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Lidocaine spray versus tetracaine solution for monopolar submucosal diathermy for inferior turbinate hypertrophy

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Abstract. *Lidocaine spray versus tetracaine solution for monopolar submucosal diathermy for inferior turbinate hypertrophy. Objective*: To compare the efficacy of lidocaine spray 10% to tetracaine 2% solution, as a local anaesthetic for patients undergoing monopolar submucosal diathermy of the inferior turbinate.
Methods: A prospective study was conducted on 48 patients undergoing submucosal diathermy of the inferior turbinate. Patients were randomly assigned to receive tetracaine 2% solution (24 patients) or to receive lidocaine spray 10% (24 patients). Patients were asked to evaluate the severity of pain during the procedure using a visual analogue scale. Patient data, pain scores, and potential complications were assessed statistically.
Results: The tetracaine group had significantly lower mean pain scores compared to the lidocaine group: 2.29 vs. 3.04 ($p < 0.001$). There were no complications or side effects from tetracaine.
Conclusion: Tetracaine 2% solution applied locally is an easy, safe, inexpensive, and effective analgesia for submucosal diathermy for inferior turbinate hypertrophy.

Introduction

Nasal obstruction is common in adults and may affect patient health via prolonged respiratory infections, secondary sinus involvement, sleep disorders, and an impaired sense of smell. One of the major causes of chronic nasal airway obstruction is pathology of the inferior turbinate. Conservative therapy is generally the treatment of choice, and can include topical steroids, antihistamines, and decongestants. Patients who do not respond to conservative treatment are usually treated by surgical reduction of the inferior turbinates. Many different techniques have been introduced in the last 200 years, some of which are obsolete and others of which are still in use.[1]

The monopolar submucosal diathermy (SMD) procedure was first described in 1930.[2] This technique reduces nasal obstruction by cauterizing blood vessels; it also decreases glandular activity in the rhinitic nose by damaging autonomic nerves.[3,4] SMD has several drawbacks. First, it is difficult to estimate the amount of deep tissue reduction.[5] Second, its effect is often limited or temporary, leading to repeated procedures.[6,7] The most common complications are delayed haemorrhage, prolonged nasal discharge, and crusting.[8] In spite of these disadvantages, SMD is the treatment of choice for many otolaryngologists because it is easy to perform and has relatively few complications.

Local anaesthesia appears to be a safe and effective alternative to general anaesthesia for pain relief during nasal procedures, with no evidence of inferior outcome and advantages such as reduced operating time and hospitalization. Local anaesthesia is also suitable for patients with morbidities that render general anaesthesia potentially dangerous.[9,10]

Although lidocaine solution is currently used for local anaesthesia for SMD of the inferior turbinate, tetracaine is a very potent and effective topical ester anaesthetic that provides long duration anaesthesia. The local intranasal anaesthetic effect of tetracaine solution has been shown to be superior to that of lidocaine.[11] The purpose of this study was to compare the efficacies of lidocaine spray and tetracaine solution as topic anaesthesia for submucosal diathermy of the inferior turbinate.

Materials and methods

This prospective study was conducted between January 2007 and March 2008 in the Department of Otolaryngology, University Hospital of Crete, Heraklion, Greece. The 48 subjects were

otherwise healthy adult patients suffering from hypertrophy of the inferior turbinate for at least 1 year. All of the subjects had failed to respond to conservative treatment, including antihistamine therapy, oral decongestants, and steroid nasal sprays. All patients underwent SMD of the inferior turbinate, but had no other procedures performed at the same time (such as functional endoscopic sinus surgery, septoplasty, or rhinoplasty). This study was approved by the local ethics committee, and informed written consent was obtained from all patients before inclusion in the study. The patients were operated on by J.B, D.K, and J.H under topical anaesthesia using the same technique. Patients receiving anxiolytic, hypnotic, and antidepressant medication were excluded from the study. Three neurosurgical sponges (60 mm × 8 mm) were applied to each side of the nose, for a total of 6 sponges for each patient (Figure 1). The first sponge was inserted under the roof of the nose to anaesthetize the branches of the anterior ethmoid nerve. The second was passed across the mid-portion of the middle turbinate in the region of the sphenopalatine foramen, and the third one was applied to the surface of the inferior turbinate. Subjects were divided randomly into two groups of 24 patients: For the tetracaine group neurosurgical sponges were soaked in 4 ml of tetracaine 2% solution (total dose, 80 mg) and wrung before use; and for the lidocaine group , each neurosurgical sponge was sprayed 3 times with lidocaine spray 10% before use (total dose, 180 mg). These comparable dosages were selected based on published data regarding the dose at which anaesthesia was ensured without toxicity (Astra Pharmaceuticals Ltd Xylocaine 10% pump spray. Information leaflet).[12]

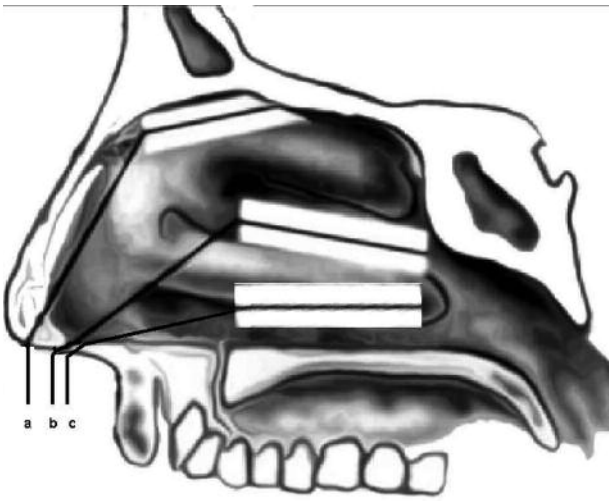

Figure 1
Three neurosurgical sponges (60 mm × 8 mm) were applied to each side of the nose as follows. The first sponge (a) was inserted under the roof of the nose to anaesthetize the branches of the anterior ethmoid nerve. The second (b) was passed across the mid-portion of the middle turbinate in the region of the sphenopalatine foramen, and the third (c) was applied to the surface of the inferior turbinate.

In each patient, oxymetazoline 0.1% was sprayed twice in each nasal cavity before insertion of the sponges. The neurosurgical sponges were inserted into the patient's nose 10 minutes before the procedure began. During the operation, patient heart rate, arterial pressure, and oxygen saturation were closely monitored at all times. The safety limits were defined as follows: between 70-95 bpm for heart rate, 140/80 for blood pressure, and >94% SpO_2 peripheral oxygen saturation (non-invasive measurement). Deviation from these values was considered abnormal and a sign of systemic toxicity. When this occurred, the operation was discontinued, and the patient was returned to the ward and monitored until the values were normal or until it was determined that further intervention was required. Monopolar diathermy was used, and the power was set at 30 W. A diathermy needle was inserted into the anterior end of the inferior turbinate and advanced submucosally until the posterior end of the turbinate was reached. The needle was withdrawn over a period of 10 seconds with applied current. This procedure was performed twice on each inferior turbinate. Two hours after the operation, patients evaluated the intensity of the pain they experienced during the diathermy of the inferior turbinate procedure using a visual analogue scale. The score range was 0-10, where 0 = no pain and 10 = intolerable pain). The scores were assessed statistically by the non-parametric Mann-Whitney U test using SSPS 14.0 software (SPSS, Inc, Chicago, IL).

Results

A power study was performed first to determine the sample size required to detect with high probability a pre-specified difference between the two treatment modalities. The power study showed that for a 0.05 significance level and a 0.95 power level, a sample size of 24 patients in each group (a total of 48) would be required to detect an actual difference of 1 in mean pain between the two groups (sigma1 = 2.29, sigma2 = 3.04, DF = 44, two-tailed test).

Our series consisted of 48 patients, 25 males and 23 females, aged 18-60 years old (mean age, 35 years). Tetracaine solution was used in 24 patients (group A) and lidocaine solution in the other 24 (group B). The mean score on the visual analogue scale was 2.29 (SD 0.62) in the tetracaine group and 3.04 (SD 0.75) in the lidocaine group. The non-parametric Mann-Whitney U test revealed that patients in the tetracaine group had significantly lower mean pain scores than the lidocaine group ($p < 0.001$; tetracaine group mean rank = 18.35 vs. lidocaine group mean rank = 30.65). The mean pain scores for each group are shown in Figure 2. Fifteen patients in group A reported throat anaesthesia, as did 20 in group B (due to minor posterior liquid overflow). No complications or side effects regarding the intranasal use of tetracaine or lidocaine were observed.

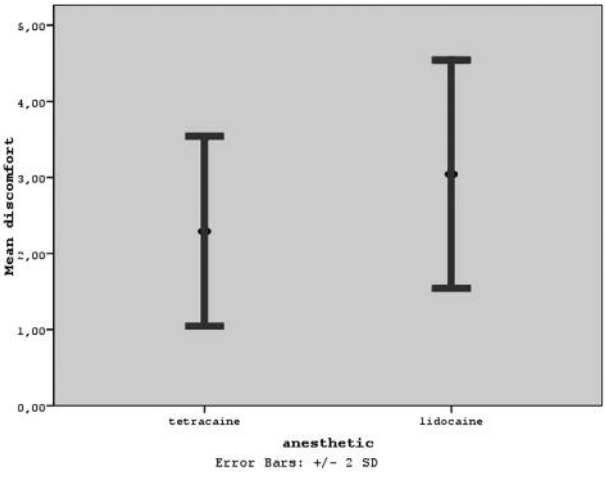

Figure 2
Mean pain scores using a visual analogue scale. The mean score for the tetracaine group was 2.29 (SD 0.62) and 3.04 (SD 000.75) for the lidocaine group. The non-parametric Mann-Whitney U test revealed a statistically significant difference for pain scores between the two groups ($p < 0.001$), with the tetracaine group reporting less pain.

Discussion

Otolaryngologists rely on local anaesthetics when performing many intranasal procedures, and for years used cocaine as a local anaesthetic.[13] However, the clinical use of cocaine in otolaryngology has decreased markedly over the past 25 years, possibly because of cocaine's potential toxicity, increasing cost, and habit-forming potential.

Few other local anaesthetics have been widely used to provide topical nasal anaesthesia. Lidocaine and tetracaine are the most commonly chosen alternatives to cocaine, but must be mixed with a vasoconstrictor to be optimal for surgical conditions. Tarver *et al.*[14] demonstrated that the combination of lidocaine and oxymetazoline was as efficacious as cocaine in providing intranasal anaesthesia and vasoconstriction. Our previous studies demonstrated that topical tetracaine is efficacious and safe for anaesthesia of the nasal mucosa.[15,16]

In a previous study, we compared cocaine with tetracaine solution for septoplasty; similarly, this study compared the anaesthetic effect of tetracaine 2% solution to lidocaine spray 10% for submucosal diathermy for inferior turbinate hypertrophy.

A 1956 report discussed fatalities that occurred after the topical application of local anaesthetics to mucous membranes. Most of those cases involved tetracaine. The adverse reactions to tetracaine were described as being more severe than reactions to other local anaesthetics and included signs and symptoms of CNS toxicity ranging from tinnitus and confusion to tonic-clonic convulsions, unconsciousness, and respiratory arrest. Signs and symptoms of cardiovascular toxicity ranged from hypertension and tachycardia to peripheral vasodilation, hypotension, arrhythmias, and, rarely, to circulatory collapse. In most of the tetracaine fatalities, the dose exceeded 100 mg.[17] Two follow-up studies showed that when tetracaine is applied topically to the mucous membranes of the pharynx and trachea, it is absorbed systemically so that the

blood levels are comparable to those after IV injection.[18,19] Absorption of local anaesthetics from the nasal mucosa was not evaluated. As a result of these reports, the use of tetracaine as a topic anaesthetic fell into disfavour.[11] Lidocaine spray 10% is a topical anaesthetic commonly used by otolaryngologists. Each pump of lidocaine spray 10% contains 10 mg of lidocaine, and the total dose of lidocaine should never exceed 20 pumps of the spray i.e. 200 mg (Astra Pharmaceuticals Ltd Xylocaine 10% pump spray. Information leaflet).

Intranasal anaesthetics are absorbed systemically to some degree. Ester local anaesthetics are rapidly hydrolyzed by pseudocholinesterase in the plasma and, in part, by the liver.[11] When an ester local anaesthetic reaches toxic levels, a systemic reaction may take place. More specifically, toxicity may occur due to excitation of the central nervous system, depression of the central nervous system, depression of the cardiovascular system, cardiorespiratory arrest, and allergic reactions.[20] Tetracaine is metabolized more slowly than other ester local anaesthetics. Small amounts of tetracaine absorbed systemically are easily metabolized in the plasma, making the topical administration of tetracaine safe as long as doses are kept below the toxic range.[11] In rhinology, tetracaine can be used safely for local anaesthesia in functional endoscopic sinus surgery and septoplasty as long as the maximum recommended dose of 1 mg/kg is not exceeded. A thorough patient history should be obtained in order to exclude liver insufficiency or haematologic disorders, since these conditions might predispose patients to side effects due to abnormal tetracaine metabolism.

No central nervous system or cardiovascular complications were observed in the 48 patients in the present study. No complications or side effects were observed, and use of 4 ml of tetracaine 2% applied to neurosurgical sponges in our study subjects was a safe dose that was very effective submucosal diathermy for inferior turbinate hypertrophy. In addition, patients given tetracaine reported significantly lower mean pain scores than those receiving a local application of lidocaine spray 10%.

Conclusions

Topical tetracaine is an efficacious and safe topical anaesthetic for nasal mucosa that is ideal for nasal surgery. However, the importance of using an adequate and safe dose along with careful monitoring during and after use cannot be overemphasized. On the basis of these findings, we recommend tetracaine solution as the first choice anaesthetic for submucosal inferior turbinate diathermy.

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