; 2006. p. 635.

3. Loach A, editor. The management of postoperative pain. In: *Orthopaedic anaesthesia, 2nd ed*. Edward Arnold: London; 1994. p. 65.
4. Macrae WA. Chronic pain after surgery. *Br J Anaesth* 2001;87:88-98.
5. Perkins FM, Kehlet H. Chronic pain as an outcome of surgery. A review of predictive factors. *Anesthesiology* 2000;93:1123-33.
6. Melzack R, Katz J. Pain assessment in adult patients. *In*: McMohan SB, Koltzenburg M, editors. *Wall and Melzack's Textbook of pain*. 5th ed. Elsevier Churchill Livingstone: Philadelphia; 2006. p. 292.
7. McLeskey CH, Shafter SL. Transdermal opioids. *Literature scan. Anesthesiology* 1991;5:2,27.
8. Bjordal JM, Johnson MI, Ljunggreen AE. Transcutaneous electrical nerve stimulation (TENS) can reduce postoperative analgesic consumption. A meta-analysis with assessment of optimal treatment parameters for postoperative pain. *Eur J Pain* 2003;7:181-8.
9. Ernst E, Pittler MH. The effectiveness of acupuncture in treating acute dental pain: A systematic review. *Br Dent J* 1998;184:443-7.
10. Holmes, C. McK. (1969). "The history and development of intravenous regional anaesthesia". *Acta Anaesthesiologica Scandinavica* (Wiley) Supplementum XXXVI: 11-18.
11. Matt, Corinna (2007). "Intravenous regional anaesthesia". *Anaesthesia and Intensive Care Medicine* (Elsevier) 8 (4): 137-9.
12. Clark, Natasha (2002). "Intravenous Regional Anaesthesia - Bier's Block". Retrieved 23 September 2011.
13. Henderson, Cynthia L, Warriner, C. Brian, McEwen, James A, Merrick, Pamela M. (1997). "A North American survey of intravenous regional anesthesia". *Anesthesia & Analgesia* (International Anesthesia Research Society) 85: 858-63.
14. So KY, Kim HJ, Go WS. Intravenous Regional Anesthesia Using Mepivacaine and Tramadol *Korean J Anesthesiol* 2002 Feb 42(2):172-176. Korean.
15. Gentili M, Bernard J-M, Bonnet F. Adding clonidine to lidocaine for intravenous regional anesthesia prevents tourniquet pain. *Anesth Analg* 1999;88:1327-30.
16. KyuSikKang, Sung Hak Jung, Ki RyangAhn, Chun Suk Kim, JiEun Kim, Si Hyun Yoo and Jin Hyung Kwon. The Effects of Neostigmine added to Ropivacaine for Intravenous Regional Anesthesia. *Korean Journal of Anesthesiology.* 2004 Nov;47(5):649-654.
17. Steinberg RB, Reuben SS, Gardner G. The dose response relationship of ketorolac as a component of intravenous regional anesthesia with lidocaine. *Anesth Analg* 1998; 86:791-3
18. Kamibayashi T, Maze M. Clinical uses of alpha-2-adrenergic agonists. *Anesthesiology* 2000;93:1345-9.
19. Aho MS, Erkola OA, Kallio A et al. Dexmedetomidine infusion for maintenance of anesthesia in patients undergoing abdominal hysterectomy. *Anesth Analg* 1992;75:940-6.
20. Jaakola ML, Ali-Melkkila T, Kanto J, et al. Dexmedetomidine reduces intraocular pressure in intubation responses and anaesthetic requirements in patients undergoing ophthalmic surgery. *Br J Anaesth* 1992;68:570-5.
21. Kalso EA, Poyhia R, Rosenberg PH. Spinal antinociception by dexmedetomidine, a highly selective α2-adrenergic agonist. *Pharmacol T oxicol* 1991;68:140-3.
22. Aho MS, Erkola OA, Scheinin H, et al. Effect of intravenously administered dexmedetomidine on pain after laparoscopic tubal ligation. *Anesth Analg* 1991;73:112-8.
23. Kleinschmidt S, Stöckl W, Wilhelm W, Larsen R. The addition of clonidine to prilocaine for intravenous regional anaesthesia. *Eur J Anaesthesiol* 1997; 14:40-6.
24. Dilek Memis, Alparslan Turan, Beyhan Karamanlıog lu, Zafer Pamukc¸ and Imran Kurt, Adding Dexmedetomidine to Lidocaine for Intravenous regional anesthesia. *Anesth Analg* 2004;98:835-40.
25. A. Esmaoglu, A. Mizrak, A. Akin, Y. Turk, A. Boyaci Addition of dexmedetomidine to lidocaine for intravenous regional anaesthesia. *European Journal of Anaesthesiology* 2005;22 447-451.
26. Kol IO, Ozturk H, Kaygusuz K, Gursoy S, Comert B, Mimaroglu C. Addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anaesthesia for hand or forearm surgery: A randomized controlled study. *Clin Drug Investig.* 2009;29(2):121-9.
27. Lurie SD, Reuben SS, Gibson CS, DeLuca PA, Maciolek HA. Effect of clonidine on upper extremity tourniquet pain in healthy volunteers. *Reg Anesth Pain Med* 2000; 25:502-5.
28. Kamibayashi T, Maze M. Clinical uses of alpha2-adrenergic agonists. *Anesthesiology* 2000;93:1345-1349.

How to cite this article: Abhishek Gupta, Mamta Mahobia, Neeraj Narang, Rekha Mahendra. "A Comparative Study of Two Different Doses of Dexmedetomidine As Adjunct to Lignocaine in Intravenous Regional Anaesthesia of Upper Limb Surgeries". Int J Sci Stud. 2014;2(3):53-62.

Source of Support: Nil, **Conflict of Interest:** None declared.