OBJECTIVES: To describe the orientation of the basal turn of the cochlea in image-normal temporal bones, the distances of the round window and cochlear aperture from the incus and the superior semicircular canal, their bilateral symmetry and relationship with mastoid pneumatization.

STUDY DESIGN: Postmortem study of cadaveric crania.

METHODS: From 41 cranial specimens, direct axial CT images were obtained for the five crania with the largest and the five with the smallest mastoids. Landmarks were defined in xyz space: round window (RW), center of the island of the superior semicircular canal (SSCC), apex of posterior process of incus, the cochlear aperture (CA), and two cochlear basal turn points so that the plane of the cochlea could be described.

RESULTS: The median angle value (and range) between the cochlear sagittal plane and the basal turn of the cochlea, perpendicular to the modiolar axis is

**Abstract**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Correlation coefficient, 95% CI</th>
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<tbody>
<tr>
<td>Mastoid pneumatization</td>
<td><em>r</em> = 0.94, <em>N</em> = 10, 0.85 – 0.97</td>
</tr>
<tr>
<td>Plane of cochlear and coronal plane</td>
<td><em>r</em> = 0.90, <em>N</em> = 10, 0.81 – 0.99</td>
</tr>
<tr>
<td>Distance from RW to SSCC</td>
<td><em>r</em> = 0.84, <em>N</em> = 10, 0.68 – 0.98</td>
</tr>
<tr>
<td>Distance from SSCC to CA</td>
<td><em>r</em> = 0.85, <em>N</em> = 10, 0.68 – 0.98</td>
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</tbody>
</table>

**Introduction**

- An accurate insertion vector is crucial during cochlear implant surgery, in order to ensure placement of the electrode into the scala tympani and to avoid cochlear trauma.
- "Mental representation of the basal turn of the cochlea is a crucial step in cochlear implantation", and is experience-dependent.
- Several coordinate systems have been proposed, each utilizing different landmarks, to define the human cochlea in a standardized manner.
- The Cochlear View, described by Xu et al., utilizes a plane of rotation along the basal turn of the cochlea, the perpendicular to the modiolar axis.
- Though "rotation" of the basal turn of the cochlea relative to sagittal plane, and "tilt" relative to horizontal plane have been described, the "watch stem set" of the round window has not been described.

**Methods and Materials**

- The Emory University Institutional Review Board determined that IRB approval was not necessary.
- From 41 clinically normal crania, the 5 with the largest and the 5 with the smallest areas of mastoid pneumatization underwent direct axial CT.
- Each cranium was exactly oriented relative to the Frankfort horizontal plane.
- Mastoid size determined by lateral radiographs correlates well with pneumatization volume determined by CT.
- Using the publicly available software program Fiji, the following landmarks were identified in xyz space: round window (RW), center of the island of the superior semicircular canal (SSCC), apex of posterior process of incus, cochlear aperture (CA), and two cochlear basal turn points to describe the plane of the cochlea.

**Discussion**

- For cochlear implantation, having a valid mental picture of the spatial orientation of the cochlea, especially of the basal turn's scala tympani, is challenging even in image-normal dissection-normal ears.

**Conclusions**

- In addition to the plane of the basal turn of the cochlea being variously positioned relative to "rotation" and "tilt", the "watch stem set" of the round window in these ear-normal adult crania is variously positioned – median 39.6° below the horizontal, range 27° to 44° for right ears.
- The spatial orientation of the cochlea has no relationship with mastoid pneumatization.
- Bilateral symmetry of multiple distances and angles describing cochlear spatial orientation, suggesting that the ontology underlying the relationships within the inner ear may be of genetic origin.

**Results**

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**References**