Cochlear Morphologic Factors Associated with Electrode Contact Position with the New Slim Modiolar Electrode

Nedim Durakovic, MD; Jonathan L. McJunkin, MD; Cameron C. Wick, MD; Craig A. Buchman, MD; Jacques A. Herzog, MD
Disclosures

• Craig Buchman, MD
  – Consultant for Cochlear Americas, Advanced Bionics, and MedEl
  – Equity interest in Advanced Cochlear Diagnostics, LLC.

• Jacques Herzog, MD
  – Consultant for Cochlear Americas

• Jonathan McJunkin, MD
  – Consultant for Cochlear Americas

• Cameron Wick, MD
  – Consultant for Stryker Corporation
Background

- Cochlear implant design modifications have attempted to decrease intracochlear trauma and optimize location of individual electrode contacts.
- Even with improved CI design, intracochlear trauma from scalar translocations and tip folds occur.
Objectives

• Quantify tip folds and translocations with the slim modiolar electrode at a single center

• Evaluate if cochlear morphologic factors (cochlear size) are associated with tip folds and translocations
Insertion Technique

Step 1

Step 2

Step 3
Methods

• Retrospective review of subjects implanted with the slim modiolar electrode

• Inclusion criteria required a post-operative CT scan reconstruction with individual electrode contact localization to identify translocations

• All subjects also had plain films to identify intraoperative tip folds
Methods – Intraoperative Plain Film

Tip Fold

Correction
Methods – CT Scan Reconstruction

Preoperative CT Scan is combined with the postoperative scan allowing for individual electrode localization on a cochlear atlas and creation of a 3-dimensional reconstruction.

Methods – CT Scan Reconstruction

Full Scala Tympani Insertion (ST)

Translocation from ST to SV
Methods – Cochlear Size Measurement

Cochlear size is measured by the distance from the round window membrane to the lateral wall (Distance A; described by Escudé, et al.)

Results

- 5 of 84 (6%) cases with tip folds
- 5 of 84 (6%) cases with translocations
Results – Variability in Cochlear Size

• Consistent with prior studies there is a measurable variability in cochlear size

• The mean cochlear size was 9.3mm with a range of 8.5mm to 10.4mm (SD 0.4mm)

Results – Translocations

There was no difference in cochlear size between full scala tympani insertions and translocations.

P=0.343
Median difference: 0.1; 95% CI: -0.2 to 0.4
Results – Tip Fold

Larger cochlear size was associated with cases of tip fold (mean size of 9.8 mm).

P = 0.05
Median difference: 0.5; 95% CI: 0 to 0.9
Tip Fold – Case Illustrations
Tip Fold - Case Illustrations

Cochlear Diameter
10.3mm

Cochlear Diameter
9.8mm

Cochlear Diameter
10mm

Cochlear Diameter
9.1mm
One case resulted in an anti-modiolar orientation of the CI tip fold which we hypothesize could be related to electrode insertion orientation away from the modiolus rather than cochlear size.
Limitations

- Retrospective study design
- Single center
- Translocations and tip folds are rare events
- Other factors likely contribute to tip folds and translocations including insertion technique and electrode orientation within the sheath
Conclusions

• Newer electrode designs have improved scalar localization within scala tympani

• Cochlear size is likely not a factor impacting scalar translocation

• Cochlear size is likely one of several factors impacting tip fold occurrence
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