International Tinnitus Journal. 2012;17(1):97-99.

A different approach to treatment-resistant tinnitus: pulsed radiofrequency to the ganglion C2

Pieter Jacob Haasnoot[1]
Henk Maria Koning[2]
Thijs Anton van Rheenen[3]

Abstract

Tinnitus represents one of the most common and distressing otologic problems, and it causes various somatic and psychological disorders that interfere with the quality of life. Treatments for tinnitus include pharmacotherapy, cognitive and behavioral therapy, sound therapy, music therapy, tinnitus retraining therapy, massage and stretching, and electrical suppression. In this case report we present a potential treatment, namely pulsed radiofrequency to the ganglion C2.

Keywords: neurology, otolaryngology, tinnitus.

[1] Department of Pain Relief, Medical Centre Jan van Goyen, Jan van Goyenkade 1, 1075 HN, Amsterdam, The Netherlands. E-mail: pieterhaasnoot@gmail.com
[2] Department of Pain Relief - Medical Centre Jan van Goyen, Jan van Goyenkade 1, 1075 HN, Amsterdam, The Netherlands - Amsterdam - Netherlands. E-mail: hkoning@jvg.nl
[3] Medicine - VU University medical centre, De Boelelaan 1117, 1081 HV, Amsterdam, The Netherlands - Amsterdam - Netherlands. E-mail: thijsvanrheenen@gmail.com
Send correspondence to:
Jan van Goyenkade 1, 1075 HN, Amsterdam, The Netherlands.
Paper submitted to the RBCMS-SGP (Publishing Management System) on April 12, 2012;
and accepted on August 16, 2012. cod. 89.

INTRODUCTION

Tinnitus is characterized by the perception of sound in the absence of external stimuli. More than 35 million American adults experience tinnitus[1], with 2-3 million severely debilitated by this distressing symptom. Although many adjust successfully, others are severely disabled by the condition[2].

Numerous neurological, vascular and other somatic disorders have been linked to the development of the tinnitus[3]. Therefore no single treatment will be effective for treating all tinnitus patients. Different treatments will be needed for different subgroups. Possible treatments for tinnitus include pharmacotherapy, cognitive and behavioral therapy, sound therapy, music therapy, tinnitus retraining therapy, massage and stretching, and electrical suppression[4]. In this case report we present a possible treatment for tinnitus, namely pulsed radiofrequency to the ganglion C2.

CASE REPORT

A 56-year-old male with a sixteen-year history of tinnitus was admitted to our pain clinic for treatment. He presented himself with complaints of tinnitus bilaterally and of equal intensity. His hearing was intact and he did not have any cervical complaints or dizziness. Ear nose and throat examination and audiogram did not reveal any specific disorders. The tinnitus was unresponsive to medication, in this case betahistine. Further medication included mirtazipine, an anti-depressant, and diazepam, a benzodiazepine. Both did not influence the intensity of his tinnitus.

Physical examination showed an intact movement of his cervical spine, hypertonic and painful trapezial muscles, and no other specific findings. Treatment via pulsed radiofrequency of the ganglion C2 was proposed. The patient gave informed consent to the treatment.

The procedure was performed by an experienced anesthesiologist on an outpatient basis. The procedure took place without sedation and by utilizing a C-arm fluoroscopic machine with a radiolucent table. The patient was placed in the prone position on the fluoroscopic table. The atlanto-occipital joint to be treated was marked in the anteroposterior view. The skin was prepared and two 22-gauge, 100 mm-long needles with a 5 mm active tip were placed and directed toward the posterolateral aspect of the atlanto-occipital joint, shown in Figure 1 A and B. The C-arm was rotated to the horizontal plane and the needles were then advanced between C1 and C2 until bone contact was made. After confirmation of correct needle placement the C2 ganglion was subjected to pulsed radiofrequency at 42 V, 2 Hz, and 10 ms for 120 seconds.

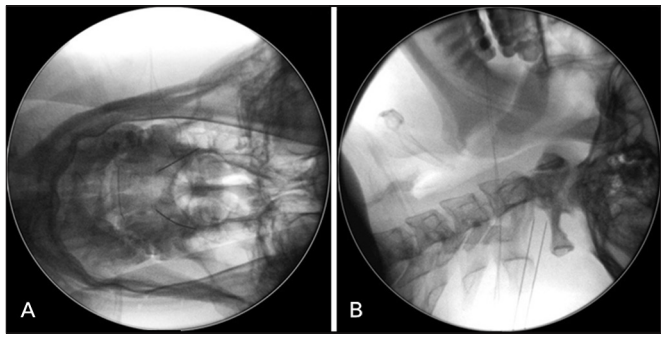

Figure 1. Anteroposterior and lateral view of the atlantooccipital joint and ganglion C2 with correct needle placement.

Following the procedure, patient stayed in the recovery-room for half an hour. The patient's vital signs were stable and he was discharged home in good health.

Four weeks later the patient presented himself for follow up. The tinnitus had resolved majorly, only minor tinnitus remained during the first hours after waking. After three months the tinnitus had not resurfaced, so no further follow-up or treatment was necessary.

DISCUSSION

Tinnitus represents one of the most common and distressing otologic problems, and it causes various somatic and psychological disorders that interfere with the quality of life[5]. If tinnitus persists for more than 2 years, it is considered permanent and irreversible.

Tinnitus does not represent a disease itself but is a symptom of a variety of underlying conditions[6]. There is considerable debate about its cause. Any pathologic lesion in the auditory pathway or any reduction in auditory nerve function has the potential to produce tinnitus[6]. However, in many cases no underlying physical cause is identifiable.

Several theories have been proposed to explain the mechanisms underlying tinnitus. Recent research has employed state-of-the-art imaging and measurement technology to examine tinnitus-related activity in the ear, auditory nerve, and auditory tracts of the brain. These studies have increasingly focused on exploring changes in putative brain-related mechanisms. The complexity of these changes in the nervous system associated with tinnitus might explain why this condition has proved so resistant to treatment.

Chronic tinnitus can be caused by whiplash injuries or functional disorders of the cervical spine[7]. Craniocervical tinnitus is argued to be caused by central crosstalk within the brain, because certain head and neck nerves enter the brain near regions known to be involved in hearing. Complex multimodal interactions exist between the auditory pathway and other sensory-motor systems innervating the head, neck and shoulders.

The atlanto-axial joint and the ganglion C2 can play a role in maintaining the complaints of tinnitus and symptoms can be alleviated via transcutaneous electrical nerve stimulation[8]. This can be explained via a neuronal pathway described in 1997 by Jansen and Loewy, located in the spine and of sympathetic origin[9]. Via pseudorabies virus injections in the stellate ganglion they were able to transneurally label a pathway that connects the cervical spine with the second thoracic vertebra and eventually connects with the superior cervical ganglion. These neuronal pathways enable us to explain sympathetic sensory input to result in innervation of the cochlea in the inner ear, and thus cause tinnitus.

Tinnitus remains difficult to treat, care may be directed towards management rather than cure. However, C2 ganglion treatment may prove promising, as shown in this case-report and earlier studies. Further research seems justified to better demonstrate and understand the positive effect of C2 ganglion blockade in tinnitus. In our opinion, C2 ganglion blockade seems worthwhile in patients with treatment-resistant tinnitus. Especially, as it is a feasible and safe technique when performed by an experienced anesthesiologist[10].

REFERENCES

1. Shargorodsky J, Curhan GC, Farwell WR. Prevalence and characteristics of tinnitus among US adults. Am J Med. 2010 Aug;123(8):711-8.
2. Malouff JM, Schutte NS, Zucker LA. Tinnitus-related distress: A review of recent findings. Curr Psychiatry Rep. 2011 Aug;13(1):31-6.
3. Lockwood AH, Salvi RJ, Burkard RF. Tinnitus. N Engl J Med. 2002 Sep 19;347(12):904-10.
4. Seidman MD, Standring RT, Dornhoffer JL. Tinnitus: current understanding and contemporary management. Curr Opin Otolaryngol Head Neck Surg. 2010 Oct;18(5):363-8.
5. Byung In Han, Ho Won Lee, Tae You Kim, Jun Seong Lim, and Kyoung Sik Shin. Tinnitus: Characteristics, Causes, Mechanisms, and Treatments. J Clin Neurol. 2009 March;5(1):11-19.
6. Shulman A, Goldstein B, Strashun AM. Final common pathway for tinnitus: theoretical and clinical implications of neuroanatomical substrates. Int Tinnitus J. 2009;15(1):5-50.
7. Folmer RL, Griest SE. Chronic tinnitus resulting from head or neck injuries. Laryngoscope. 2003 May;113(5):821-7.
8. Transcutaneous electrical nerve stimulation (TENS) of upper cervical nerve (C2) for the treatment of somatic tinnitus. Vanneste S, Plazier M, Van de Heyning P, De Ridder D. Exp Brain Res. Jul 2010;204(2):283-7.
9. Jansen AS, Loewy AD. Neurons lying in the white matter of the upper cervical spinal cord project to the intermediolateral cell column. Neuroscience. 1997 Apr;77(3):889-98.
10. Halim W, Chua NHL, Vissers KC. Long-term pain relief in patients with cervicogenic headaches after pulsed radiofrequency application into the lateral atlantoaxial (C1-2) joint using an anterolateral approach. Pain Pract. 2010;10:267-71.