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Original Research Article

Tramadol Added to Lidocaine for Intravenous Regional Anaesthesia

Nichelle M. Saldanha[1], K. Harshavardhan[2]

[1]Junior Resident, [2]Assistant Professor,
Department of Anaesthesiology, Father Muller Medical College, Kankanady, Mangalore-575002, India.

Corresponding Author: Nichelle M. Saldanha

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ABSTRACT

Introduction: Tramadol is a centrally acting analgesic with both an opioid and non opioid mode of action. Recent studies suggest that tramadol might have a specific effect on peripheral nerves when added to a local anaesthetic. The present study was designed to evaluate adjunct properties of tramadol for intravenous regional anaesthesia (IVRA).
Methods: After institutional approval and informed consent, 100 ASA 1 and 2 volunteers, were taken into study. In first group (Group L) of 50 , the patients were randomly allocated to receive IVRA for upper limb with 40ml of 0.5% lidocaine; in the second group of 50 (group LT) patients randomly received IVRA of upper limb with 40ml of 0.5% lidocaine with 100mg tramadol. The onset and recovery of sensory block were tested in six sites of the forearm and hand, determined by pin prick touch and cold. The cuff was released after 45 minutes. The onset of complete motor block was also assessed and any symptoms after cuff deflation were recorded. Standard hemodynamic monitoring was used; two groups were compared statistically and Z test was used for data analyses; a p value <0.05 was considered significant.
Result: The speed of onset of sensory block, was higher in group LT and in L group ($p < 0.001$) but recovery of touch sensation was slower in group LT than in group L ($p<0.001$); these were no significant differences in the recovery of cold and pinprick sensations between two groups. All patients in L and LT groups developed complete motor block within 20 minutes without any significant difference regarding the onset time. They were a few incidences of rash and pain/burn sensation at injection site in LT group.
Conclusion: The present study suggests that tramadol might significantly modify the action of local anaesthetic providing a shorter onset time but not a prolongation of sensory block.

Key words: IVRA: Intravenous regional anaesthesia. Local anaesthetic: lignocaine hydrochloride: opioid: tramadol hydrochloride.

INTRODUCTION

Intravenous regional analgesia (IVRA) was introduced into clinical practice by August Bier in 1908 but was forgotten for nearly half a century until it was revived by Holmes in Great Britain in 1963. Since then it became widely popular and numerous reports from all over the world have appeared testifying to its efficacy in properly selected cases. The factors to be considered while performing this technique are possible reaction to the agents used and the

anticipated length of procedure. Since the analgesia is dependent upon the uninterrupted presence of the tourniquet, it provides satisfactory analgesia for most surgical procedures on distal parts of the limbs [1] (below the tourniquet).

This form of analgesia is ideally suited for emergencies, where patient is with full stomach or suffering from other diseases that contraindicates general anaesthesia, moreover the feasibility and simplicity of execution of this method, its effectiveness and its lack of any side effects have been gratifying. The equipment needed is minimal. It can be performed in a casualty department (with necessary resuscitation equipment handy), minor operation theatre. IVRA is particularly suitable day care surgeries as it requires minimal preparation and pre medication. [2]

The perfusion block is suitable for distal limb surgeries like manipulative reduction and dislocations of bones of forearm/leg, amputations, wound debridement, tendon repair, foreign body removal, open reductions of fracture of forearm, ganglion excision, decompression in De Quervain's disease etc.

Since opioids such as meperidine and fentanyl have local anaesthetic properties in vitro, several authors investigated the addition of various opioids to local anaesthetic solutions for IVRA. [3]

Tramadol is a weak opioid selective for μ receptors. A dose of 100mg tramadol added to 40ml of 1% mepivacaine improved the quality of brachial plexus blockade in patients scheduled for surgery of the forearm and hand.

The present study was designed to evaluate the quality and onset of IVRA with 100mg tramadol added to 40 ml of 0.5% lidocaine.

Objectives:

To compare the onset and quality of intravenous regional anaesthesia produced by mixture of lidocaine and tramadol with lidocaine alone for upper limb procedures.

MATERIALS AND METHODS

The present study was designed to evaluate the quality and onset of intravenous regional anaesthesia in the upper limb with tramadol added to lignocaine.

Detailed history was taken and complete clinical examination was done to exclude patients with history of epilepsy, hypersensitivity to local anesthetics, neurological, cardiac and hemolytic diseases. Routine investigations like blood grouping, hemoglobin %, blood urea and blood sugar were done. E.C.G. whenever indicated was undertaken to rule out the presence of any cardiac disease. Pre-operative temperature, pulse rate, respiratory rate, blood pressure and condition of heart and lungs noted. Patient's weight was recorded.

Written and informed consent was taken prior to scheduled operation. Patients were explained about the procedure of intravenous regional anesthesia to gain co-operation.

Patients with grossly edematous and inflamed limbs excluded from the study.

The study comprised of 100 patients belonging to both sex and range between ages 15 to 60 years. All the patients belonged to ASA (American Society of Anaesthesiologists) Grade I or II.

Patients were divided into two groups. Group LT patients underwent I.V.R.A. with solution containing lignocaine 0.5% and tramadol 0.25%. Group L patients underwent I.V.R.A. with solution containing only lignocaine 0.5%.

The following equipments and drugs were kept ready before proceeding with technique.

Equipment:

- Boyle's apparatus with full oxygen cylinders.

- Laryngoscope
- Airways
- Endotracheal tubes appropriate to the patient
- Suction apparatus
- Intravenous cannulae – 22G and 18G one each
- 10ml syringes
- Stainless steel cylinders
- Cotton roll
- Esmarch bandages (4 inch)
- Pneumatic tourniquets
- 24 G IM needles
- Test tubes

Drugs for resuscitation:

- Atropine ampoules
- Adrenaline ampoules
- Thiopentone vial
- Suxamethonium vial

Drugs for I.V.R.A.:

- Lignocaine 2% vial
- Tramadol 50mg per ml ampoules

Technique:

A 18G intravenous cannula was inserted into a vein on one of the non operated limb for the purpose of administering fluids or drugs.

Premedication:

Midazolam 0.02mg/kg body weight was given.

Cannulation for I.V.R.A. :

22G intravenous cannula was introduced into suitable vein on dorsum of hand that was to be operated as distally as possible and firmly secured.

Tourniquet:

Cotton padding was placed on the proximal part of the limb to be operated. Double tourniquets setup connected to pneumatic pressure gauge was placed over it. The occlusion pressure i.e. the pressure at which pulse disappears was noted for each tourniquet.

Exanguination the extremity:

The arm to be operated was elevated to 90˚ angle from the body above the level of heart for 5 minutes to drain the blood from the limb. Esmarch bandage was wrapped tightly around the arm from the most distal part to near the pneumatic tourniquet to further exangunate. The proximal cuff inflated to 100 mm Hg higher than the occlusion pressure and esmarch bandage removed.

Injecting the anaesthetic solution:

The limb was placed horizontally and local anesthetic was injected steadily (2ml per second).

Group LT patients received 40ml of solution containing

Lignocaine 0.5% and tramadol 0.25%.

Group L patients 40ml of solution containing only lignocaine 0.5%.

After injection IV cannula was removed and pressure was applied to venipuncture site for sometime till bleeding stops:

Monitoring: The following parameters were observed and recorded continually throughout the surgical procedure.

- Pulse rate
- Blood pressure
- Respiratory rate
- Level of consciousness

The following parameters were noted

- Tourniquet time
- Grade of analgesia
- Complications arising intra operatively or post operatively

Assessment of block:

Six areas supplied by radial, median, ulnar nerves tested in sequences as shown in figure 1, with the patient unable to observe testing. At 90 second intervals after administration (considered as time zero), the sensory as pinprick, touch or absent. Cold sensation was assessed using a cube of ice placed in sterile test tubes. Motor function

was assessed by asking the subject to flex and extend his wrist and fingers.

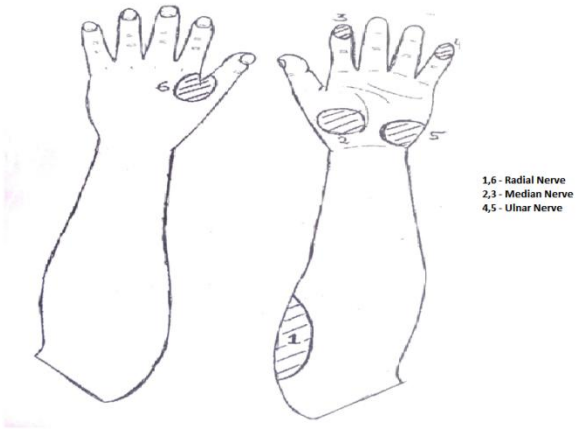

Figure 1: Areas to be assessed for sensory impairment.

Complete motor block was considered when no voluntary movement was possible.

Tourniquet pain:

Sometime after proximal tourniquet inflation discomfort from tourniquet becomes bothersome. Then distal cuff was inflated to 100 mm Hg higher than the occlusion pressure and proximal cuff was deflated.

Tourniquet release:

The tourniquet was deflated for 15seconds and then re-inflated for 2 minutes and the cycle was repeated three times before the cuff was let down permanently.

Monitoring after tourniquet release:

The patients were monitored for any change in pulse rate, blood pressure, loss of consciousness and for any signs of systemic toxicity like twitching, convulsions and E.C.G. abnormalities.

Sensory assessment was continued at similar intervals until full recovery occurred at all six sites.

Grading of analgesia was performed as per Table 1.

Onset of sensory block was assessed by noting the time periods at which loss of pinprick sensation, cold sensation and touch sensation occurred at all six sites selected. Motor block was assessed by noting the time period at which patient was unable to move fingers. Onset of proximal tourniquet pain was also noted.

Recovery of sensory block was assessed by noting the time period at which pinprick, cold and touch sensation was appreciated at all 6 sites. Recovery of motor block was assessed by noting the time period at which patient was able to move fingers.

Table 1: Grading of analgesia: Method adopted was one given by R.J.Ware (1979)

GRADE	DESCRIPTION
I (Excellent)	Complete analgesia and motor loss as evidenced by inability to move fingers.
II (Good)	Complete analgesia but no motor paralysis. (Patients able to move fingers).
III (Fair)	Loss of pain sensation but discomfort to deep pressure still present.
IV (Partial)	Only partial and patchy analgesia, requiring supplementation .
V (Poor)	No analgesia at all, requiring general anaesthesia.

RESULTS

Table 2: Distribution of age, sex and weight

	Group L		Group LT	
	Mean	SD	Mean	SD
Age	32.35	11.89	33.35	12.86
Sex	1.70	0.502	1.70	0.502
Weight	63.35	10.965	64.00	10.31

Table 3: Z test was used for data analyses

	Group L		Group LT	
	Mean	SD	Mean	SD
Loss of pinprick sensation	13.00	3.02	6.98	2.99
Recovery of pinprick sensation	10.03	1.81	9.24	2.268
Loss of cold sensation	6.46	2.29	3.972	1.97
Recovery of cold sensation	11.25	2.35	10.68	2.42
Loss of touch sensation	16.47	2.32	9.00	3.38
Recovery of touch sensation	5.33	2.14	11.61	5.20
Motor block onset	15.20	2.16	14.30	3.11
Recovery of motor block	5.01	0.89	4.80	1.13
Onset of proximal tourniquet pain	15.13	5.19	15.00	5.05

Age, Sex and weight distribution in both groups is comparable (P value >0.005). Loss of pinprick, cold and touch sensation occurred earlier in group LT (P value

<0.001). Recovery of pinprick and cold sensation occurred at similar intervals in both groups. Touch sensation recovery occurred a little later in group LT (P value <0.005).

Onset of tourniquet pain, onset and recovery of motor block occurred at similar intervals in both groups.

Skin rash occurred in 10 of 50 patients in group LT which relieved spontaneously.

DISCUSSION

Intravenous regional anaesthesia is a simple, cheap and safe technique for surgery over extremities especially for upper limbs.

Recent studies have shown that tramadol has local anaesthetic effect. Pang and co-workers were able to induce a sensory block to pin prick, touch and cold at the intradermal injection of 5% tramadol similar to 1% lidocaine. The suggested action of tramadol was excluded because of the small doses used (25mg). [4] It was also demonstrated that IV retention of 50mg of tramadol for 1 minute significantly reduced pain associated with injection of protocol by the same route. [5] As the study used a modified IVRA technique local action of tramadol on endovenous sensory nerve endings was suggested.

By using IVRA, the present study eliminates any central effect of tramadol that may interfere with peripheral action. The present study was designed to evaluate the quality and onset of IVRA with tramadol added to 0.5% lidocaine by comparing with only 0.5% lidocaine.

The present study was conducted on 100 patients undergoing various upper limb procedures. The patients were randomly allotted to two groups, Group L and Group LT. Group L patients underwent IVRA with combination of tramadol 0.25% and 0.5% lidocaine.

In our study, the addition of 100mg tramadol to 0.5% lidocaine for IVRA was effective.

The speed of onset of sensory block was faster in group LT than in group L and recovery of touch sensation was prolonged in LT group. The lack of effect on motor block could be explained by small concentration of tramadol.

The present study confirms the time course of differential sensory blockade. During IVRA, with cold sensation decreasing faster than the pinprick and touch sensation being most resistant to blockade. The addition of tramadol to lidocaine intensified the differential effect, mainly for touch sensation. In comparison with the effect on pinprick and cold sensation, addition of tramadol produced a more pronounced increase in the speed of onset of blockade of touch sensation and only recovery of touch sensation was prolonged.

The precise mechanism by which tramadol exerts its anaesthetic effect is unknown. Tramadol is structurally related to codeine and its selectivity for μ receptors. However a possible interaction of tramadol with peripheral opioid receptors in IVRA is less probable, as was proved by study conducted by Acalovaschi et al. In their study there was no difference between the sensory block induced by tramadol and isolated ischemia. [6] The lack of effect after the addition of fentanyl to local anaesthetic for IVRA represents another argument for the absence of peripheral opioid mediated mechanism in such circumstances. [7]

Besides its opioid action, tramadol also has action on monoaminergic system. Tramadol has dual mechanism of action, unlike traditional morphine-like analgesics, it also has the ability to block the reuptake of norepinephrine and 5- hydroxy tryptamine at the α-2 adrenergic receptor level. The pretreatment with α-adrenergic antagonist like yohimbine results in

significant reduction of tramadol antinociceptive effect. The result is that Tramadol has a profile of action similar to that of clonidine which inhibits release of norepinephrine from pre-junctional α-2 adrenoceptors in the periphery.

Selection of patient:

In a study by Dr. Goel Sunitha N et al the patients were taken for upper limb surgeries after confirming adequate starvation, physical findings and basic investigations. [8]

In our study, patients were taken after adequate starvation, physical findings and basic investgation. Also, few patients with full stomach and were not fit for general anaesthesia temporarily coming for emergency upper limb surgeries were included in our study.

Sex:

Dr. Goel Sunitha. N et al had male to female ratio 14:6 in Tramadol group and 18:2 in control group (saline). [8]

In our study there were 18 females and 32 males.

Exsanguinations:

John Mabee et al showed that while Esmarch was most effective exsanguination method, arm elevation or arterial compression also were effective. [9] In our study, first gravitational drainage was done followed by Esmarch bandage application.

Dose :

Alayurt S et al : 35ml of 0.5% lidocaine and used 5ml saline or Sufentanil 25µg or tramadol 100mg or clonidine 1µg/kg as adjunct. [10]

Goel Sunitha et al : 40ml of 0.5% lidocaine + saline 1ml; 40ml of 0.5% lidocaine + tramadol 50mg. [8]

Acalvoschi et al : 40ml of 0.9% Saline; 0.25% tramadol; 40ml of 0.5% lidocaine; 40ml of 0.5% lidocaine with 100mg tramadol. [11]

Tan S.M et al: 50mg of tramadol with 0.5% of 30ml lidocaine; 30ml of lidocaine with 1ml saline. [12]

In our study group LT received 40ml of 0.5% lidocaine with 100mg tramadol and group L received 40ml of 0.5% lidocaine.

Operating time:

In our study, because of fixity of injection release interval to 40 minutes, the surgery duration was less than 45minutes.

Effect of analgesia:

Thorn-Alquist reported satisfactory analgesia in 99% of 967 patients. [13] Acalovschi found good analgesia in his study. [11] In Goel Sunitha N. et all too found good analgesia in their study. [8]

In our study in both groups, the analgesia was excellent.

Toxicity reactions:

The complications of IVRA usually are caused by the systemic toxicity of the agent used.

Brown and co-workers in their 20 years experiences described IVRA without mortality and morbidity. [14]

In one series of 1400 patients only 8 patients had CNS stimulation sufficient to require CNS administration of barbiturate and only three of these had frank convulsions. [15]

Dunbar and Mazze found no arrythmias and only a slight drop in blood pressure or slight bradycardia on release of tourniquet. [16]

Kennedy and co-workers in their 77 patients found a 15% incidence of ECG changes, mostly of a minor nature but recorded one cardiac arrest, that was preceded by bradycardia. They felt that smaller the dose and greater the injection-release interval the chances of toxic reactions were rare. [17]

Acalovschi found skin rash below the tourniquet that disappeared within one hour of deflation was the only significant side effect when tramadol was added to lignocaine. [11]

In our study, the observed changes in pulse rate were not severe enough to label them as either bradycardia or tachycardia. Mild transient giddiness occurred in patients in both groups. Skin rashes or pain/burn sensation at injection rate was observed in 10 patients of Group LT.

Blood levels:

Mazze and co-workers reported a blood level of 1.5µg/ml following 3mg/kg of 0.5% lidocaine. [18]

Hargrove and co-worker found that maximum levels of anaesthetic in venous blood from other arm did not exceed 2µg/ml. [19]

In our study we could not estimate blood levels due to lack of facilities.

Complications related to the use of tourniquet:

A study reviewed an estimated 6,30,000 tourniquet application found an incidence of peripheral nerve damage of 1:80,000. The incidence was higher in procedures involving the upper limb than in those involving the lower limb. The tourniquet time varied from 20 minutes to 2 ½ hours. [20]

Gregoire Longlois and co-workers found that the addition of tramadol did not reduce tourniquet pain and post operative pain during IVRA. [21]

In our study, there were no complications related to the use of tourniquet. It was also found that addition of tramadol did not reduce tourniquet pain during IVRA.

CONCLUSION

In conclusion, the present study suggested that tramadol will modify the action of local anaesthetic, providing a shorter onset time of sensory block in I.V.R.A. The disadvantage with use of tramadol as an adjunct to lidocaine in I.V.R.A. is occurrence of rash in some patients.

REFERENCES

1. Cousins, Bridenbough. *Neural blockade in clinical anaesthesia and management of pain.* 3rd edition Lippincott Raven; Philedelphia 1998
2. Miller.D.R. Anaesthesia 6th edition volume 2 Churchill Livingstone Philedelphia 2005
3. Choyce et al. A systematic review of adjuncts for intravenous regional anaesthesia for surgical procedures. *Can J Anesth* 2002;49(1): 32-45
4. Pang et al. *Local anaesthetic effect of tramadol, metoclopramide, and lidocaine following intradermal injection*. Reg Anesth Pain Med 1998; 23(6): 580-583
5. Pang WW, Chang DP, Huang MH. *The peripheral analgesic effect of tramadol in reducing propofol injection pain; a comparison with lidocaine.* Reg Anesth Pain med 1999; 24(3): 246-249.
6. Sztark et al. *The use of 0.25% lidocaine with fentanyl and pancuronium for intravenous regional anaesthesia*. Anesth Analg 1997; 84(4): 777-779.
7. Reuben et al. A dose response study of intravenous regional anesthesia and meperidine. Anesth Analg 1999; 88(4): 831-835
8. Dr. Goel Sunitha N, Dr. Daftary Swati R, Pantavaidya Shanti. H.*Intravenous regional anaesthesia using Tramadol hydrochloride and Ketorolac; A Double blind controlled study*. Indian J. Anaesth 2002; 46(5): 369-372.
9. Mabee J, Orlinsky M. *A volumetric comparison and venous pressure study.* Academic emergency Medicine 2000; 7(2): 105-113.
10. Alayurt S, Memis D, Pamukcu Z. *The addition of sufentanil, tramadol or clonidine to lignocaine for*

intravenous regional anaesthesia. Anaesth Intensive Care. 2004; 32(1): 22-27
11. Acalovschi et al. *Tramadol added to lidocaine for intravenous regional anaesthesia*. Anesth Analg 2001; 92(1): 209-214
12. Tan SM, Pay LL, Chan ST. *Intravenous regional anaesthesia using lignocaine and tramadol*. Ann Acad Med Singapore 2001; 30: 516-519.
13. Thorn- Alquist. A.M. *Intravenous regional anaesthesia*. Acta Anesthesiol Scand; 1971; 16:23.
14. Brown, SM, Mcgriff J.T. *Malinowski R.W. Intravenous regional anaesthesia (Bier block); review of 20 years experience.* Can J. Anaesth 1971;11 : 301
15. Van Mierkerk JP, and Tonkin PA. *Intravenous regional anaesthesia*. S.Afr, Med J, 1966;40:165
16. Dunbar R.W.Mazze R.P. *Intravenous regional anaesthesia*. Anaesth Analg 1967;46:806
17. Kennedy, Duthie AM, Parbrook GD, Carr T.L. *Intravenous regional anaesthesia*; An appraisal Br. MedJ 1965; 1:954
18. Mazze R.L, Dunbar RW. *Plasma lidocaine concentration after caudal, lumbar, epidural axillary and intravenous regional analgesia*. Anaesthesiology 1966; 27:574
19. 19.Hargrove R.C, Hoyle J.R., Parker J.B. *Blood lidocaine level following intravenous regional anaesthesia.* Anaesthesia 1966;26:37
20. Middleton R.W.D. Varian J.P. *Tourniquet paralysis*. Aust. N.Z.J. surg 1974;44:124
21. Gregoire Langlois, Jean Pierre Estebe, Marc E, Gentili, Loik Kerdiles, Phillip Mouilleron and Claude Ecoffey. *The addition of Tramadol to Lidocaine does not reduce Tourniquet and post operative pain during intravenous regional anaesthesia.* Can J. Anaesth 2002; 49:32-45.

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