Transient Interruption of Unilateral Tinnitus by Fentanyl and Propofol in a Patient with Neuromuscular Disorder

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Abstract: A 64-year-old man with left-sided tinnitus since September 2003 underwent left atrial catheter ablation for atrial flutter that he had been experiencing since 1999. For the procedure, he was anesthetized with a cumulative intravenous dosage of 700 mg propofol and 0.5 mg fentanyl over 2.5 hours. The patient's tinnitus had completely disappeared after he awoke from the anesthesia. Ten days after the procedure, however, tinnitus recurred. In conclusion, high-dose intravenous fentanyl and propofol transiently discontinue unilateral, idiopathic tinnitus. The observed effect may have implications for the treatment of tinnitus.

Key Words: anesthesia; buzzing; hearing; neuromuscular vertigo; side effect; therapy

Owing to its multifactorial origin (Table 1) [1], tinnitus presents a treatment challenge [2]. In cases in which its cause can be identified, the success rate is higher than in idiopathic cases [3]. For idiopathic tinnitus, various therapeutic strategies have been proposed (Table 2) [4]. Discontinuation of tinnitus after administration of fentanyl and propofol has not been reported in the literature thus far.

CASE REPORT

In September 2003, a tinnitus newly occurred on the left side in a 64-year-old man with a history of muscle cramps and fasciculations since boyhood; easy fatigability; slightly but recurrently elevated serum glutamic-oxaloacetic transaminase and serum glutamic-pyruvic transaminase; arterial hypertension; hyperuricemia; adequately treated borreliosis; nephrolithiasis; muscle cramps; and paroxysmal atrial flutter since 1999. The man's hearing was subjectively not affected, but initial audiometry revealed impaired hearing for lower frequencies on the left side. Follow-up audiogram results were normal. The tinnitus was recurrently associated with vertigo, nausea and, occasionally, vomiting. Initially, the sound was a low-frequency permanent noise evoking the feeling of a water-filled left ear. Later on, the frequency changed and evoked an unpleasant feeling on reaching higher frequencies. The man had not undergone any treatment for idiopathic tinnitus thus far (see Table 2). His family history was informative for diabetes mellitus (father, sister), renal failure (brother), heart failure and tetanus (mother), short stature (mother, sister), and liver cell carcinoma (father).

For his paroxysmal atrial flutter, the patient had undergone right atrial catheter ablation in spring 2002, with a short-lived effect. In December 2003, a second catheter ablation was performed. At that time, the patient was receiving metoprolol, ramipril, allopurinol, pentoxifylline, and betahistine. At the beginning of the procedure, the patient received local anesthesia with lidocaine, which the treating physician carefully avoided to inject intraarterially. For analgesia and sedation during the procedure, which lasted 2.5 hours, the patient received a total of 0.5 mg fentanyl and 700 mg propofol intravenously via a motor pump.

Immediately after waking from anesthesia, the patient recognized that the left-sided tinnitus had completely disappeared. Additionally, vertigo and nausea had completely vanished. Pentoxifyllin and betahistine were discontinued. Ten days after the intervention, left-sided, high-frequency tinnitus recurred, associated with vertigo, nausea, and vomiting. Pentoxifyllin and betahistine were

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Table 1. Causes of Tinnitus

Vascular: high blood pressure; AICA pontocerebellar infarction; middle-ear hemangioma; high jugular bulb; chronic subdural hematoma; migrainous infarction, tandem internal carotid artery (ICA) stenosis; aberrant ICA; diverticulum of the sigmoid sinus; jugular bulb diverticulum; severe ICA kinking and coiling; carotid cavernous fistula; transverse-sigmoid sinus aneurysm; vascular compression; lateral sinus vein thrombosis; cervical artery dissection; orthostatic, benign dural arteriovenous fistula; cervical venous hums; capillary telangiectasia; Hippel-Lindau disease; Eagle's syndrome

Infections (immunological): meningitis; otitis media; hepatitis B vaccination; nasopharyngeal tuberculosis; human immunodeficiency virus; borreliosis; Wegener's granulomatosis; neurosyphilis; Behçet's syndrome; limbic encephalitis; Vogt-Koyanagi-Harada syndrome; labyrinthitis; cysticercosis

Metabolic: mitochondriopathy; hyperinsulinemia; diabetes mellitus; hyperlipidemia; Fabry's disease; zinc deficiency

Trauma or surgery: skull or brain trauma; head-neck trauma; stapes surgery; posttraumatic leptomeningeal cyst; noise exposure; acoustic trauma; whiplash injury; boxing; rupture of round-window membrane

Tumor: acoustic neurinoma; cerebellopontine angle tumor; chondrosarcoma of the jugular foramen; arachnoidal cyst; Langhans' cell histiocytosis; giant-cell tumor of the skull base; nasopharyngeal carcinoma; cochlear, vestibular, or facial-nerve schwannoma; glomus tumor in the ear; cholesteatoma

Drugs: quinine; acetylsalicylic acid; aminoglycosides; loop diuretics; antineoplastic drugs; antimalarial drugs; clarithromycin; valproic acid; interferon; bupivacaine; sildenafil

Miscellaneous: stapedius, middle-ear, or palatal myoclonus; Ménière's disease (tinnitus, hearing loss, vertigo); depression; scuba diving; dehiscence of the posterior semicircular canal; extensive pneumatization of the temporal bone; superficial siderosis; instability of the upper cervical spine; stress; congenital internal auditory canal stenosis; fibrous dysplasia of the petrous bone; posterior lumbar decompression; fibromuscular dysplasia; bruxism; autosomal-dominant partial epilepsy with auditory features; osteosclerosis; Kimmerle anomaly; Eagle's syndrome; embedding of jugular vein bulb to inferior pyramidal wall

Table 2. Therapeutic Strategies for Idiopathic Tinnitus

Some effect: lidocaine (intravenous, transtympanic, intradermal); alprazolam; tricyclic agents; extradural electrical stimulation over the mastoid; enoxaparin; leupeptin; intratympanic dexamethasone

Mixed evidence of effect: biofeedback; psychotherapy; tinnitus-retraining therapy; sequential sound therapy; pulsed high-frequency electromagnetic therapy; clonazepam; gentamicin; low-frequency muscle vibration

No effect: acupuncture; masking; lidocaine iontophoresis; carbamazepine; tocainide and related drugs; vitamin B_{12}; melatonin; zinc; Ginkgo biloba; hyperbaric oxygen therapy; benzodiazepines other than alprazolam; gabapentin; gene therapy; transtympanic pilocarpine

restarted, with limited effect. The frequent muscle cramps responded well to magnesium.

Clinical neurological investigation revealed ptosis on the left side, hypoacusis on the left side, slight wasting of the tongue edges, generally absent deep-tendon reflexes, slight wasting of the thighs, a deficit of elbow extension of 5 degrees bilaterally, postural tremor, gynecomastia, and turning to the right by 45 degrees on Unterberger's treadmill test. The lactate stress test result was abnormal. Nerve conduction studies and electromyography revealed a carpal tunnel syndrome exclusively. A magnetic resonance imaging scan of the brain showed multiple, small white-matter lesions in the parietal region bilaterally. Results of ultrasonographic investigation of the carotid arteries, otolaryngologic investigation, and audiometry all were normal.

To reproduce the curative effect of propofol or fentanyl on the tinnitus, the patient was scheduled to undergo a second injection with propofol and fentanyl. However, at follow-up, five months after the second ablation, the tinnitus had already decreased to such a degree that it no longer affected the patient's well-being.

DISCUSSION

The cause of tinnitus in the described patient remained speculative. Possible causes were arterial hypertension, increased tone of the cervical muscles, stress or cardiac rhythm abnormality, and mitochondriopathy (see Table 1). Because the man's blood pressure was well controlled, it was not regarded as causative. A cervicogenic cause was largely excluded, as physiotherapy of the cervical spine was ineffective. The cardiac rhythm abnormality was excluded because it had persisted for 4 years, whereas the tinnitus had persisted for only 3 months. Additionally, the tinnitus recurred even though atrial flutter had been successfully stopped after the second ablation. Mitochondriopathy was considered because of the patient's individual and family history and the clinical neurological examination results and because tinnitus has been reported to occur in 7% of patients with mitochondriopathy [5]. Other possible causes of tinnitus (see Table 1) were excluded by a perusal of the patient's history and through appropriate investigations.

Whether fentanyl, propofol, or both caused the described effect remains speculative. Arguments in favor of propofol are that it reduces blood pressure; causes bradycardia, tachycardia, and metabolic acidosis; increases the serum level of fentanyl; and causes hyperkalemia [6]. Arguments against propofol are that no anti-tinnitus effect of the substance has been previously reported and that it may cause muscle rigidity [6]. An argument favoring fentanyl is that it causes bradycardia and arterial hypotension [6]. Arguments against fentanyl are that it increases the intracranial pressure and causes muscle rigidity. Assuming a cervicogenic origin, one can speculate that muscle relaxation during an-

esthesia relieved hypertension of the cervical muscles. However, this assumption does not explain why the effect lasted for 10 days, although the muscle-relaxant effect of anesthesia had disappeared already. Additionally, a cervical cause of the tinnitus could not be excluded definitively, as no magnetic resonance imaging scan of the cervical spine had been performed. That discontinuation of tinnitus was caused by unintentional intraatrial administration of lidocaine is rather unlikely, given the particular care with which the local anesthesia was placed, the fact that the tinnitus did not disappear immediately after injection of the local anesthetic, and the long-standing therapeutic effect (10 days).

The causes of left-sided ptosis, fasciculations, muscle cramps, easy fatigability, the generally reduced deep-tendon reflexes, or elevation of some muscle enzymes in this patient remain speculative, as results from nerve conduction studies, electromyography, and creatine-kinase analysis were repeatedly normal. These negative results, however, do not exclude a neuromuscular disorder, such as a laminopathy or metabolic myopathy. The most frequent causes of ptosis (e.g., brainstem infarction, myasthenia, myopathy, trauma, and congenital origin) were appropriately excluded. Our study was limited in that the cause of tinnitus could not be definitively discovered and we could not determine whether fentanyl, propofol, or both were responsible for the therapeutic effect.

CONCLUSION

This case study shows that high-dose intravenous fentanyl and propofol may transiently discontinue unilateral, idiopathic tinnitus. Whether the observed effect has any therapeutic implications remains to be investigated.

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