International Journal of Health Sciences and Research
www.ijhsr.org ISSN: 2249-9571

Original Research Article

To Compare the Effects of Lignocaine versus Lignocaine with Dexmedetomidine in Bier's Block: A Prospective Double Blinded Study

Nitin Purohit[1], Pramod Patil[2], Manish Mishra[1], Sushil Bhadane[3]

[1]Third Year Resident, [2]Prof. & HOD Anaesthesiology, [3]Lecturer;
ACPM Medical College, Dhule, India.

Corresponding Author: Nitin Purohit

Received: 24/01/2015 *Revised: 22/02/2015* *Accepted: 26/02/2015*

ABSTRACT

Background: Dexmedetomidine reduces anaesthetic requirement and have analgesia without respiratory depression. We designed this study to evaluate peri-operative effects of Dexmedetomidine when added to lignocaine in Bier's block.
Materials and Methods: Sixty patients randomly allocated in two groups L and D, receiving 40ml of 0.5 % lignocaine alone and 40 ml 0.5 % lignocaine with 1 ml of 0.5 mcg/kg Dexmedetomidine respectively. During study hemodynamic changes, onset of sensory and motor block, time of tourniquet pain, post-operative analgesic duration and sedation were noted.
Result: Shortened sensory and motor onset time, delayed tourniquet pain, prolonged intra-operative and post- operative analgesic duration with reduced analgesic requirement in D group compared to L group.
Conclusion: We conclude that addition of 0.5 mcg/kg Dexmedetomidine to 40 ml of 0.5% lignocaine in Bier's block improve quality of anaesthesia and peri-operative analgesia without any side effects.

Key words: Lignocaine, Dexmedetomidine, Bier's block, Intravenous regional anaesthesia

INTRODUCTION

God gifted hands for better skillful work with arm and forearm as backbone. In this fast moving world, there is an increase in the number of road traffic accidents and so is the number of patients with upper limb trauma coming for various orthopaedic surgical procedures. Intravenous regional anaesthesia is also called Bier's block. It is named after August Karl Gustav Bier, a German surgeon, who first introduced this technique into clinical practice. [1,2]

IVRA has been limited by tourniquet pain and the inability to provide postoperative analgesia. [3] One of the problems with IVRA, as compared with peripheral nerve blocks, is that there is no prolonged analgesic effect after tourniquet release. To improve the quality of IVRA block, the addition of various opioids to local anaesthetics has been investigated with controversial results. A meta-analysis concluded that opioids lack significant effect. [4]

α-2-Adrenergic receptor (adrenoceptor) agonists have been the focus of interest for their sedative, analgesic, and perioperative sympatholytic and

cardiovascular stabilizing effects with reduced anesthetic requirements. Dexmedetomidine, a potent α-2-adrenoceptor agonist, is approximately 8 times more selective toward the α-2-adrenoceptors than clonidine. Dexmedetomidine has been shown to decrease anaesthetic requirements by up to 90% and to induce analgesia in rats, volunteers, and patients. [5-10]

Since Dexmedetomidine has been introduced in India only in 2009 not many studies have been done in our country regarding its use in IVRA, there is a need to study the effectiveness of Dexmedetomidine in improving the quality of anaesthesia in IVRA and for perioperative analgesia in forearm and hand surgeries. We planned to investigate the sensory and motor block onset, the quality of anesthesia, intraoperative and postoperative hemodynamic variables, intraoperative and postoperative pain, sedation, and the other effects of dexmedetomidine.

MATERIALS AND METHODS

The Prospective randomized double blind study was undertaken at Department of Anaesthesiology Dhule after obtaining ethical committee approval as well as informed, written consent from all the patients.

The study population consisted of sixty patients aged between 20-50 years belonging to ASA class 1 and 2 scheduled for elective upper limb surgeries requiring intravenous regional anaesthesia. Those with allergic reaction to lignocaine, significant cardiovascular disease, psychiatric disease, sickle cell disease were excluded from study. These patients were randomly allocated into two groups with thirty patients in each group.

- Group L (n =30): received 40 ml of 0.5% lignocaine with 1 ml of saline.
- Group D (n =30): received combination 40 ml of 0.5% lignocaine with 1 ml of 0.5mcg/kg Dexmedetomidine.

A thorough preoperative evaluation was done in all the patients on the day before surgery. The patients were graded as per the ASA classification and they were explained about the procedure to ensure good co-operation. An informed written consent was obtained from each patient. As far as possible cases were chosen such that the surgery was expected to get over within the maximum tourniquet time of the upper limb (that is < 90 minutes).

The patients were placed in supine position with due comforts on a tiltable operative table. The intravenous line was secured on the non-operating upper limb with 20 gauge intravenous cannula for infusion of intravenous fluids. The patients were connected to standard monitors that included continuous E.C.G, pulse oximetry, non-invasive blood pressure monitor. The baseline values were recorded. All the necessary equipments and emergency drugs were kept ready for resuscitation, in order to cope with any toxic and untoward reactions occurring during the procedure. All the patients were pre-medicated with inj.ondensetron 0.08mg/kg and inj midazolam 1 mg 20 min before start of procedure.

On the operative hand distal dorsal vein is punctured with 22G and fixed. Exsanguination was done by elevating the limb above body for 2-3 min and by using Esmarch tourniquet starting from tip of finger with taking care of IV cannula. The tourniquet was applied over cotton, wrapped over the site of application, to prevent tourniquet discomfort. The time of application was noted. In the present study, two tourniquets were used. The second pneumatic tourniquet was applied just distal to first tourniquet. The Pneumatic tourniquet

was inflated to100 mmHg above systolic pressure of the patient. The adequacy of vascular occlusion by proximal (first) and distal (second) tourniquet was confirmed by the absence of radial pulsation. Before applying second tourniquet, the local anaesthetic drug was injected to the operating limb through 22 gauge intravenous cannula. The distal Pneumatic tourniquet was applied after the onset of sensory and motor action and roller bandage roll over it to prevent accidental release of tourniquet during intra-operative procedure. After the application of second tourniquet, first tourniquet was released.

The drugs were prepared and left unlabelled by the third person who did not take further part in the study. The bier block was performed by observer who was blinded to the drug in use. Even patients were not informed about the drug in use. So both the patients and observer who recorded the data were blinded to study drug received.

The patient's pulse, systolic and diastolic blood pressure, respiratory rate, oxygen saturation and E.C.G were monitored and recorded at 1st, 3rd, 5th, 10th, 20th, 30th, 40th and 60th minute after injection of the drug and thereafter till the end of the surgery. Patient was counseled regarding tourniquet pain and when patient complains of tourniquet pain inj.Tramadol 100 mg given as rescue analgesia. The patients were monitored for side effects such as nausea, giddiness, diplopia, bradycardia during the intra-operative period.

The time at which the patients were unable to appreciate pinprick after the injection of drug was considered as the time of onset of sensory loss and the time at which the patients were unable to flex or extend his or her finger and appearance of the wrist drop after the injection of drug was considered as the time of onset of motor loss.

Tourniquet was kept for minimum 30 min even if surgery was completed before 30 minute. Tourniquet time was noted. After the operation, the surgeon, who did not know what medication was given, was asked to qualify the operative conditions according to the following numeric scale:

- 0 –unsuccessful,
- 1 - poor,
- 2 - acceptable, and
- 3 - perfect.

All of the operations were per formed by the same surgeon. At the end of operation, the resident who was blinded to drug was asked to qualify the operative conditions according to following numeric scale:

- 4 (excellent) - no complaint from patient,
- 3 (good) - minor complaint with no need for supplemental analgesics,
- 2 (moderate) - complaint that required supplemental analgesics, and
- 1 (unsuccessful) - patient given general anesthesia.

The patients were observed post-operatively for changes in pulse rate, blood pressure (systolic and diastolic), respiratory rate, oxygen saturation, E.C.G and any side effects for 30 minutes after release of second tourniquet (that is at 1st, 3rd, 5th, 10th, 20th, 30th minute). The patient was monitored for postoperative analgesia using VAS at 30th, 1st, 2nd, 3rd, 4th, 5th, 6th up to 12th hour. When VAS >3inj.Diclofenac sodium 75 mg IV given. Time of first analgesic requirement and number of analgesic requirement noted.

Compiled data was analysed using SPSS version 16 statistical software. The Groups were compared according to age

group and gender distribution using non parametric Pearson's Chi- square test. Continuous data was presented as mean and standard deviation. mean age, weight, baseline, intra operative and post-operative hemodynamic parameters at different time intervals, onset of sensory and motor block , analgesia requirement was compared in between the two groups by unpaired t test. The level of significance for accepting the significant difference was selected as 0.05 levels.

RESULT

60 Patients were enrolled in this study, study carried out from April 2013 to September 2014, both the groups were homogenous regarding mean age, weight and gender (p>0.005). In the present study, the mean time of onset of sensory loss was 4.73 ± 0.38 minutes in group D and 6.93 ± 0.86 minutes in group L. In the present study, the mean time of onset of motor block was 4.87 ± 0.79minutes in group D and 8.27 ± 1.07 minutes in group L. The difference between the two groups regarding the mean time of onset of sensory loss and onset of motor block were statistically significant (P< 0.05). There was no statistical difference between groups when compared for MAP, HR, and Spo2, Respiratory rate at any intra- operative and postoperative period.

The following table shows the results obtained in the present study,

	D Group	L Group	P Value
Mean age (in years)	37.73 ± 7.52	40.80 ± 7.54	0.424
Sex distribution (male-female)	19:11	13:17	0.121
Mean weight (kgs)	59.43 ± 5.26	59.27 ± 3.59	0.886
Mean time of onset of sensory loss (minutes)	4.73 ± 0.38	6.93 ± 0.86	0.031
Mean time of onset of motor block (minutes)	4.87 ± 0.79	8.27 ± 1.07	0.001
Time of mean tourniquet pain (minutes)	45.47 ± 3.35	34.63 ± 2.76	<0.001
Intra Operative Consumption of Analgesic	16.70± 37.90	80 ± 40.68	<0.001
Mean Post-Operative Analgesic time	236 ± 36.73	32.50 ± 15.80	<0.001
Post-Operative Consumption of Analgesic	77.50 ± 13.69	110 ± 38.06	<0.001

It was seen that mean tourniquet pain in D group was 45.47 ± 3.35 min compared to L group which was 34.63 ± 2.76 min with p <0.001 and mean difference of 13.67 which was highly statistically significant. The onset of tourniquet pain is significantly delayed in group D compared to group L. Requirement of intra-operative analgesia was significantly less in group D compared to group L.Post-operatively there was a statistically significant difference between groups when compared for VAS scores for postoperative analgesia at 30, 60, 75, 90, 120, 150, 180, 210, 240 and 300 min; there was a statistically highly significant lower VAS in group D compared to group L. Mean duration of post-operative analgesia in group D was 236 ± 36.73 min compared to L group which was 32.50 ± 15.80 which was statistically significant (p<0.001). Similarly post-operatively there was significant reduction in number of patient requiring Diclofenac as analgesic and its consumed amount in Dexmedetomidine group (77.50 ± 13.69 mg) compared to Lignocaine group (110 ± 38.69 mg).(p<0.001).

Intra-operatively quality of anaesthesia was noted with opinion of same surgeon and resident after completion of operation. It was found that Surgeon rated the quality of anaesthesia as perfect in 84% and acceptable in 16%in D group compared to L group in which he rated 60% acceptable and 40% poor. And resident rated the quality of anaesthesia as 70% excellent, 14%good and 16% moderate in D group compared to L group in which he rated 20%

good and 80% moderate. There was statistically very highly significant ($p<0.001$) difference of quality of anaesthesia rated by surgeon and residents for D and L group.

There was no significant difference at any interval regarding sedation intra-operatively and post-operatively. ($p>0.005$) No patient experienced hypotension, bradycardia or hypoxemia.

DISCUSSION

IVRA isolates the arm from the rest of the circulation and is therefore a useful model for studying the peripheral actions of a drug in the absence of central effects. Local anaesthetic agents are known to block impulse conduction by inhibiting voltage gated sodium channels. The advantages of IVRA are high indices of reliability, rapid onset of analgesia within 5-10 minutes and good muscular relaxation. The disadvantage of IVRA is the application of a tourniquet, which must remain inflated continuously throughout the procedure which leads to tourniquet pain. Another drawback with this technique is the absence of postoperative analgesia.

α-2-adrenoceptor agonists have been studied for their sedative, analgesic, cardiovascular stabilizing and perioperative sympatholytic effects with reduced anesthetic requirements. [11] Dexmedetomidine is a potent α-2-adrenoceptor agonist with 8 times higher affinity for the α-2 adrenergic adrenoceptors than clonidine. Dexmedetomidine has been shown to decrease anesthetic requirements by up to 90% to induce analgesia and may cause hemodynamic side effects such as hypotension and bradycardia. [12,13]

In this study we found that mean onset of sensory and motor block time was significantly earlier in Dexmedetomidine group compared to Lignocaine group. Intra-operatively tourniquet pain was statistically delayed and analgesic requirement was significantly reduced in Dexmedetomidine group compared to lignocaine group. Similarly post-operatively VAS score was statistically lower in Dexmedetomidine group. Time to first analgesic requirements was significantly longer in group D in the postoperative period.

In study carried out by Abosedira M.A., [14] it conclude that there was significant reduction in number of patient requiring analgesia and its consumed amount in Dexmedetomidine group (0% and 0 mcg respectively) compared to clonidine (40% and 27 ± 43 mcg respectively)in study comparing Dexmedetomidine and clonidine added to lignocaine in Bier's block. Clonidine induces analgesia mainly through stimulation of α-2-adrenergic receptors in the dorsal horn of the spinal cord.

Gentili and reuben et al. reported that clonidine could decrease the tourniquet pain as an adjuvant drug under IVRA. [15] Nerve fiber action potentials are depressed especially in small, unmyelinated C fibers. [16] Dexmedetomidine produces sedation, analgesia, and anxiolysis [17] and previous animal studies indicate that dexmedetomidine reduces anesthetic and analgesic requirements in dogs [18] and rats. [19] α-2-adrenoceptors located at nerve endings may play a role in the analgesic effect of the drug by preventing norepinephrine release. [20] It was reported that drugs, which stimulate the α-2 adrenoceptors lead to production of analgesia at the spinal cord level [8] those studies reveal that both central and peripheral mechanisms are involved in the increased quality of anesthesia and reduction of analgesic requirements when dexmedetomidine is used.

Acalovschi I et al. concluded that tramadol does not reduce tourniquet or postoperative pain when combined with a

local anaesthetic for IVRA. [21] In the same way the addition of various opioids to local anaesthetic such as fentanyl, sufentanil and morphine have been studied, the results of which are found to be deprived a significant benefit on postoperative analgesia. [22]
Intra-operative quality of anaesthesia was better in dexmedetomidine group compared to Lignocaine group. There was no significant difference at any interval regarding sedation intra-operatively and post-operatively between the groups. Memis et al [23] found that when Dexmedetomidine (0.5mcg/kg) added to lignocaine in biers block improves quality of anaesthesia and peri-operative analgesia, earlier onset of sensory and motor block. Esmaoglu A. et al [24] carried out study using Dexmedetomidine (1mcg/kg) with lignocaine in Bier's block found no difference in onset of sensory and motor block but improves perioperative analgesia and reduced analgesic requirement with delayed onset of tourniquet pain in Dexmedetomidine group. According to Kumar A. et al [25] there was no difference in onset of sensory and motor block but better intra-operative and post-operative analgesia with significantly lower VAS and reduced analgesic requirement. Esmaoglu A. et al [24] and Kumar A. et al [25] found significant difference in post - operative sedation in Dexmedetomidine group. This difference may be due to dose difference between the two studies.

CONCLUSION

We conclude that addition of 0.5 mcg/kg Dexmedetomidine significantly improve quality of anaesthesia and intra-operatively and post –operatively prolonged analgesia with earlier onset of sensory and motor block without any side-effects.

REFERENCES

1. Holmes CM. Intravenous regional analgesia a useful method of producing analgesia of the limbs. Lancet 1963; 1:245-7.
2. Colbern E. C. "The Bier Block for Intravenous Regional Anesthesia: Technic and Literature Review ",anaesth and analgesia …current researches nov-dec 1970;vol 49(6):935-40
3. Johnson CN. Intravenous regional anesthesia: New approaches to old technique. CRNA.2000;11:57–61.
4. Picard PR, Tramer MR, McQuay HJ, Moore RA. Analgesic effi- cacy of peripheral opioids (all except intra-articular): a quanti- tative systemic review of randomised controlled trials. Pain 1997;72:309–18.
5. Kamibayashi T, Maze M. Clinical uses of alpha-2-adrenergic agonists. Anesthesiology 2000;93:1345–9.
6. Aho MS, Erkola OA, Kallio A, et al. Dexmedetomidine infusion for maintenance of anesthesia in patients undergoing abdomi- nal hysterectomy. AnesthAnalg 1992;75:940–6.
7. 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.
8. Kalso EA, Po ¨yhia R, Rosenberg PH. Spinal antinociception by dexmedetomidine, a highly selective 2-adrenergic agonist. PharmacolToxicol 1991;68:140–3.
9. 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.
10. Intravenous ananesthetic, alpha adenorecptor agonist:Millers anaesthesia 7th Ed. Churchill Livingstone. 2010:751-57.
11. Kamibayashi T, Maze M: Clinical uses of alpha-2-adrenergic agonists. *Anesthesiology;* 2000, 93:1345-9.

12. Kalso EA, Pöyhiä R, Rosenberg PH: Spinal antinociception by dexmedetomidine, a highly selective α2-adrenergic agonist. PharmacolToxicol; 1991 Feb; 68(2):140-3.
13. Aho MS, Erkola OA, Scheinin H, Lehtinen AM, Korttila KT:Effect of intravenously administered dexmedetomidine on pain after laparoscopic tubal ligation. Anesth Analg; 1991 Aug; 73(2):112-8.
14. AbosediraM.A."Adding clonidine or Dexmedetomidine to lignocaine in Bier's block: a comparative study.", J.Med.Sci;1st nov 2008:8(7):660-4.
15. Reuben SS, Klatt ML, Klatt JL, et al: Intravenous regional anesthesia with lidocaine and clonidine. Anesthesiology; 1998, 89:857.
16. Gaumann DM, Brunet PC, Jirounek P: Clonidine enhances the effects of lidocaine on C-fiber action potential. AnesthAnalg; 1992, 74:719-25.
17. Bhana N, Goa KL, McClellan KJ: Dexmedetomidine. Drugs; 2000, 59:263-68.
18. Salmenpera MT, Szlam F, Hug Jr CC: Anesthetic and hemodynamic interactions of dexmedetomidine and fentanyl in dogs. Anesthesiology; 1994, 80:837-46.
19. Rabin BC, Reid K, Guo TZ, Gustafsson E, Zhang C, Maze M:Sympatholytic and minimum anesthetic concentration-sparing responses are preserved in rats rendered tolerant to the hypnotic and analgesic action of dexmedetomidine, a selective alpha (2)-adrenergic agonist. Anesthesiology; 1996, 85:565-73.
20. Sato J, Perl ER: Adrenergic excitation of cutaneous pain receptors induced by peripheral nerve injury. Science; 1991, 251:1608-10.
21. Acalovschi I, Cristea T, Margarit S, Gavrus R: Tramadol added to lidocaine for intravenous regional anesthesia. AnesthAnalg; 2001, 92:209-14.
22. Choyce A, Peng P: A systematic review of adjuncts for intravenous regional anesthesia for surgical procedures. Can J Anaest; 2002, 49:32-45.
23. Memis D, Turan A, Karamanlıog˘lu .B, Pamukc¸.Z, Kurt I, "Adding Dexmedetomidine to Lidocaine for Intravenous Regional Anesthesia"; AnesthAnalg 2004;98:835–40.
24. Esmaoglu.A, MizrakA, Akin.A, Turk.Y, Boyaci.A,"Addition of dexmedetomidine to lidocaine for intravenous regional anaesthesia" European Journal of Anaesthesiology 2005; 22: 447–451.
25. Kumar A, Sharma DK, Datta B, "Addition of ketamine or dexmedetomidine to lignocaine in intravenous regional anesthesia: A randomized controlled study."J Anaesthclinpharma 2012;28(4):501-4.

How to cite this article: Purohit N, Patil P, Mishra M et. al. To compare the effects of lignocaine versus lignocaine with dexmedetomidine in bier's block: a prospective double blinded study. Int J Health Sci Res. 2015; 5(3):75-81.

****