ORIGINAL ARTICLE

COMPARISON OF 0.5% LIGNOCAINE VS 0.5% LIGNOCAINE PLUS 0.25% TRAMADOL IN INTRAVENOUS REGIONAL ANAESTHESIA

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ABSTRACT

Objective: To compare the quality, onset and duration of intravenous regional anaesthesia (IVRA) with 0.5% lignocaine plus tramadol and 0.5% lignocaine alone.

Type of Study: A comparative, double blind, randomized, prospective study.

Place & Time of Study: Orthopaedic operating rooms, Nishtar Medical Institution, Multan, Pakistan, from June 2005 to June 2006.

Patients and Method: In our of 60 adult ASA class I and II patients undergoing upper limb surgeries in patients were divided in two groups having 30 patients in each. We used tramadol, a weak opioid as a component of IVRA with lignocaine to suppress intra-operative pain and enhance postoperative analgesia. Patients received IVRA with 40ml of 0.5% lignocaine to which either 100mg tramadol or saline was added. The onset of anaesthesia and recovery was compared by loss and regain of sensations.

Results: Tramadol with lignocaine was found to be significantly better for rapid onset and quality of anaesthesia compared to lignocaine alone and devoid of opioid related side effects.

Conclusion: We conclude that tramadol as a component of IVRA is significantly better adjunct to lignocaine.

KEYWORDS: IVRA; Tramadol; Lignocaine.

INTRODUCTION:

The International Association for the Study of Pain (IASP) has defined Pain as unpleasant sensory and emotional experience associated with actual or potential tissue damage. So it can be understood that there is an inter play between the objective, physiologic sensory aspects of pain and its subjective, emotional and psychological components.[1] Painful stimulus produced by a surgical incision can lead to a hyper excitable state which is the major cause of post operative pain.

The scope and necessity of day care surgery is increasing day by day. Day Care Surgical Units provide services to the patients whose hospital stay is expected to be less than 24 hours.[2] In these units, intravenous regional anaesthesia is one of the safest and most reliable form of anaesthesia for short surgical procedures on the upper extremity.[3,4] However its use has been limited by tourniquet pain and inability to provide post operative analgesia.[5] It has been associated with a more favorable recovery and patients require less analgesia and anti emetics during recovery as compared with general anaesthesia. It also requires less nursing care in post anaesthesia care unit and promotes expedited discharge from the hospital.[6]

Intravenous regional anaesthesia was first described in 1908 for anaesthesia of the hand and forearm surgeries. The earliest agent injected into the isolated vascular space was procaine. In 1960's Holmes used lignocaine. Lignocaine remains the

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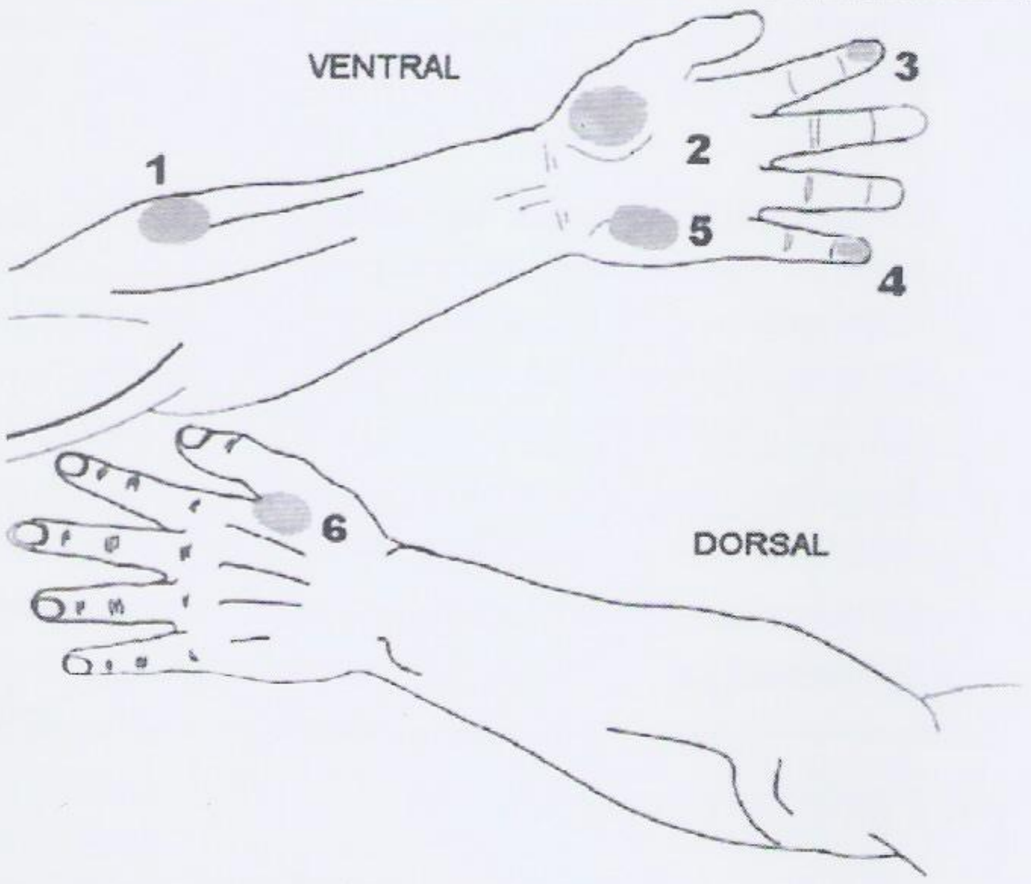
standard local anaesthetic agent for intravenous regional anaesthesia in our setting but prilocaine is preferred in Europe.[7]

An ideal intra venous regional anaesthetic solution should have rapid onset, reduced dose of local anaesthetic and prolonged analgesia. At present, this may only be achieved by addition of various adjuncts to local anaesthetics like morphine, fentanyl, clonidine[8], tramadol and non steroidal anti inflammatory drugs like ketorolac.[9] Tramadol is a weak opioid, selective for the mu receptors [10]. Recent studies suggest that tramadol may have specific local anesthetic properties on peripheral nerves when used alone [11]. A dose of 100 mg tramadol added to 40 ml 1% mepivacaine has been shown to improve the quality of the brachial plexus blockade in patients scheduled for surgery of the forearm and hand [12]. On the basis of these results, we hypothesized that the same dose of 100 mg tramadol would be efficient for IVRA. The present study was designed to compare the quality, onset and duration of IVRA using tramadol plus 0.5% lignocaine with 0.5% lignocaine alone.

PATIENTS AND METHODS

Sixty ASA physical status I and II patients, aged 2140 years from both genders, selected for surgery under IVRA were included in this study. The study protocol was approved by the medical ethics committee of the institution, and informed consent was obtained from all patients. None of them had experienced allergy to tramadol or local anesthetics. To evaluate the adjuvant effect of tramadol added to a local anesthetic, the 30 patients were allocated to two study groups. Before establishing the anesthetic block, two cannulae were inserted, one in a vein on the dorsum of the selected hand (the same site in all patients) and the other in the opposite hand, to assure an IV route. The arm was exsanguinated by using an esmarch bandage, and then a pneumatic tourniquet, placed around the upper arm, was inflated to 250 mm Hg. After the bandage was removed, 40 ml of solution was injected over 60 seconds. Patients received 40 ml of either 0.5% lignocaine (Group L) or a mixture of 0.5% lignocaine and 0.25% tramadol (Group TL). The lignocaine-tramadol solution consisted of 100 mg tramadol in 0.5% lignocaine. The solutions were administered in a double-blinded, randomized fashion by using an envelope system. At 90 sec interval after administration (considered as time zero), the sensory block was assessed by using a 22-gauge, short beveled needle. The subject reported verbally the sensation as pinprick, touch, or none. Temperature sensations were assessed by using a cube of ice. Six areas supplied by the ulnar, radial, and median nerves (Figure I) were tested in a random sequence with the subject unable to observe the testing. The performance of testing required approximately the same duration of time in all cases. At the same time the motor function was assessed by asking the subject to flex and extend his wrist and fingers and complete motor block was noted when no voluntary movement was possible. The tourniquet was deflated after a 22.5-min, necessary for 15 measurements, and the sensory assessment continued at similar time intervals until full recovery had occurred at all six sites. The rate of onset and the extent of loss of pinprick, touch and temperature

Figure I: Sites tested with pinprick, blunt, and cold stimulus:



1) Forearm (radial nerve);
2) Thenar eminence (median nerve);
3) Index finger (median nerve);
4) Little finger (ulnar nerve);
5) Hypothenar eminence (ulnar nerve);
6) First webspace (radial nerve).

sensations were compared in each of the two groups. To analyze the statistical data and the onset of complete motor block, Student's t-test was applied. The comparative incidence of side effects was determined by the chi-square test. A p-value of < 0.05 was considered statistically significant.

RESULTS

The differences with regard to age, gender and weight of patients of both TL and L group made no considerable impact over the outcome.

Table I. Onset of Sensory Block (Time in seconds)

Sensation tested	Group L Mean (SD)	Group TL Mean (SD)	P value
Pinprick	122.5 (8.9)	114.4 (7.4)	$P < 0.05$
Temperature	126.5 (5.9)	121.2 (4.9)	$P < 0.05$
Touch	112.4 (15.5)	89.1 (11.9)	$P < 0.001$

SD: Standard deviation

Table II. Recovery from Sensory and Motor Block (Time in minutes)

Sensation tested	Group L Mean (SD)	Group TL Mean (SD)	P value
Temperature	34.5 (13.9)	40.9 (8.9)	> 0.05
Pinprick	25.8 (9.1)	29.4 (7.2)	> 0.05
Touch	11.6 (5.5)	19.5 (6.7)	< 0.05

SD: Standard deviation

Table III. Side effects in both groups (No. of patients)

Side effects	Group L	Group TL	P value
Skin rash below the tourniquet level	1	9	$P < 0.01$
Painful or burning sensation at the inj. site	1	2	$P > 0.05$
Nausea and vomiting	1	1	$P > 0.05$

Group L = Lignocaine
Group TL = Tramadol + Lignocaine

Groups L and TL comparison demonstrated statistically significant differences between the two groups for the onset of each type of sensory block (Table I). The speed of onset and the overall degree of blockade to pinprick, temperature and touch were noted to be rapid in the Group TL than in the Group L ($P < 0.05$, $P < 0.001$), suggesting a possible adjuvant effect of tramadol added to the local anesthetic. The difference in speed of total recovery of the sensory block was not statistically significant between the two groups when considering the pinprick and temperature sensations ($P > 0.05$). With regard to the touch sensation, the speed of total recovery was faster in Group L than in Group TL ($P < 0.05$) (Table II). In each group, the temperature sensation was blocked faster than the pinprick sensation whereas the touch sensation was most resistant to blockade. Recovery of sensation occurred in reverse order; touch returned first and temperature last. All subjects from Groups L and TL developed a complete motor block within 22.5 min: at 14.5 ± 2.5 min in Group L and at 11.8 ± 3.9 min in group TL; no significant difference was recorded between groups ($P > 0.05$).

Side effects were noted in both groups with a significantly increased incidence of skin rash below the tourniquet level in Group TL (9 patients) when compared with Group L (0 patient) ($P < 0.01$). Three patients in Group TL versus two patients in Group L complained of painful or burning sensation at the injection site witch was not significant. ($P > 0.05$) Complaints of nausea and vomiting were also not significant in both groups. ($P > 0.05$) (Table III) All complaints subsided spontaneously during a 1 h follow-up period. There were no changes in the respiratory rate in either group after the tourniquet release, and the variations of blood pressure did not exceed 20% of basal values.

DISCUSSION

Recent studies have shown a local anesthetic action of tramadol. Pang et al.[13] were able to induce a sensory block to pinprick, touch and temperature after the intradermic injection site of 5% tramadol similar to that of 1% lignocaine. The suggested site of action of tramadol was the nerve endings and a possible associated central effect of tramadol was excluded because of the small doses used (25 mg).

The same authors demonstrated that IV retention of 3 ml of 1.66% tramadol for 3 minutes significantly reduced the local pain associated with injection of propofol by the same route.[11] The existing data suggest an effect on peripheral nerve endings when larger concentrations are used. The use of large concentrations of tramadol for IVRA, without exceeding the safe dose, is limited by the small volume of solution that could be injected. Use of 40 ml 1.66% solution for instance, results in the IV administration of 664 mg tramadol, a dose that is exceedingly large. However, the 0.25% tramadol was effective for prolongation of axillary brachial plexus blockade when 100 mg tramadol was mixed with 40 ml 1% mepivacaine [12]. The duration of both sensory block to pinprick and motor block was significantly longer when tramadol was added to mepivacaine. In our study, the addition of 100 mg tramadol to 0.5% lignocaine for IVRA was also effective. The speed of onset of sensory block was faster in Group TL than in Group L and the recovery of touch sensation was prolonged in the TL group. The lack of effect on motor block could be explained by the small concentration of tramadol solution.

A study regarding the site of action of IVRA using lignocaine showed that in small concentrations, Lignocaine acts on the sensory nerve endings and small nerves, whereas a larger concentration of lignocaine was needed for the nerve trunks[14]. Accordingly, 0.25% tramadol solution could be inadequate to modify the blockage of the motor fibers responsible for flexion and extension of the wrist and fingers. However, Kapral et al.[12] obtained a prolongation of the motor blockade of the brachial plexus with the same concentration of tramadol added to mepivacaine. It is difficult to reconcile the contradictory results obtained with 0.25% tramadol in IVRA and in brachial plexus block. The discrepancy could be explained by the different mechanisms of blockade of the brachial plexus and of the peripheral nerves during IVRA. While at the brachial plexus, the whole anesthetic solution penetrates the large mixed nerves; in IVRA, the initial effect is a direct block of nerve endings near the injection site, followed later by a profound block of main nerve trunks [15]. The non uniform anatomy of the peripheral nervous system also provides a basis for differential sensory and motor blockade. Different types of fibers have a varying susceptibility to blockade in vivo. Although contradictory, the findings of both studies suggest that 0.25% tramadol may improve the local anesthetic blockade of peripheral nerves. The present study confirms the time course of differential sensory blockade during IVRA with temperature sensation wearing off faster than the pinprick and the touch sensation being the most resistant to blockade; the addition of tramadol to lignocaine intensified the differential effect, mainly for touch sensation. In comparison with the effect on pinprick and temperature sensation, addition of tramadol produced a more pronounced increase in the speed of onset of touch blockade and only the touch blockade was prolonged during recovery. The difference in the speed of onset appears mainly for touch sensation, which is also the only sensation significantly prolonged during recovery. That represents an interesting fact, as this test is correlated with the deepest stage of anesthesia. The precise mechanism by which tramadol exerts its anesthetic effect is unknown. Tramadol is structurally related to codeine[16], and is selective for the mu receptors[10]. However, a possible interaction of tramadol with the peripheral opioid receptors is less probable, as this cannot explain the modified motor blockade of the brachial plexus after addition of Tramadol to mepivacaine [12]. The lack of effect after the addition of fentanyl to local anesthetic for IVRA[17] represents another argument for the absence of peripheral opioid-mediated mechanism in such circumstances. Besides its opioid action, tramadol is also acting on the monoaminergic system. Unlike the traditional morphine-like analgesics, tramadol has a dual mechanism of action, also blocking the reuptake of the norepinephrine and 5-hydroxy-tryptamine at the $\alpha 2$ adrenergic receptors level[18]. The pretreatment with a-adrenoreceptor antagonist yohimbine and idazoxan resulted in a significant reduction of antinociceptive effect of tramadol[19]. The result is that tramadol has a profile of action similar to that of clonidine, which inhibits the release of norepinephrine from prejunctional $\alpha 2$ adrenoceptors in the periphery [20]. Therefore, we can hypothesize that tramadol added to local anesthetics for peripheral nerve block, may act in a similar way as clonidine. Clonidine has depressant

properties on the C-fiber action potential and produces tonic and phasic inhibition of nerve conduction in vitro[21]. As an adjunct, clonidine showed an enhancing effect on Lidocaine induced inhibition of C-fiber action potential[22]. Added to mepivacaine for brachial plexus blockade, clonidine prolonged the duration of sensory and motor block whereas onset characteristics were not influenced[23]. Similar results were obtained by Kapral et al.[12] by using 0.25% tramadol in mepivacaine solution for brachial plexus blockade. Addition of clonidine to local anesthetics for IVRA produced contradictory results. Kleinschmidt et al.[25] did not find any significant improvement in block characteristics or postoperative analgesia, whereas Reuben et al.24 demonstrated improved postoperative analgesia. In our study, by addition of 100 mg tramadol to lignocaine for IVRA, only the onset of sensory block was increased. A major disadvantage for the use of tramadol as a local anesthetic is the increased frequency of side effects. Fifteen patients from both the L and TL groups exhibited a skin rash distal to the tourniquet, suggesting histamine release. Although one of the proposed sites of action of tramadol is the nerve endings along the veins[11], the incidence of pain/burning at the injection site was significantly greater in Group TL versus Group L (five patients in Group TL versus one patient in Group L). An increased incidence of pain/burning at the injection site was also noted when meperidine was compared with lignocaine for IVRA[25]. Both tramadol and meperidine have a local irritating effect, which overrides the anesthetic effect on the endovenous sensory endings. In conclusion, the present study suggests that tramadol may modify the action of a local anesthetic, providing a shorter onset time of sensory block in IVRA.

CONCLUSION

We conclude that the speed of onset and the overall degree of blockade in intravenous regional anaesthesia with lignocaine and tramadol were significantly improved in comparison to lignocaine alone, hence it is a good adjunct to lignocaine.

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