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Case Report

Misplaced cochlear implant into the superior semicircular canal

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ABSTRACT

Cochlear implantation (CI) has become a routine surgery for the treatment of profound hearing-impaired patients all around the world. Surgical complications can occur and are an unexpected medical event related to the procedure itself and causing additional morbidity or a need for a revision surgery. Our goal was to describe a clinical case of a major complication of CI placement and the treatment performed. Our case is about a 68-year-old man proposed for unilateral CI placement. The electrode was placed in the vestibule and semicircular canal requiring surgical revision. This is a rare complication described in literature. Patient gave verbal consent to publish the case.

Keywords: Cochlear implants, Complication, Superior semicircular canal, Surgery

INTRODUCTION

Cochlear implant has revolutionized adults and children lives with profound and severe hearing loss, unilaterally and bilaterally. It is considered, nowadays, the treatment of choice in patients whose auditory rehabilitation with hearing aids isn´t beneficial.[1]

Complications in cochlear implant surgery can be divided into minor – can be resolved with conservative treatment or minimal invasive surgery, and major - requires, sometimes, surgical revision and/or reimplantation.[2] In literature main reasons to surgical revision are: device extrusion, device failure and electrode misplacement. Insertion of the electrode array into vestibule and out of the cochlea is considered a major complication and corresponds to approximately 0,17 to 2,12% of all major complications.[3] Cochlear implant electrode array misplacement can be associated with damage to neurovascular structures like internal carotid artery, vestibular disturbance, and failure in hearing rehabilitation.[4]

Intraoperatively, appropriate electrode placement can be confirmed with electrophysiologic measures and postoperative with cranial x-ray.[5] Proops et al showed that there was a 7% chance of an abnormal position on x-ray even when the surgeon thought the procedure went without difficulty.[6] Electrophysiologic measures like neural response telemetry (NRT) can be misunderstood because no measurable NRT doesn´t indicate lack of auditory response or a dysfunctional device. So, sometimes, may lead surgeons not taking it as an alarm signal. NRT is used to assess the response of a patient's auditory system to electrical stimulation immediately after surgery. In case of doubt, intracochlear impedance measurements as well as radiographic evaluation of CI position can be used to confirm correct position.[3]

CASE REPORT

A male, 68 years old, with a post-lingual profound bilateral sensorineural hearing loss without discrimination on vocal audiometry was observed in an ENT appointment for CI placement assessment (Figure 1). High resolution CT-scan and a magnetic resonance imaging were performed and didn´t show the presence of malformations in inner ear or retro cochlear pathology. video head impulse test was performed and showed a left vestibular hypofunction (Figure 2). He underwent CI (cochlear implant) (advanced bionics SLIM J) placement on left ear through a posterior tympanotomy where the

round window was clearly identified and electrode array was fully inserted through the membrane with no resistance. NRT was performed and no neural response was detected. On the next day a cranial x-ray was performed and already showed an abnormal electrode array position (Figure 3). A CT-scan showed placement of electrodes on anterior aspect of the vestibule and in superior semicircular canal (Figure 4 to 6). Patient hadn´t vestibular symptoms due to already known left vestibular hypofunction. It was performed a surgical revision where the misplaced electrodes were removed and reimplantation through round window was performed. Electrode position was confirmed by taking an intraoperative cranial x-ray (Figure 7). One month after surgery CI was activated without any complication. Patient had an improvement in hearing thresholds (pure tone average approximately 50 dB) (Figure 8).

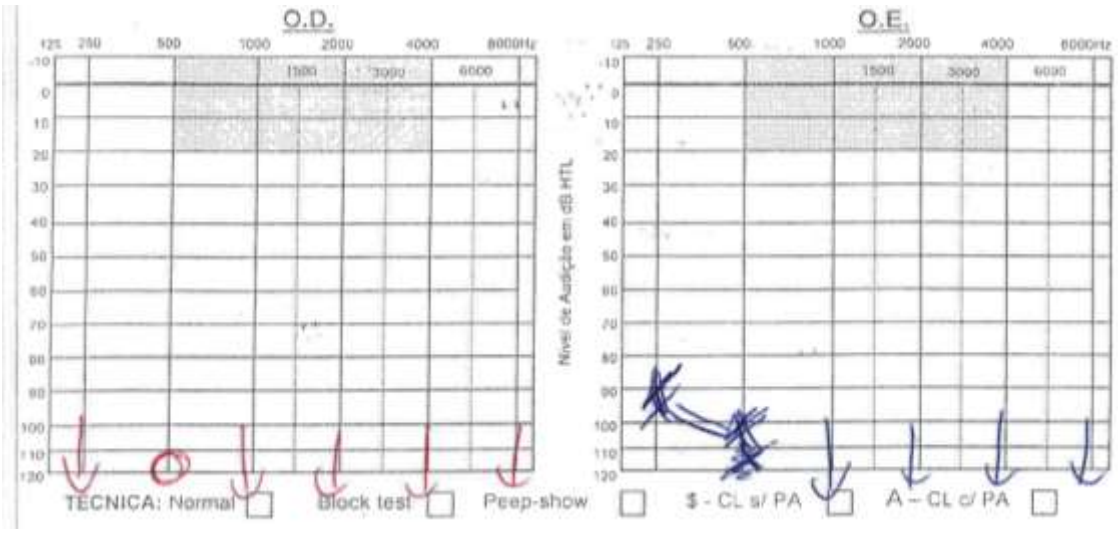

Figure 1: Audiogram showing a profound bilateral sensorineural hearing loss.

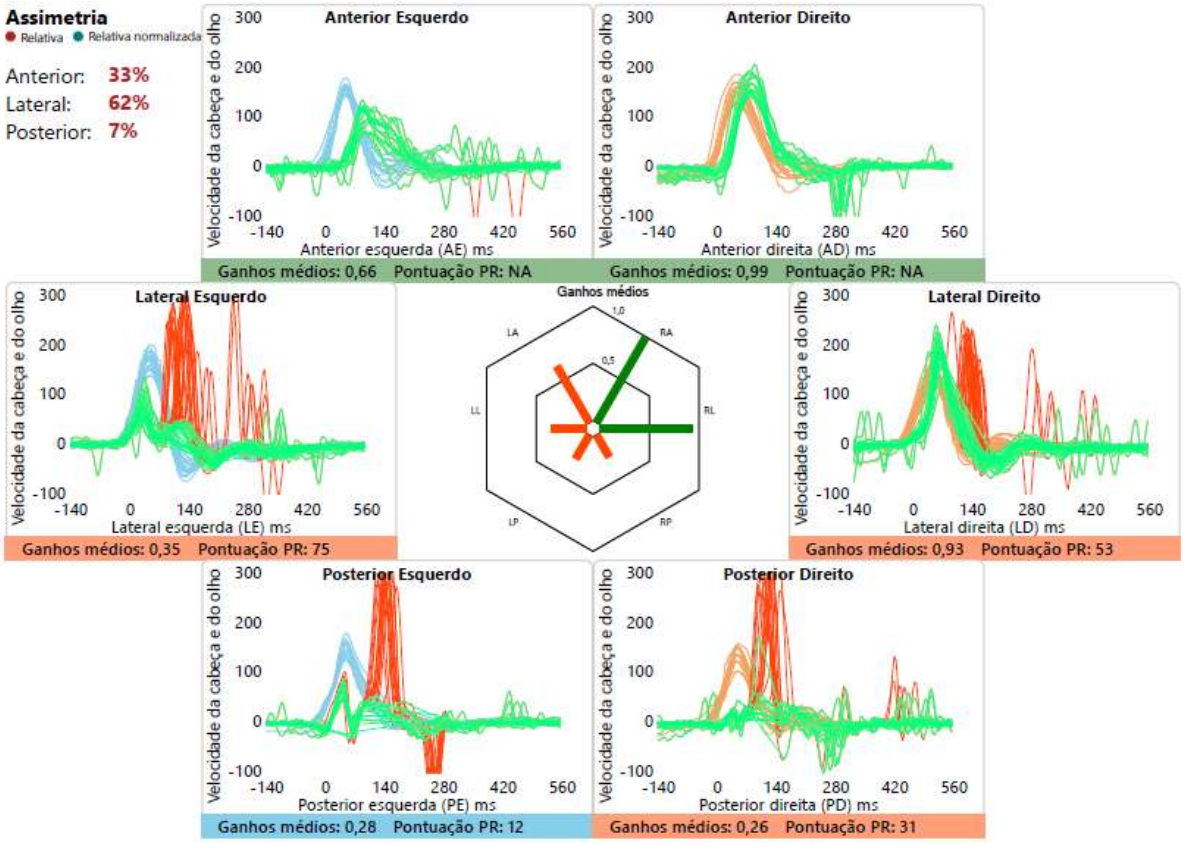

Figure 2: Video head impulse test showing a left vestibular hypofunction.

Figure 3: Cranial x-ray showing an abnormal electrode array position.

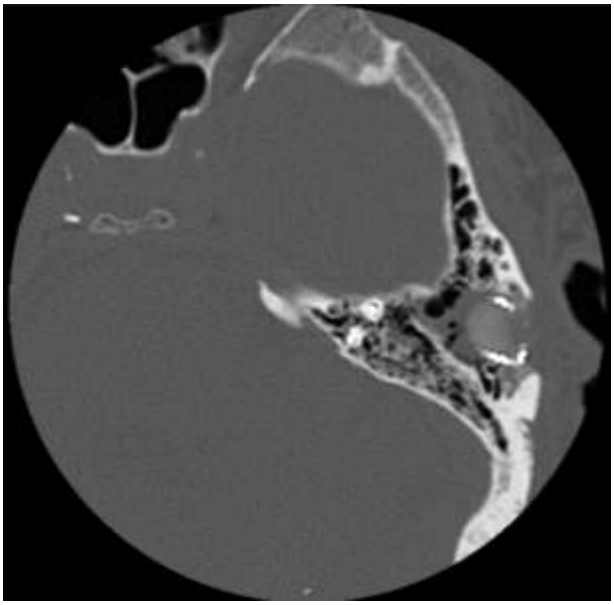

Figure 4: Axial CT-scan showing placement of electrodes in superior semicircular canal.

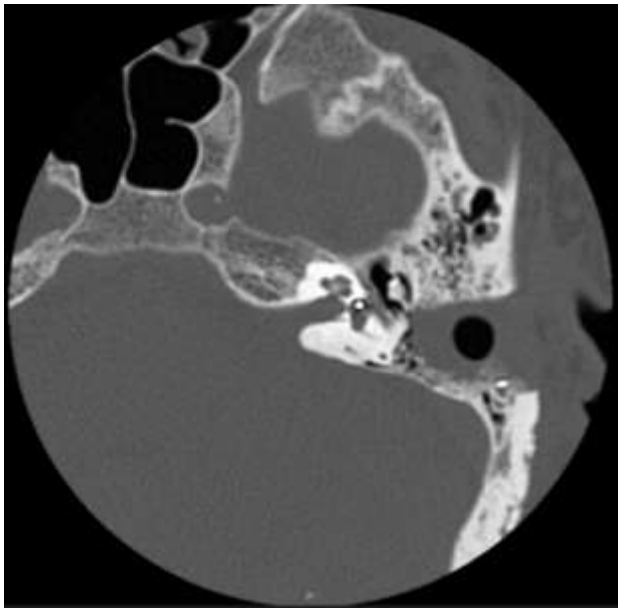

Figure 5: Axial CT-scan showing placement of electrodes on anterior aspect of the vestibule.

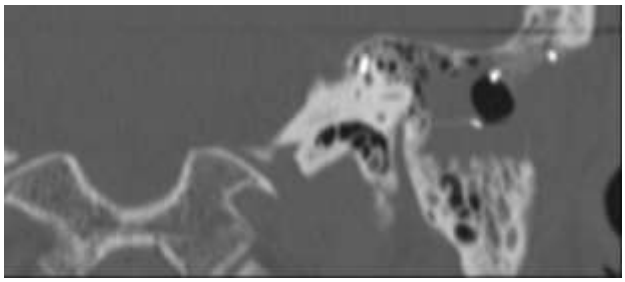

Figure 6: Coronal CT-scan showing placement of electrodes in superior semicircular canal.

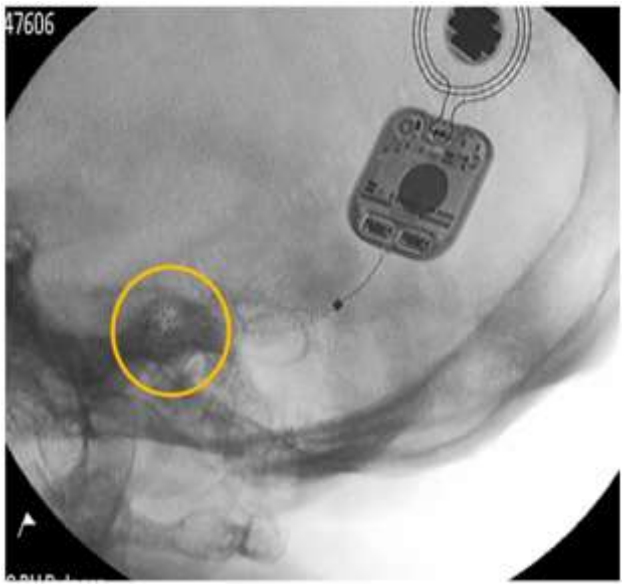

Figure 7: Cranial x-ray showing a normal electrode array position.

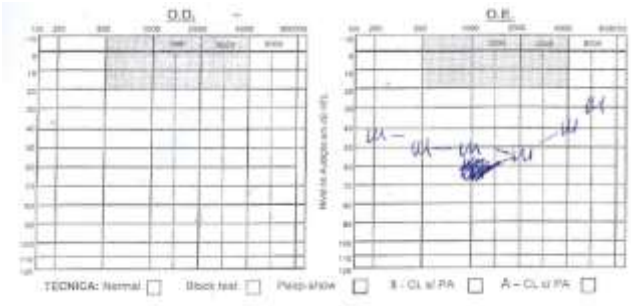

Figure 8: Audiogram showing an improvement in hearing thresholds.

DISCUSSION

Our goal was to describe a clinical case of a major complication of CI placement and the treatment performed.

Cochlear implantation involves the placement of a foreign body on peripheral auditory system and it isn´t risk-free8. However, is known to be a safe procedure with a low rate of complications.[9]

In our case what happens was that when placing the electrode through round window towards scala tympani there was a curvature that caused the entrance directly into the vestibule and then into superior semicircular canal, despite having entered without resistance. On the revision surgery care was taken to insert electrodes towards scala tympani. Intra-operatively, absence of NRT, like in our patient, does not always indicate the lack of stimulation or misplaced electrodes. So, NRT cannot be used safely to assess correct electrode placement. Radiography intra-operative was considered the method of choice for confirmation the proper position of the electrodes but, nowadays is not considered useful for uncomplicated cochlear implantations.[10]

Radiological assessment on the next day was useful to verify electrodes misplacement into the superior semicircular canal. It is recommended that when there is a suspected complication after CI placement that a CT-scan should be ordered as it is the gold standard in these situations11. In cases without auditory benefit, those patients should be evaluated with device integrity testing and a CT-scan.

Cochlea is within walking distance to important structures and, because of this, mispositioning can occur. Electrode array insertion in superior semicircular canal is a rare complication of CI placement, and only a few cases are described in literature. After diagnosis, revision surgery with reimplantation is the indicated treatment.

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