Int. J. Morphol.,
29(3):857-861, 2011.

Relationship Between Volume of Pterygopalatine Fossa and Block Anesthesia of Maxillary Nerve. A Pilot Study.

Relación entre el Volumen de la Fosa Pterigopalatina y la Anestesia Troncular del Nervio Maxilar. Un Estudio Piloto

[*,**]Pedro Aravena Torres; [***]Nicole Cresp Sinning; [***]Katherine Büchner Sagredo;
[***]Carlos Muñoz Rocha & [****]Ricardo Cartes-Velásquez

ARAVENA, T. P.; CRESP, S. N.; BÜCHNER, S. K.; MUÑOZ, R. C. & CARTES-VELÁSQUEZ, R. Relationship between volume of pterygopalatine fossa and block anesthesia of maxillary nerve. A pilot study. ***Int. J. Morphol., 29(3)***:857-861, 2011.

SUMMARY: Block anesthesia of maxillary nerve 9BAMN) is achieved by depositing anesthesia through greater palatine canal into the pterygopalatine fossa. Authors differ in the amount of anesthesia to be administered and the rate of complications (diplopia and hematomas), Coronado *et al*., (2008), measured the size of the pterygopalatine fossa finding an average of 1.2 ml, suggesting that amount of anesthesia for BAMN. The aim of this study is to compare the effectiveness of low doses of 1.2 ml (LD)versus traditional dose of 1.8 m. (TD) of anesthesia for BAMN and its adverse effects. A quasi experimental exploratory clinical study was performed involving 82 patients where the anesthetic technique was suitable for tooth extraction procedure; patients were randomized in LD and TD groups, 2% lidocaine with 1:50.000 epinephrine was used. Demographic (sex and age), clinical (tooth for extraction and anesthetic dose) as well as anatomical variables (upper facial and cranial index) were recorded. The anesthetic success (AS) was defined as the possibility to perform the tooth extraction with no pain or minimal pain as measured by visual analogue scale (VAS). For statistical analysis chi-square and t test ($p < 0.05$) were used. The results show that the pain and AS were 2.93 and 61.67% in LD group and 3.09 and 59.09% in TD group respectively, there were 6 cases of diplopia with no significant statistical difference between groups.

KEY WORDS: Maxillary nerve; Anesthesia; Pterygopalatine fossa; Lidocaine; Tooth extraction.

INTRODUCTION

Technique for block anesthesia of maxillary nerve (BAMN), known as the Carrea technique in South America is a local ambulatory anesthesia for use in dentistry. Described for the first time in 1917 by Mendel (Hawkins & Isen, 1998) it is primarily used in three areas: oral cavity, nasal cavity and facial regions. In surgery such as tooth extraction, maxillary sinus surgery (Douglas & Wormald, 2006), Caldwell- Luc approach surgery, maxillary fracture, excision of torus and other surgeries in which hard and soft palate are involved (Poore 1973 cited by Mahoney 1977). It is also used in the diagnosis and treatment of pain syndromes of maxillofacial area (Hawkins & Isen; Methathrathip *et al*., 2005).

The technique is described as the anesthesia administration in the pterygopalatine fossa of the skull, locating the greater palatine foramen in the palatal mucosa and subsequently inserting a needle into the greater palatine canal where the local anesthetic solution is deposited around the trunk of the maxillary nerve (Methathrathip *et al.*), achieving anesthesia of the regions innervated by its branches including maxillary teeth.

The greatest technical difficulty arises by the location of greater palatine foramen, bone accidents near or around the canal Suazo *et al.*, 2007). There are those who define it as a very traumatic experience for the patient (Malamed, 2006; Tima, 1995), as well as a complex technique given the potential to generate side effects such as diplopia by VIth cranial nerve pair anesthesia (Malamed; Magliocca *et al.*, 2006) in addition to exophthalmos, eye edema (Mahoney), projection of an infection, hematoma, nerve damage and

* Institute of Anatomy, Histology and Pathology. Faculty of Medicine. Universidad Austral de Chile, Chile.
** Doctoral Program in Medical Sciences, Faculty of Medicine. Universidad de la Frontera, Chile.
*** Institute of Odontoestomatology. Faculty of Medicine. Universidad Austral de Chile, Chile.
**** Etapa de Destinación y Formación. CESFAM Ralco Alto Biobio. Servicio de Salud Biobio, Chile.

facial nerve block (Bahl, 2004). Several authors describe the technique as injection of 1.8 ml of anesthesia (Malamed), 2 to 3 ml (Seltsam, 1956; Mahoney; Douglas & Wormald) and 3.6 ml (Schwartz-Arad *et al.,* 2004). There may be complications such as diplopia by dissemination of the anesthetic into the orbit through inferior orbital fissure (Jorgensen & Hayden, 1982; Tima).

Achieving an optimal anesthetic effect is the ideal condition in clinical practice Coronado et al. (2008) measured the volume of pterygomaxillary fossa finding an average of 1.2 ml. This study allows us to extrapolate the required volume containing the bone cavity, thereby determining the minimum amount of anesthesia needed to achieve the anesthetic effect avoiding the risk of disseminating to other spaces of skull cavities.

With the information previously described, the aim of this pilot study is to compare the anesthetic efficacy between 1.2 ml low dose (LD) and 1.8 ml traditional dose (one cartridge) (TD) of 2% lidocaine with epinephrine 1:50.000 in the maxillary nerve block via the greater palatine canal in patients requiring extraction of maxillary teeth and observe the possible complications associated with the dose used.

MATERIAL AND METHOD

A quasi-experimental exploratory (pilot) clinical study was carried out in patients selected from the Dental Emergency Services, in Valdivia, Chile, between May and September of 2009.

Ethical issues: Methodology and informed consent were approved by the Bioethics Committee of the Faculty of Medicine, Universidad Austral de Chile.

Selection criteria: Patients included in this research were between 18 and 65 years of age, of both sexes, ASA I or II, lucid and willing to cooperate, consulting only for acute pain of maxillary tooth, and whose clinical diagnosis was submucosal abscess with collection of purulent exudate at the bottom of buccal vestibule, and where use of an infiltrative anesthetic technique was contraindicated due to risk of infection dissemination (Malamed & Trieger, 1983). We excluded patients requiring multiple extractions, pregnant female patients, those with a history of serious medical conditions, active sites of pathosis near injection site, or inability o give consent due to trismus, cases where direct view of greater palatine foramen was difficult, and those cases where is was not possible to reach location of greater palatine canal or complete needle penetration.

Patient registration: Chief dentist of Dental Services examined patients and determined clinical diagnosis. Those patients who could be included in the study were encouraged to participate and were given the informed consent, if approved a researcher recorded age, sex, cranial index, upper facial index and type of tooth to be extracted. For cranial index, maximum anteroposterior skull length between the glabella and external occipital protuberance and maximum width of skull were measured, to match biparietal diameter. Cranial index was calculated dividing transverse length by anteroposterior length multiplied by 100. Based on this index, the skulls were classified as hyper-dolichocephalic (<70.9) dolichocephalic (<71 to 75.9) mesocephalic (76.0 – 80.9) brachycephalic (81 – 85.4) and hyper-brachycephalic (>85.5) , (del Sol, 2005, 2006). For the upper facial index, facial height was measured, determined by the distance between nasion and prostion, and facial width determined by the length between zygion-zygion points (Spinalle & McNamara, 1989). Subsequently we determined upper facial index by dividing facial height by facial width and multiplying the quotient by 100. Patients were classified as hyper-euryonic (<44.9), euryonic (45.0 to 49.9), mesial 50.0 to 54.9) lepto 55.0 – 59.9), hyper-lepto (>60.0, (del Sol, 2005, 2006). For cranial and upper facial index we used an 8“ industrial caliper (Mitutoyo, Japan). Teeth were grouped into molars (first, second or third molar), premolars (first or second premolar) and anterior teeth (canine and incisive).

Randomization: Following consent to participate in the study, diagnosis of tooth to be extracted and measurement of craniometric indexes, a researcher distributed patients at random in two groups, according to the last digit of his / her identification (ID) document:

Even number: LD group.
Odd number: TD group.

Anesthetic technique and procedure perfomance: The chief dentist of Emergency Services anesthetized the maxillary nerve using technique described by Malamed. Placing the greater palatine foramen in the palatal mucosa projected by palpation with the blunt end of the dental mirror. In the place where depression was located, the mucosa was punctured and penetrated the entire needle 27G 0.4 mm x 41 mm (Terumo Corporation, Japan), into the canal to reach pterygopalatine fossa depositing 1.2 ml or 1.8 ml (randomized) of anesthesia (Penta Farmaceutica S.A.,Chile). A second dentist evaluated the anesthetic effect after 15 minutes by syndesmotomy of the tooth to be extracted with a dental curve probe. Patient was asked to report pain intensity by visual analogue scale (VAS). After obtaining this information the emergency dentist extracted

the tooth, defining anesthetic success (AS) as the possibility to perform tooth extraction with no pain or minimal pain, and defining anesthetic failure (AF) as pain being intolerable, in such cases dose was reinforced with 1.8 ml of anesthetic. Pain intensity was recorded during the extraction. After extraction surgical site was conditioned and cleaned with saline solution 0.9%. When necessary surgical wound was sutured with 4-0 silk. Presence of complications such as diplopia, palatine artery hemorrhage, nausea, vomiting, fainting and/or any other patient discomfort was recorded. For postoperative care, patients received tablets of paracetamol 500 mg (Kitadol® Laboratorio Chile, Chile), with dosage of 500 mg every hour for 3 days.

Statistical analysis: Data were analyzed using Chi square test for dichotomous variables and T test for continuous variables with a statistical significance level of 0.05. For recorded, tabulation and statistical analysis we used Stata 10.0 (StataCorp. L, USA).

RESULTS

Of the 397 patients attended, 139 complied with the selection criteria, of those, 57 patients refused to participate arguing personal reasons. Finally a study population of 82 patients with a mean age of 37.7 years (SD 11.64; min: 19 max: 63) was obtained. According to randomization we defined an LD group (n=60) and TD group (n=22), characterization of both groups is shown in Table I. There was no significant statistical difference between the groups according to age (p=0.95), sex (p=0.75), tooth type (p=0.59), cranial index (p=0.67) and facial index (p=0.07).

Anesthetic success in LD group was 61.67% and 59.09% in TD group with no significant statistical difference between them (p=0.83).

Pain intensity in LD group was 2.9 (±3.35; min=0 max=10) and 3.09 (±3.76; min=0 max=10) in TD group with no significant statistical difference between them (p=0.8).

In all anesthetized patients, six (7.32%) had transient diplopia, four (6.67% in LD group and two (9.09%) in TD group. However, there was no statistical association between the dose used and this complication (p=0.7). There were no other complications as acute pain or discomfort in palatal location nor the deposit of anesthesia in the pterygopalatine fossa.

Table I. Frequency characterization of study population by dose group.

Variable	LD Group (n=60)	TD Group (n=22)
Sex		
Female	25	10
Male	35	12
Upper facial index		
Hyper-euryionic	7	0
Euryonic	13	2
Mesial	21	10
Leptous	9	8
Hyper-leptous	10	2
Cranial index		
Hyper-dolichocephalic	3	2
Dolichocephalic	14	2
Mesocephalic	29	11
Brachycephalic	12	6
Hyper-brachycephalic	2	1
Tooth type		
Anterior	34	11
Premolar	22	8
Molar	4	3

DISCUSSION

This pilot study found that maxillary nerve trunk block via greater palatine canal is possible in 61.67% of cases by depositing 1.2 ml 2% lidocaine with 1:50.000 epinephrine, there were no differences with the use of 1.8 ml of anesthesia. This study is based on suggestions made by Coronado *et al.*, with minimum amount necessary to minimize risks that may affect important neurovascular elements of common cavities of the skull. The pterygopalatine fossa is comprised of maxillary nerve and pterygopalatine ganglion, pterygoid artery and vein, and connective tissue. Excess of anesthetic solution may disseminate into the infratemporal fossa through the pterygomaxillary fissure, into the orbit through the inferior orbital fissure and into the middle cranial fossa through foramen, which may explain headache reported by some patients (Stajcic' & Todorovic', 1997). Results show the feasibility of using reduced amounts of anesthesia to the previously required 1.8 ml or higher amounts. However, these results were not achieved in all cases, and immediate extraction can be difficult which could be the result of a lack of deepanesthesia, extending to other skull cavities (Malamed; Jorgensen & Hayden; Tima).

Diplopia was reported in 6 patients, 4 of the patients were administered 1.2 ml of anesthesia. This could have been the result of diffusion of the anesthetic into the orbit through inferior orbital fissure blocking VIth cranial nerve pair (Mahoney; Malamed; Tima; Magliocca *et al*.) or excessive carpule depth of the needle from the oral cavity at the base of the skull (Sved *et al.*, 1992). In the case of anesthesia through nostrils, anesthetic spreads through sphenopalatine foramen, which did not however result in greater patient discomfort.

Patients reported no significant pain or rejection to the palatal puncture or anesthesia injection into the fossa. According to Figun & Garino (2001) the technique was easy and safe. As Mahoney suggested this technique compared to infiltration technique extends the area for anesthesia for oral surgery. In the case of multiple maxillary tooth extractions it is more effective to block the trunk of maxillary nerve via greater palatine canal, than to administer multiple injections and painful palatal punctures.

This pilot study provided the basis for the feasibility of a randomized double blind clinical trial in which the dose studied was compared with that suggested by the authors previously mentioned. The study suggests integrating demographic variables and patient morphotype in a study model to obtain the most effective dose and lower complication rates.

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RESUMEN: El bloqueo troncular del nervio maxilar (BTNM) se logra depositando anestesia vía canal palatino mayor en la fosa pterigopalatina. Los autores difieren en la cantidad de anestesia a depositar y la tasa de complicaciones asociadas (diplopía y hematomas). Coronado et al. (2008) midió el volumen de la fosa pterigopalatina encontrando un promedio de 1,2ml, sugiriendo dicha cantidad de anestesia para el BTNM. El objetivo del presente trabajo es comparar la eficacia de dosis bajas de 1,2ml (DB) versus dosis tradicional de 1,8ml (DT) de anestesia para el BTNM y sus efectos adversos. Se realizó un estudio clínico cuasiexperimental de carácter exploratorio, participaron 82 pacientes donde la técnica anestésica estaba indicada para un procedimiento de exodoncia, los que fueron aleatorizados en los grupos DB y DT, administrándoles lidocaína al 2% con 1:50.000 de epinefrina. Se registraron variables demográficas (sexo y edad), clínicas (pieza a extraer y dosis administrada) y anatómicas (índices facial superior y craneal). El éxito anestésico (EA) se definió como la posibilidad de realizar la exodoncia con nulo o mínimo dolor, medido con escala visual análoga (EVA). En el análisis estadístico se utilizaron los tests de chi cuadrado y t de student ($p<0,05$). Los resultados muestran que el dolor y el EA en el grupo DB fueron de 2,93 y 61,67% y en el DT de 3,09 y 59,09% respectivamente, hubo 6 casos de diplopía sin diferencias estadísticamente significativas entre ambos grupos.

PALABRAS CLAVE: Nervio maxilar; Anestesia; Fosa pterigopalatina; Lidocaína; Exodoncia.

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Correspondence to:
Pedro Aravena Torres
Institute of Anatomy, Histology and Pathology
Faculty of Medicine
Universidad Austral de Chile
Rudloff 1640
Valdivia
CHILE

Email: paravena@uach.cl

Received: 09-03-2011
Accepted: 29-06-2011