

Intravenous Regional Anaesthesia Using Lignocaine and Tramadol

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Abstract

Introduction: This prospective, randomised, double-blind study was designed to assess if the addition of 50 mg tramadol to 30 mL 0.5% lignocaine would improve the efficacy of intravenous regional anaesthesia. **Materials and Methods:** Fifty-four adult patients undergoing upper limb surgery were randomly allocated to receive either 30 mL 0.5% lignocaine and 1 mL normal saline (group A) or 30 mL 0.5% lignocaine and 50 mg tramadol (group B). They were then assessed for onset of sensory and motor block and the VbAS score for tourniquet pain. **Results:** Although more patients in group B had a faster onset of sensory and motor block, this was not significantly different. Patients in group B had a significantly lower VbAS score 30 min after tourniquet inflation and after change over to the distal tourniquet ($P < 0.05$). There were no complaints of postoperative nausea and vomiting. Two patients in group B developed localised skin urticaria of the forearm which resolved with the release of the tourniquet. **Conclusion:** There is a positive trend that tramadol might improve the quality of intravenous regional anaesthesia.

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Introduction

Intravenous regional anaesthesia (IVRA) has a reported success rate of between 94% and 98% for upper limb surgery.¹ Limitations to its use include the quality of intra-operative anaesthesia, tourniquet pain and lack of adequate postoperative analgesia. Various analgesics including morphine, fentanyl, sufentanil, pethidine and ketorolac have been added to the IVRA solutions to improve preoperative analgesia, with varying degrees of analgesic efficacy.^{2,3}

Tramadol is a centrally acting analgesic with both opioid and non-opioid modes of action.⁴ It has local anaesthetic effect^{5,6} and has been shown to increase the duration of an axillary brachial plexus block when added to mepivacaine.⁷ Similarly, pethidine, an opioid with local anaesthetic properties, when added to prilocaine for IVRA has also been shown to improve the onset and quality of block.⁸

The aim of this study was to assess whether the addition of tramadol to 0.5% lignocaine for IVRA might improve the onset, quality and duration of anaesthesia.

Materials and Methods

This randomised, prospective, double-blind trial was conducted after approval by the hospital ethics committee.

Fifty-four American Society of Anesthesiologists (ASA) physical status I and II patients aged between 20 and 70 years and weighing between 45 and 90 kg gave written and informed consent to participate in the study. They were scheduled to undergo one of the following unilateral upper limb surgery: carpal tunnel release, excision of a ganglion or cyst, tenolysis, removal of simple implants from the hand, open reduction and fixation of a simple phalangeal or metacarpal fracture.

The following patients were excluded from the study: patients who refused consent, patients with history of allergy to lignocaine or tramadol, pregnant patients, patients with history of any organ failure, peripheral vascular disease, sickle cell disease or epilepsy and patients on monoamine oxidase inhibitors and coumarine.

All patients were not given sedative premedication. They were randomly allocated into one of two groups (group A or group B). Intravenous access was established with 22G intravenous cannulae on the dorsum of both the operative limb and the non-operative limb. All patients were continuously monitored with electrocardiography, pulse oximetry and an automated blood pressure measurement system. An electronic double-cuffed tourniquet controller system (Zimmer, ATS 2000; USA)

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was used for all cases.

The operative limb was exsanguinated by elevating it and wrapping it with an Esmarch bandage. The tourniquet was inflated to 250 mmHg, or 100 mmHg above systolic blood pressure (whichever is higher). Circulatory isolation of the arm was confirmed by inspection and the absence of the radial pulse. The test solution was administered over 60 sec under continuous electrocardiogram monitoring. Patients in group A ($n = 27$) received 30 mL of 0.5% lignocaine and 1 mL of normal saline, while those in group B ($n = 27$) received 30 mL of 0.5% lignocaine and 50 mg (1 mL) tramadol.

The time to onset of anaesthesia was determined by the loss of sensation to pinprick and the loss of motor power. These two parameters were assessed at 0 min, 1 min, 2.5 min and subsequently at 2.5 min intervals. Sensation was tested with a short-bevelled 22G hypodermic needle at 6 sites chosen to represent areas supplied by the radial, the ulnar and the median nerves (Fig. 1). The sensation was recorded as sharp, blunt or absent. Motor function was assessed by asking the patient to squeeze a blood pressure cuff that was preinflated to 40 mmHg. The maximum pressure generated was recorded. The duration of tourniquet use, anaesthetic time, surgical time and time from start of anaesthesia to start of surgery were recorded. Pain was recorded at the time of incision as present or absent. When necessary, intraoperative fentanyl or supplemental local anaesthetic administered as a local infiltration was allowed.

Intraoperative tourniquet pain was assessed every 10 min using a verbal analogue scale (VbAS), where 0 = no pain and 10 = the worst pain imaginable. If the patient was unable to tolerate the tourniquet pain, the distal cuff was inflated and the proximal cuff deflated. The time from start of anaesthesia to tourniquet change and the VbAS score was noted.

Postoperative pain was assessed using a visual analogue scale (VAS), with 0 = no pain and 10 = worst pain

imaginable. The patients were assessed at 1 min, 3 min, 5 min and subsequently at 5 min intervals until analgesia was requested. Intravenous ketorolac was given for postoperative analgesia, when necessary and if it was not contraindicated. The time to first dose of analgesia and VAS score was recorded. Patients who did not request for analgesia within 60 min were excluded from the statistical analysis of the postoperative VAS score. Any occurrences of nausea, vomiting or skin urticaria and erythema were also recorded.

Demographic data, the duration of surgery and the use of tourniquet were analysed using independent samples *t*-test. The time taken for sensory loss, motor power loss, VbAS and VAS scores were analysed using Mann-Whitney U test. A *P* value of less than 0.05 was considered significant.

Results

There was no significant difference between the two groups, in age, sexual distribution, weight, height, duration of surgery, tourniquet time and time to start of surgery (Table I).

Generally, more patients in group B had a faster onset of sensory and motor block (Figs. 2 and 3) than patients in group A (Table II). However, this difference was not significant.

Six patients (22%) in each group experienced some degree of sensation at the start of surgery. This ranged from vague sensation to pain. Of these patients, 4 patients in group B and 6 patients in group A required either fentanyl or supplementation with local anaesthetic by the surgeon.

TABLE I: DEMOGRAPHIC DATA, TOURNIQUET TIME, SURGERY TIME AND TIME TO ANAESTHESIA

	Group A	Group B
Sex F/M	10/17	11/16
Age (y)	40 ± 11	34 ± 13
Weight (kg)	65 ± 11	63 ± 12
Height (cm)	163 ± 9	164 ± 9
Duration of surgery (min)	23 ± 15	23 ± 16
Duration of tourniquet (min)	39 ± 16	41 ± 20
Time to start of surgery (min)	13 ± 3	14 ± 4

Data are presented as mean ± SD

TABLE II: ONSET OF SENSORY AND MOTOR BLOCK AND TIME TO FIRST DOSE OF ANALGESIA

	Group A	Group B
Time to sensory block (min)	7.5 (1-15)	2.5 (1-12.5)
Time to motor block (min)	5 (1-15)	2.5 (1-15)
Time to 1 st dose of analgesia (min)	7.5 (3-59)	10 (5-59)

Data are presented as median (range)

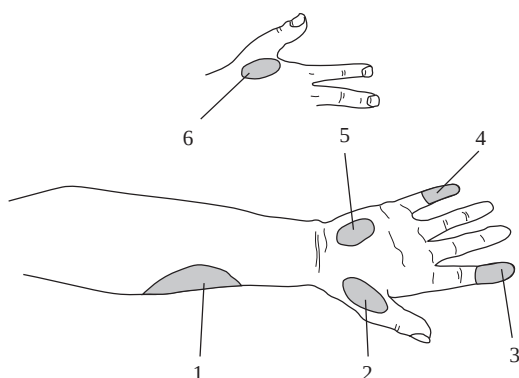


Fig. 1. Sites used for sensory testing. 1, forearm (radial nerve); 2, thenar eminence (median nerve); 3, index finger (median nerve); 4, little finger (ulnar nerve); 5, hypothenar eminence (ulnar nerve); 6, first webspace (radial nerve).

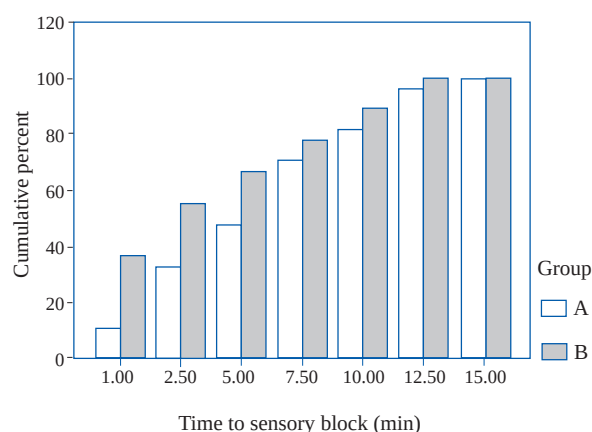


Fig. 2. Onset of sensory block in groups A and B. Histograms show the cumulative frequency.

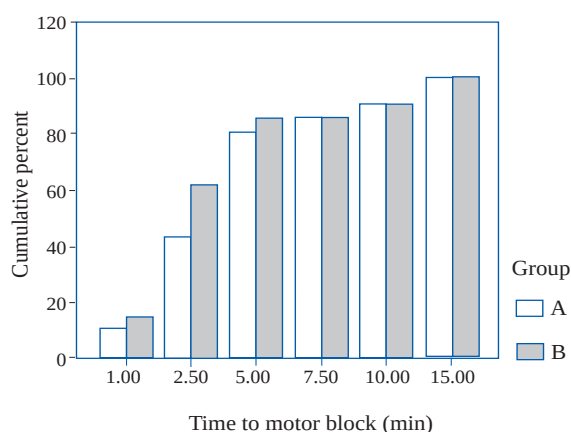


Fig. 3. Onset of motor block in groups A and B. Histograms show cumulative frequency.

There was no difference in the tourniquet VbAS score at 10 min and 20 min intervals. However, patients in group B had a significantly lower VbAS score 30 min after tourniquet inflation and after change over to the distal tourniquet ($P < 0.05$) (Table III). Twenty-two (88%) of patients in group A and 18 (67%) of patients in group B required postoperative analgesia. However, this, the VAS score and the time to first dose of analgesia were not significantly different between the two groups.

There were no complaints of intra or postoperative nausea or vomiting. Two patients in group B developed localised skin urticaria of the forearm which resolved spontaneously after the release of the tourniquet.

Discussion

Tramadol has multimodal mechanisms of action. In addition to its agonist action at the mu receptor, it also inhibits the uptake of 5-hydroxytryptamine (5-HT) and norepinephrine and it stimulates 5-HT release.⁴ Thus, it enhances the function of the spinal descending inhibitory pathway.

TABLE III: VbAS SCORES FOR TOURNIQUET PAIN WITH THE PROXIMAL CUFF AT 10, 20 AND 30 MIN AND DISTAL CUFF AFTER CHANGE OVER 0, 10 AND 20 MIN

VbAS score	Group A	Group B
Proximal, 10 min	3.5 ± 2.2	3.6 ± 1.7
Proximal, 20 min	4.8 ± 2.3	4.9 ± 2.3
Proximal, 30 min*	5.8 ± 1.6	4.5 ± 1.3
Distal, 0 min*	3.2 ± 1.6	2.1 ± 1.8
Distal, 10 min	4.3 ± 1.8	3.4 ± 1.4
Distal, 20 min	4.8 ± 1.8	4.3 ± 1.3

VbAS: verbal analogue scale

Data are presented as mean ± SD. * $P < 0.05$

Pang et al⁵ have demonstrated that tramadol has local anaesthetic effects following intradermal injection. Kapral et al⁷ have also shown that the addition of tramadol to mepivacaine prolongs the duration of axillary brachial plexus block. Thus, there is evidence that tramadol has an effect on peripheral nerves.

While IVRA is a safe and reliable technique for upper limb surgery, its usefulness has been limited by tourniquet pain and the lack of postoperative analgesia. Many additives have been added to improve its quality.^{2,3} One such additive, pethidine, which like tramadol, has been shown to be an opioid with local anaesthetic activity.⁸ Previous research has shown that the addition of pethidine to IVRA has allowed a reduction in the dose of lignocaine used and resulted in prolonged postoperative analgesia.⁹ However, the side effects of pethidine especially sedation and respiratory depression have limited its clinical usefulness.⁹ Tramadol has been shown to have minimal respiratory depressant effect⁴ and may be a better alternative to pethidine.

In our study, 50 mg tramadol was added to 30 mL of 0.5% lignocaine in an attempt to improve the quality of IVRA. Although our results did not support the hypothesis that the addition of tramadol to 0.5% lignocaine will improve the quality of IVRA, there was a positive trend towards a faster onset of sensory and motor block when tramadol was used. Also, the tourniquet appeared to be better tolerated by patients who received tramadol. The lack of significant findings may be due to the dose of tramadol chosen. The current recommended intravenous analgesic dose of tramadol is 3 mg/kg bodyweight.⁴ Kapral et al⁷ used 100 mg tramadol together with mepivacaine to prolong the duration of axillary brachial plexus block. A cautious dose of 50 mg tramadol was chosen because intravenous injection of tramadol can result in dose-dependent nausea and vomiting.⁴ This adverse effect was not observed in our patients.

Further studies with larger doses could be carried out to

determine if tramadol can improve the quality of IVRA. However, caution is required. Apart from the increasing likelihood of nausea and vomiting, there may be a potential for local irritation. Pang et al¹⁰ used intravenous retention of 50 mg tramadol to reduce the pain from propofol injection and reported 31% incidence of skin erythema and/or wheals. In their subsequent study, intradermal injection of 25 mg tramadol persistently resulted in skin erythema and/or wheals.⁵ This high incidence was not observed in our study where only 2 patients experienced localised skin urticaria of the forearm. The low incidence is most likely due to the overall lower concentration of tramadol used in our study. As with the patients in the 2 studies by Pang et al, this adverse reaction resolved spontaneously without permanent sequelae.

Our study has shown that tramadol has the potential to enhance the efficacy of IVRA. Administration of 50 mg tramadol together with 30 mL of 0.5% lignocaine has resulted in a trend towards a faster onset of sensory and motor block and also better tolerance of the tourniquet. This is also without any significant adverse result. A larger dose like 75 mg or 100 mg tramadol may be attempted to determine if significant results and additional benefits like prolonged postoperative analgesia can be obtained.

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