



Analysis of Cochlear Duct Length Based on Computed Tomography Images of Temporal Bones in Patients of the Institute of Physiology and Pathology of Hearing

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INTRODUCTION

The first cochlear implant surgery in Poland was performed in 1992, marking 34 years of continuous clinical advancement. Since then, the team led by Prof. Henryk Skarzynski has steadily refined this method, contributing significantly to its global development.

Accurate knowledge of individual cochlear dimensions is crucial for the proper selection of electrodes during cochlear implantation. Such precision minimizes the risk of intracochlear complications.

OTOPLAN provides a comprehensive framework for calculating and visualizing cochlear parameters, enabling **not only precise assessment of postoperative electrode placement but also individualized optimization of the implantation strategy.**

AIM

This study aimed to analyze cochlear length in the Polish population and establish normative reference values, including sex-specific differences, using computed tomography (CT) imaging of the temporal bone.

MATERIAL AND METHODS

The study was conducted retrospectively using anonymized clinical data.

Participants were recruited from the Institute of Physiology and Pathology of Hearing in Poland.

The inclusion criteria were:

- normal cochlear morphology,
- high-quality imaging data.

High-resolution temporal bone CT images were analyzed using OTOPLAN software. All cochlear duct measurements were performed by an experienced radiologist.

A total of 1,056 cochleae (left ear: n=531; right ear: n=525) were examined, derived from 528 individuals. Of the analyzed cases, 517 (49%) of the cochleae belonged to females and 539 (51%) to males.

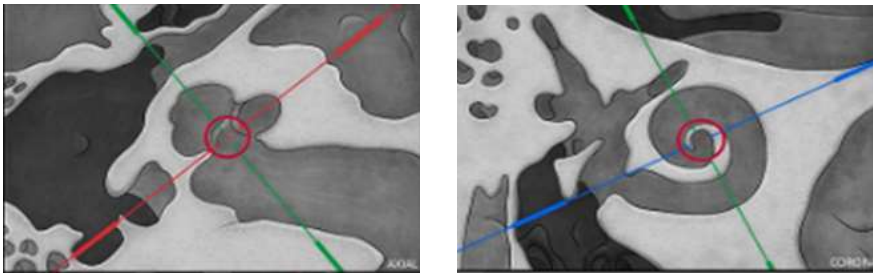


Figure 1. Cochlear measurements.

RESULTS

The average length of the cochlear duct across all subjects was 35.51 mm (SD = 1.75 mm), ranging from 27.10 to 41.20 mm.

To examine **gender-related differences** in cochlear duct length, a Student’s t-test for independent samples was performed. The results showed a **statistically significant difference** ($t(1056) = -10.54$, $p < 0.001$), which was confirmed by the nonparametric Mann–Whitney U test ($p < 0.001$). Male cochleae ($M = 36.00$ mm, $SD = 1.73$) were significantly longer than female cochleae ($M = 34.96$ mm, $SD = 1.61$).

Considering the non-normal distribution, cochlear duct length was further divided into tertiles separately for each gender (**Table 1**).

Sex	Short cochleae (mm)	Average cochleae (mm)	Long cochleae (mm)
Female	≤ 34,4	34,5–35,5	≥ 35,5
Male	≤ 35,4	35,5–36,8	≥ 36,8

Table 1. Classification of cochlear lengths in women and men.

DISCUSSION

As cochlear implantation techniques continue to evolve, reliable CDL assessment has emerged as a critical step in preoperative planning. Choosing the correct electrode may reduce the risk of damage to intracochlear structures and increase potential for residual hearing preservation.



Figure 2. Surgery performed at the WHC.

CONCLUSIONS

This study presents the first normative data on cochlear duct length (CDL) in the Polish population, obtained using a standardized OTOPLAN-based protocol. **The mean CDL was 35.51 mm**, with males exhibiting significantly longer cochleae than females, although the difference was modest, leading to the establishment of gender-specific normative values.

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