




Case Report

Seizure as Early Presentation of a Pneumocephalus after Cochlear Implant: A Case Report

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Pneumocephalus after cochlear implantation is very rare with five reported cases in the literature. The presence of clinical features in the immediate postoperative period has never been reported, because they occur weeks after surgery. These neurological manifestations can compromise the patient's life; thus, it is important to have proper knowledge and management of these manifestations. We present a case report with a review of the literature. A 35-year-old man began having seizures a few hours after a cochlear implantation. Computed tomography (CT) scan revealed a pneumocephalus and bone defect at the level of the electrode's drilling path, not objected during the surgery. The patient was handled conservatively, and in subsequent reviews, CT objected reabsorption of the pneumocephalus. The presence of a pneumocephalus should be taken into account in the neurological features of a patient with cochlear implant, especially if mastoid bone defects are suspected during surgery. The management of the pneumocephalus will, in most cases, be conservative, consisting of clinical observation and imaging tests. Surgical treatment is reserved for situations in which the clinical manifestations are very symptomatic and when they are tension pneumocephalus.

KEYWORDS: Seizures, cochlear implant, pneumocephalus, postoperative complications

INTRODUCTION

Complications of cochlear implants are rare, and when they occur, they are similar to those of middle ear surgery: infections, facial nerve palsy, and cerebrospinal fluid (CSF) fistulas.^[1] Postimplantation, pneumocephalus is rare; however, it must be taken into account because it can be a serious pathology because of the involvement of the brain mass.

The first case of an intraparenchymal pneumocephalus that occurred a few hours after the intervention, although infrequent, should be taken into account as close monitoring of the patient is necessary.

CASE PRESENTATION

A 35-year-old man with a unique personal history of severe bilateral, postlingual sensorineural hearing loss began having seizures a few hours after a cochlear implantation. Imaging tests before surgery, computed tomography (CT) scan and magnetic resonance imaging (MRI), showed no pathological findings. The intervention was performed in February 2018 using a transmastoid approach with posterior tympanotomy and complete round window electrode insertion (Medel Flex 28 model; MEDEL Corporation, Durham, N.C., USA), without incident. After 3 h postoperatively, the patient began experiencing mental confusion and disorientation followed by generalized tonic-clonic crisis with relaxation of the bladder sphincters. A single dose of Diazepam 5 mg (Valium; Roche Farma, Basilea, Switzerland) intramuscular was administered to avoid self-injury, impacts on the implant site, and bleeding from the surgical wound. The acute phase was resolved, leaving the patient in a postcritical state.

The condition of the surgical wound was evaluated and no signs of local complication were observed. The otological examination was completely normal, and so urgent CT skull was requested. This showed several intraparenchymal air sacs in the left temporal lobe (Figure 1), corresponding to pneumocephalus without midline displacement. No pneumocochlea or defect was found in the tegmen tympani. In the 3D reconstruction of the CT scan, a bone defect was observed at the implant site (Figure 2). Guidelines for action were agreed with the Neurosurgery Service and consisted of close monitoring, anticonvulsant treatment with levetiracetam

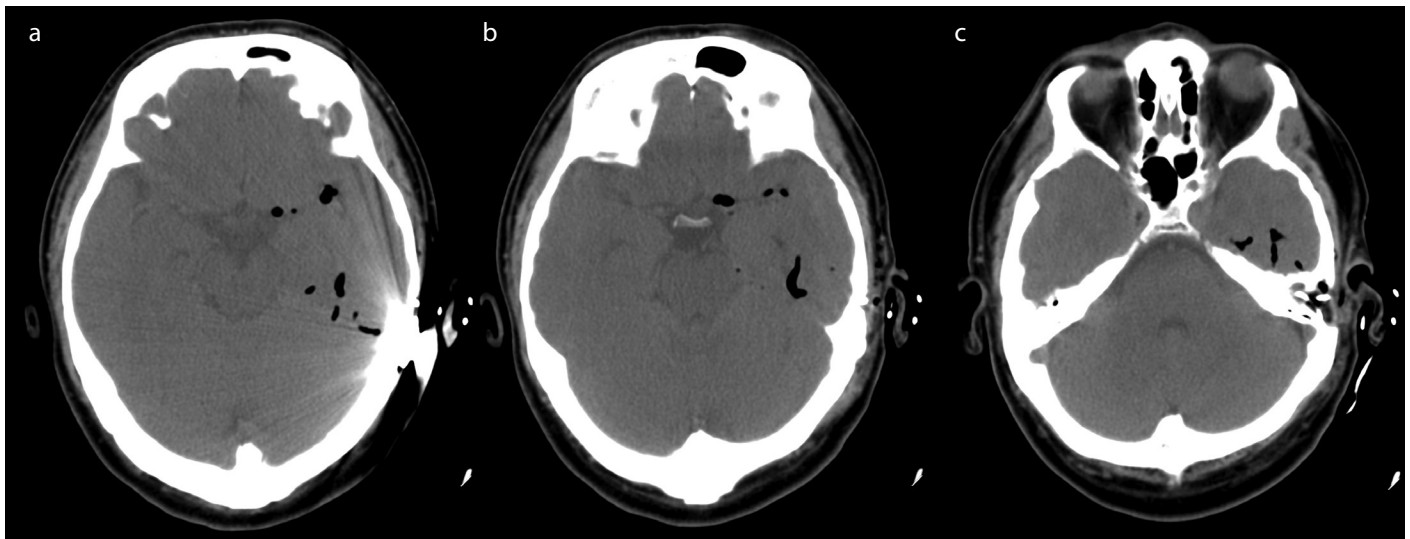


Figure 1. a-c. Axial Computed Tomography 3 h after the cochlear implantation demonstrating pneumocephalus in the temporal lobe (a, b, and c). (a) The point of entry from the implantation zone is shown. (b) Air sacs migrating from the temporal lobe to lateral sulcus. (c) Temporal lobe air sacs and electrodes of cochlear implant.

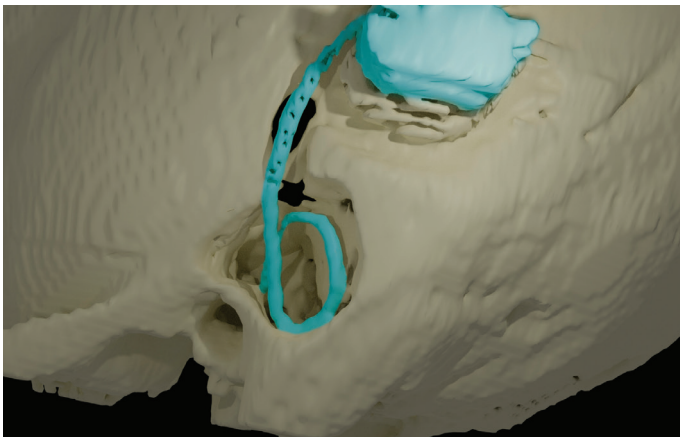


Figure 2. 3D reconstruction showing the bone defect in the temporal bone. The electrode path of the implant is shown (in green).

(Keppra; Glaxosmithkline, Brentford, United Kingdom) at a dose of 500 mg/12 h, oxygen at high flow, supine decubitus rest at 0°, and the non-performance of Valsalva maneuvers.

The patient was asymptomatic for the next 24 h. A new control CT was requested in which a marked decrease in the size of the intra-parenchymal pneumocephalus was observed. After 48 h of hospi-

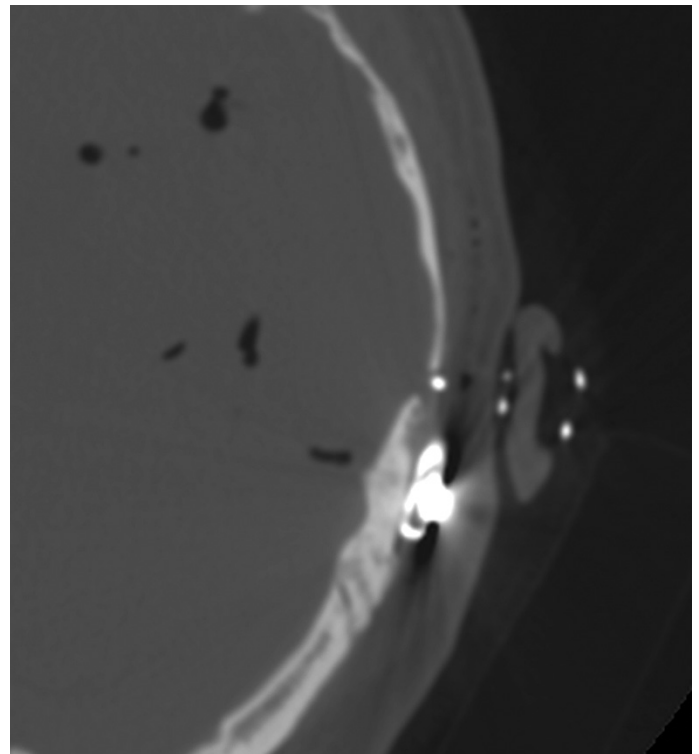


Figure 3. Axial Computed Tomography 3 h after the cochlear implantation demonstrating the surgical defect in the temporal bone.

MAIN POINTS

- Pneumocephalus is a potentially serious complication that can occur in cochlear implant surgery, a routine surgery performed apparently without any incidents observable by the surgeon.
- Drilling the cortical is an important step to avoid mobilization of the device and must be done very carefully due to the proximity of the meninge.
- Imaging exams are important in the presence of neurological symptoms in a patient undergoing cochlear implantation surgery.

tal observation, the patient remained asymptomatic and without signs of neurological focus; therefore he was discharged with anticonvulsant treatment. The patient's condition was reviewed on the 15th day with a new CT scan as he had not presented new episodes or other associated symptomatology. The CT scan showed a complete resolution of the pneumocephalus, and therefore anticonvulsant treatment was suspended. The implant was activated 1 month after surgery and after 2 months of surgery, the patient has not presented any other symptoms and the implant works without incidents. The patient gave informed consent for the publication of this case.

DISCUSSION

Pneumocephalus after cochlear implantation surgery is extremely rare with only five cases described in the literature. Cochlear implantation surgery is becoming more frequent because of the growing number of centers that perform this intervention. For this reason, it is important to know the possible complications and the different forms of their clinical presentation.

Two causal mechanisms have been proposed in the literature for the entry of air into the brain region after surgical procedures. The first mechanism consists of the pressure gradient generated by the positive atmospheric pressure in front of the intracranial pressure, causing a valve mechanism with the introduction of air but preventing its exit.^[2] In this case, the most plausible mechanism for the entry of intracranial air is the possibility of cortical and dural injury during surgery (Figure 3). However, although less likely, we cannot rule out the second causal mechanism consisting of a decrease or loss of CSF, which causes a negative pressure, sucking air from the outside through the defect, a mechanism known as the "soda bottle down effect."^[3]

This case is the first in the literature where the clinical features for the development of pneumocephalus occur in the immediate postoperative period. Hagr et al^[4] described a case of intraparenchymal pneumocephalus in which the patient manifested fever, otalgia, and inflammation around the ear 5 weeks after the implant. In the case reported by Di Lella et al,^[5] it was after 8 weeks that the patient began having headache, fever, vomiting, cervical pain with movements, and mental confusion. In both cases, chronic nose blowing was the trigger. Furthermore, in the case reported by Di Lella et al,^[5] a defect was identified at the level of the tegmen tympani for an air entry point. Very similar is the case reported by Gillet et al^[6] where the symptoms were mild headache and lack of concentration, established after 6 days in a patient, a swimmer who performed Valsalva maneuvers 30 times a day to "clean their ears." Page et al^[7] also described a surgical defect in the tegmen tympani during mastoid drilling as an air entry point in a diffuse pneumocephalus with a slight mass effect. Again, Valsalva maneuvers, sneezing, or postsurgical coughing appear to be the causal mechanisms of the pneumocephalus. Here, the clinical symptoms occurred at 12 days and consisted of headaches associated with nausea, mild imbalance, and a vague numbness of the right leg. In our case, the patient did not perform any Valsalva maneuver, and neither did he blow his nose before the establishment of clinical features. This did not occur in the case reported by McKinnon and Watt,^[8] but in their case, the pneumocephalus was produced after a pneumocochlea because the implant was placed by cochleostomy. The patient's clinical symptoms were headache and cervical pain that began 6 years after implant placement.

The management of pneumocephalus will, in most cases, be conservative, consisting of clinical observation and imaging tests. Surgical treatment is reserved for situations in which the clinical manifestations are very symptomatic and when they are tension pneumocephalus.^[9] In our case, we opted for a conservative attitude with vigilance and anticonvulsant treatment.

The presence of seizures is rare, although the toxic effect of air on the cerebral parenchyma is known because of the cerebral edema that

occurs around the air bags,^[10] which is why we believe that anticonvulsant drugs should be administered in these cases.

CONCLUSION

Pneumocephalus is an extremely rare condition that can occur in the immediate postoperative period following cochlear implant surgery. In patients manifesting neurological features, mental confusion, headache, seizures, and/or cervical pain with a history of cochlear implantation, even a few hours after implantation, the possibility of pneumocephalus must be taken into account. Moreover, if there is intraoperative suspicion of mastoid bone defect, imaging tests are essential for the diagnosis and follow-up of this pathology. The treatment must be adjusted to the characteristics of each patient, and surgery may be necessary for its resolution.

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