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Ropivacaine: a new local anaesthetic agent in maxillofacial surgery

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Abstract

We have compared the anaesthetic efficacy, duration of action, pain, pulpal anaesthesia, and cardiovascular effects of 0.5% ropivacaine or 2% lignocaine hydrochloride in bilateral symmetrical impacted third molars. In a randomised single-blind trial we studied 78 healthy patients who required bilateral extraction of identical impacted lower third molars. A test dose was given to all patients with subdermal infiltration of 0.5% ropivacaine 0.5 ml. A classic inferior alveolar and long buccal nerve block was created using 0.5% ropivacaine 2 ml on one side and 2% lignocaine hydrochloride 2 ml with adrenaline on the other. The time to onset and duration of action were noted. Pain, numbness of the lip and tip of the tongue, and haemodynamic changes were monitored throughout the procedure. The teeth were extracted two weeks apart. The onset of anaesthesia ranged between 2 and 3 min after the injection and lasted for more than 5 h. Ropivacaine alone did not cause appreciable changes in the cardiovascular variables, but lignocaine with adrenaline caused a transient increase in arterial pressure and heart rate 2 min after injection. We conclude the 0.5% ropivacaine alone does not affect the cardiovascular system and has more beneficial effects than 2% lignocaine hydrochloride with adrenaline. These findings may be useful for oral and maxillofacial surgeons who are looking for a local anaesthetic with minimal cardiovascular risk and without a vasoconstrictor to provide regional anaesthesia for long procedures.

Keywords: Ropivacaine; Lignocaine HCl; Adrenaline; Vasoconstrictor

Introduction

The success of a minor oral procedure relies on the efficiency of the local anaesthetic and the dexterity of the operator. Local anaesthetic with an extended duration of action, good analgesia, and negligible toxicity is an optimal choice. A common standard option is 2% lignocaine hydrochloride with adrenaline (1:80,000). However, lignocaine is not recommended for long procedures or in patients with cardiovascular compromise.

Various clinical trials have suggested other options, one of which is ropivacaine. It is available in various concentrations (0.75%, 0.5%, 0.375%, or 0.25%) and is said to have inherent vasoconstrictive properties at low concentrations.[1,2] Some studies have shown that the addition of a vasoconstrictor to ropivacaine does not improve its efficacy or duration compared with the drug alone.[3–5] We hypothesised that ropivacaine alone is efficient in providing potent prolonged anaesthesia with minimal cardiovascular toxicity, and so compared 2% lignocaine hydrochloride with adrenaline (1:80,000) and 0.5% ropivacaine for the removal of lower third molars.

Patients and methods

We organised a randomised, single-blind clinical trial in 78 otherwise healthy patients aged between 20 and 30 years who required prophylactic ($n = 35$, 14 men and 21 women) and symptomatic ($n = 43$; 17 men and 26 women) removal

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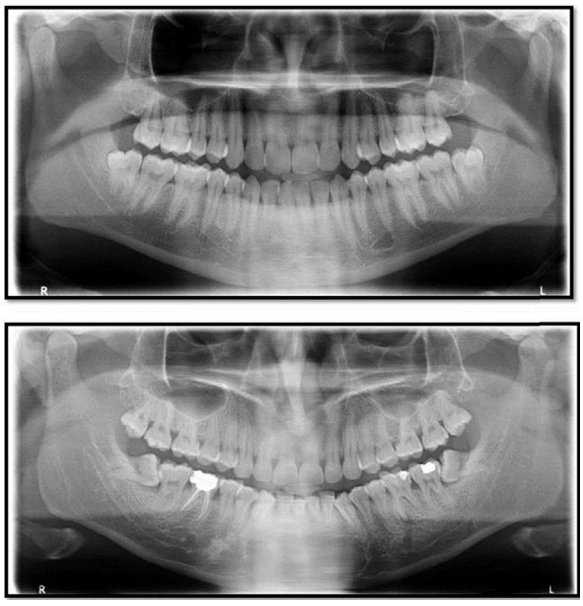

Fig. 1. Bilateral symmetrical impacted lower third molars with a similar "difficulty index".

of bilateral symmetrical lower mandibular third molars. The College Ethics Committee approved the protocol. The study was conducted in Sri Sai College of Dental Surgery, Vikarabad, from 2012 to 2014. Written informed consent was obtained from each patient. All patients were given 0.5% ropivacaine (Ropin 0.5%, Neon Laboratories Ltd, India) on one side and 2% lignocaine hydrochloride with adrenaline on the other side with a two-week interval in between. Lignocaine was chosen as the control as its effects are well documented.

Patients with bilateral symmetrical impacted lower third molars that had a similar "difficulty index" (Fig. 1) and were not associated with acute infection or any other systemic problems were included in the study. Patients were excluded if they were known or suspected to be hypersensitive to sulphites, amide-type local anaesthetics, or any ingredients in the anaesthetic solution; if they had any coexisting cardiac or neurological diseases or were immunocompromised; if they were pregnant or lactating; or if they were taking central nervous system depressants or any other analgesics preoperatively.

The same surgeon operated on all the patients. The choice of local anaesthetic for the first operation was randomised (by the toss of a coin), and they were given the other local anaesthetic for the second side. All patients were infiltrated with 0.5 ml of 0.5% ropivacaine intradermally as test solution. The visual analogue score (VAS) was explained preoperatively and patients asked to say as soon as the lip and tongue became numb. A classic inferior alveolar and long buccal nerve block was given using a sterile luer lock disposable syringe (3 ml), and a standard surgical technique was used to remove the teeth.[6,7] Postoperatively patients were given a treatment regimen of antibiotics and analgesics. They were instructed not to take any analgesics until the lip and tongue were no longer numb. All patients were admitted for 24 h for hourly observations.

We recorded the volume of the drug used, the need for reinforcement, the time to onset of action, and the duration of action. Intensity of pain and depth of anaesthesia were assessed subjectively using a VAS that ranged from 0 = no pain to 10 = the worst pain imaginable. Haemodynamic changes (blood pressure and heart rate) were monitored throughout the procedure, and a calculated amount of saline was used during all procedures. The residual amount of blood collected after excluding the saliva content (usually 20 ml, so 1.5 L/day in healthy people) and saline, in the manual suction was counted as blood loss.[8] We did not use gauze or any absorbent swabs during the procedure. Any postoperative complications such as paraesthesia and trismus were also recorded.

Statistical analysis

All analyses were made with the help of SPSS (version 14, SPSS Inc, Chicago, IL, USA), and probabilities of less than 0.05 were accepted as significant. The significance of differences between the groups was assessed using Student's paired *t*-test.

Results

All 78 subjects were given equal amounts of drug on either side (2 ml for the inferior alveolar and lingual nerve block, and 0.5 ml for the long buccal nerve block). The onset of action for lignocaine ranged from 1 to 2 min whereas for ropivacaine it was from 2 to 3 min. The duration of the procedure ranged from 30 to 45 min. The rest of the results are shown in Table 1.

Discussion

Ropivacaine is a local anesthetic of the amide type that is chemically similar to bupivacaine and mepivacaine. It was first used in 1992 at the Royal Hospital for Women in Sydney and introduced for clinical use in 1996 (Gatt S, et al. A double-blind, randomised, parallel investigation into neurobehavioural status and outcome of infants born to mothers receiving epidural ropivacaine 0.25% and bupivacaine 0.25% for analgesia in labour. Abstract presented at the Australian Society of Anaesthetists Annual General Meeting, October 1995). Because of its favourable qualities such as low toxicity, long duration of action, and selectivity for nerve fibres responsible for pain transmission, ropivacaine has been successfully used worldwide, and is useful for minor oral procedures. The only shortcoming of ropivacaine is its cost (in the UK three times that of bupivacaine, 2015).

Ropivacaine is an optically pure S(−) enantiomeric from the parent chiral molecule propivacaine. It belongs to the