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Technical Note

Orthopedic Surgery Position Enhances Safety in Adults with Cervical Rigidity during Cochlear Implantation

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Abstract: Cochlear implantation is the therapy used for patients with severe to profound sensorineural hearing loss. For the success of the surgery, it is important that each surgical step is performed with meticulous precision, starting from the correct patient position on the operating table. In elderly or obese patients, this can be difficult to achieve due to cervical rigidity. With this technical note, we want to describe a new position from orthopedic surgery to perform a posterior tympanotomy accurately, ensuring a safe procedure and avoiding unpleasant complications.

Keywords: sensorineural hearing loss; cochlear implantation; mastoidectomy; posterior tympanotomy

1. Introduction

The number of hospitals specialized in cochlear implants has recently increased and so has the number of people who can benefit from such devices.

A cochlear implant is the standard treatment for patients with sensorineural hearing loss ranging from severe to profound [1]. The surgical procedure for cochlear implantation aims to atraumatically insert the cochlear implant electrode array into the cochlea. Surgeons must access from the surface of the temporal bone (Figure 1a) to reach the round window (Figure 1b). In standard procedures, this access is created by removing portions of the mastoid bone through a mastoidectomy with antro-atticotomy and posterior tympanotomy [2,3].

Cochlear implantation surgery is well tolerated in the elderly. However, despite many advantages, different kinds of complications [4,5] might occur and they must be studied very carefully.

First, the correct patient's position on the operating table is crucial for otology surgery as it can directly impact access to the surgical site, stability during the surgery procedure and comfort post-implantation for the patient. The essential prerequisite for performing a safe surgical procedure avoiding surgical complications or fatal consequences is the position of the patient's head, which should be rotated 180 degrees toward the opposite side of the surgeon's position.

While this approach is suitable in the majority of cases, certain anatomical variations or medical conditions may require alternative positioning strategies to optimize surgical access and minimize risks.

Possible complications, if there is no correct visualization of the area of posterior tympanotomy, could be the impossibility of continuing the surgery with the standard technique, the excessive thinning of the wall of the auditory canal [6] with its subsequent erosion, damage to the VII cranial nerve [7] and the opening of the lateral or posterior semicircular canal [8].

The degree of head mobility varies widely among the population. It can be different from one patient to another and it can also change within the same person based on the moment of his/her life. For example, elderly or obese patients may be affected by neck stiffness.

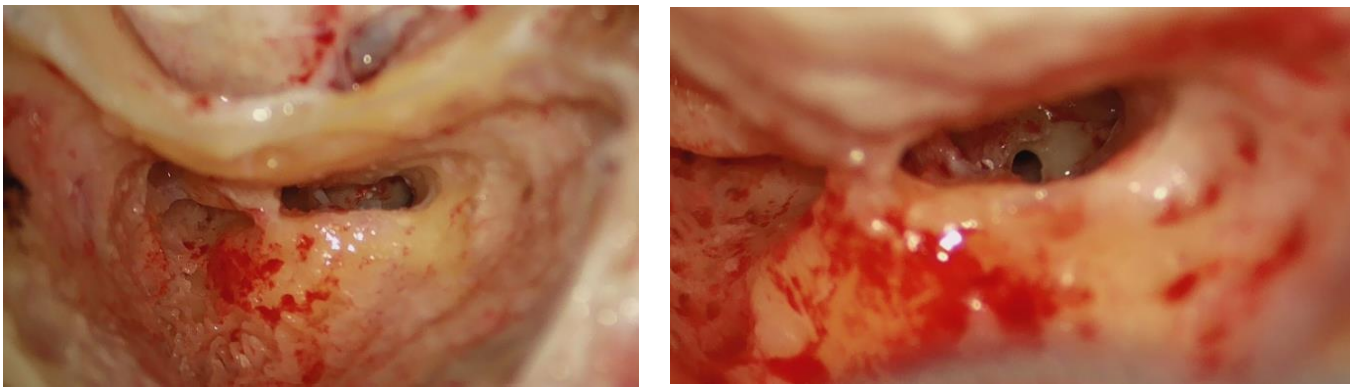
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(**a**) (**b**)

Figure 1. (**a**) Mastoidectomy with posterior tympanotomy; (**b**) The view of the round window through the posterior tympanotomy.

In such cases, the issue can be overcome by rotating the operating table; however, sometimes, the correct view to perform posterior tympanotomy is still not achieved.

Our aim, with this technical note, is to explain our strategy, inspired by orthopedic surgery [9], in order to overcome this challenge. We retain that using this original position during cochlear implantations, an optimized surgical exposure to undertake an optimal posterior tympanotomy and view of the round window, will be obtained even in patients with significant cervical rigidity. This new method allows a safe procedure for both patient and surgeon.

2. Materials and Methods

In the ENT clinic of Valdagno (Vicenza), 63 patients over 65 y underwent cochlear implantation with remarkable emphasis on safety and anatomical precision from 2021 to 31 December 2023. In 10 of these patients, "orthopedic surgery position" was adopted.

Description of the Clinical Techniques

Standard position during cochlear implantation is supine with the head rotated 180 degrees toward the opposite side of the surgeon's position. In some patients, this correct position may not be attainable. Sometimes, for example, in cases of severe cervical arthrosis or obese patients, the angle of head rotation may be limited to an angle range within 45 degrees. The rotation of the bed is a surgeon's expedient to obtain a good field to perform a posterior tympanotomy. However, this increases the instability of the procedure and exposes the patient to a higher risk of complications.

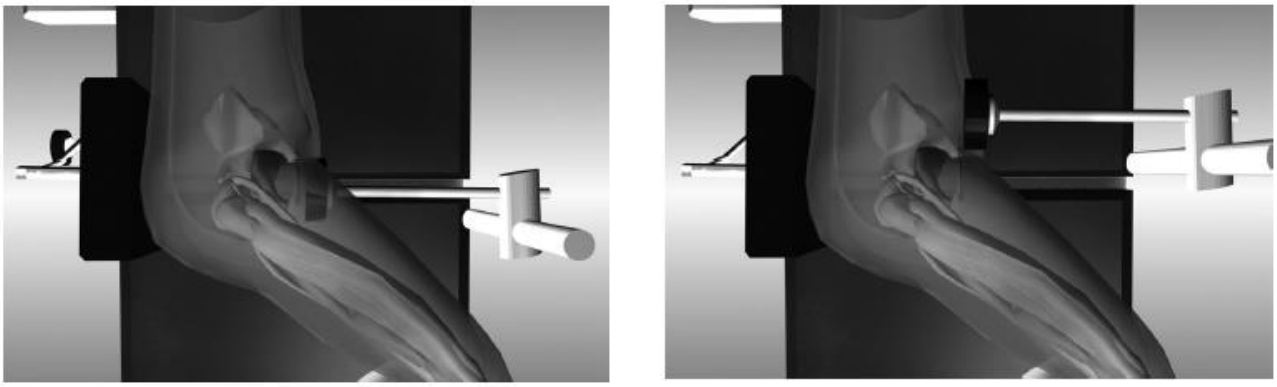
The orthopedic position used in "hip replacement surgery" can be adopted to avoid this impediment (Figure 2a). We decided to proceed with this new method in all cases where the patient's head rotation was less than 130 degrees (Figure 2b).

The patient is operated on lateral decubitus, on the contralateral side to the surgical site. The stabilization is guaranteed by supports placed posteriorly over the sacrum and another cranial at the scapular level. If the patient's stability is not well obtained, an anterior fixator must also be used, over the pubic symphysis or the ipsilateral anterior superior iliac spine (Figure 3a,b) [9]. The upper limb, on the same side as the surgery, is fixed anteriorly over a support perpendicular to the chest. The contralateral upper limb can be left alongside the body or extended like the ipsilateral limb to allow further access available to the anesthetist. In this position, cervical spine stiffness is no longer a problem, and furthermore, no rotation of the operating table is necessary.



(**a**) (**b**)

Figure 2. (**a**) Patient decubitus in "orthopedic position"; (**b**) patient's head rotation less than 130°.



(**a**) (**b**)

Figure 3. Patient stability in "hip replacement surgery" [9]. (**a**) The anterior support is placed over the pubic symphysis or (**b**) over the anterior superior iliac spine.

3. Results

In 3 years, from 2021 to December 2023, 63 patients over 65 y (the oldest 81 years old) underwent cochlear implantation surgery. In 10 of these (6 males and 4 females) the head rotation was less than 130 degrees. Every one of these 10 patients was operated on using the new "orthopedic position". The operation was performed without any surgical difficulty, with excellent exposure of the posterior tympanotomy area without having to further rotate the position of the bed.

No postoperative complications attributable to the new surgical position were recorded, such as joint pain in the shoulder or cervical spine, hematomas, or pressure sores. In these patients, there were no postoperative otological complications like excessive thinning of the wall of the auditory canal or its subsequent erosion, damage to the VII cranial nerve, or the opening of the lateral or posterior semicircular canal.

4. Discussion

Otologic surgery, especially cochlear implant surgery, must be performed with meticulous attention. The otologist is aware that any minimal angular variations from the standard position can make posterior tympanotomy difficult and, in the worst-case scenario, can lead to not recognizing the round window or any other anatomical structures, causing

surgical complications (excessive thinning of the wall of the auditory canal or its erosion, lesion of VII cranial nerve and the opening of the lateral or posterior semicircular canal) or unsuccessful cochlear implant placement. Especially in elderly or obese patients, cervical spine stiffness can be a limitation for achieving the correct surgery position.

In all cases, a patient position like that used in "hip replacement surgery" allows for a maximum of 180 degrees of head rotation toward the opposite side of the surgeon's position, enabling safe mastoidectomy and posterior tympanotomy that is performed without having to rotate the patient's head or the operating table. Future research directions may also be highlighted.

5. Conclusions

In conclusion, the importance of precise patient positioning in cochlear implant surgery cannot be underestimated. The above-described alternative technique, inspired by hip replacement surgery positioning, offers a recommended solution for cases in which the standard positioning proves to be inadequate due to cervical spine stiffness or other rotation issues. By ensuring optimal visualization and access to the surgical site for posterior tympanotomy, this approach increases safety and efficiency, benefitting both the surgeon and the patient.

This technique may contribute to improving outcomes in cochlear implant surgery, particularly in challenging cases.

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