Abstract: Automatic Estimation of Cochlear Duct Length and Volume Size

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The exact cochlear length and size are required is an important factor of selecting the suitable cochlear implant. We present a fast cochlear length and volume size estimation method from clinical multi-modal medical images. The method utilizes atlas-model-based segmentation to estimate a transformation from a model to an input volume. The result is used to transform a well-defined segmentation and a points-set of a scala tympani to the input image that segments and estimates the scala tympani length in a few seconds using standard hardware e.g. a laptop. The method is based on automatic cochlea image registration (ACIR) [1]. The error is estimated using the known length of the cochlear implants. A dataset of 71 3D images of 21 patients from various age and gender groups is used. The estimated average scala tympani length was 29.54 mm, with 0.27 mm standard deviation. The average scala tympani volume size was 41.56 mm³, with 0.19 mm³ standard deviation (Fig. 1). The method is available as an open source 3D Slicer plug-in. The source code and the data can be downloaded from a public server as described in [2].

Fig. 1. Samples of segmentation results, left: CBCT, middle: MR and right: CT.

References

1. Al-Dhamari I, Bauer S, Paulus D, et al. ACIR: automatic cochlea image registration. *Proc SPIE*. 2017;10133(10):1–5.
2. Al-Dhamari I, Bauer S, Paulus D, et al. Automatic cochlear length and volume size estimation. *OR 20 Context-Aware Oper Theaters, Comput Assist Rob Endosc*. 2018; p. 54–61.