ABSTRACT

Aim

The aim of this study is to determine if the cochlear duct length predicts depth of insertion after cochlear implantation with different length electrodes.

Methods

35 adult patients who received a MedEl Flex 31 electrode and 21 patients who received a Flex 28 as part of hearing preservation protocol were included. Preoperatively, high-resolution temporal bone CT scans were reformatted in the axial and oblique coronal planes. The basal diameter of the cochlea (A value), and the mid and outer wall lengths of the cochlear duct were measured. Postoperative plain film XRs were used to determine the degrees of electrode insertion and number of electrodes within the cochlea.

RESULTS

The A value is positively correlated with both the cochlear duct length in its outer wall and its mid scalar position. Patients who received the shorter electrode paradoxically achieved a greater depth of insertion with more electrodes within the cochlea. Larger cochleae were associated with a greater depth of insertion with the shorter electrode.

1. The A value and cochlear duct length measurements for all patients are shown in Table 1.
2. Cochlear outer wall length is significantly correlated with Ac (R=0.70), AcM (R=0.72) and Ax (R=0.52), p<0.05 (Chart 1).
3. Cochlear mid scalar length is significantly correlated with Ac (R=0.6), AcM (R=0.58), and Ax (R=0.49), p<0.05
4. Outer wall lengths and mid scalar lengths are highly significantly correlated (R=0.85), p<0.05
5. Degrees of insertion positively correlates with the number of channels inserted on plain XR (R=0.63), p<0.05
6. Flex 31mm mean insertion angle is 488.29 degrees with 10.9 electrode vs. Flex 28 mm mean insertion angle 525 degrees and 11.3 electrodes. Compared to the Flex 28, Flex 31 patients have shallower degrees of insertion and fewer electrodes within the cochlear (Table 2).

METHODS AND MATERIALS

56 patients undergoing hearing preservation cochlear implantation were retrospectively reviewed. 35 patients received the Flex 31 electrode (31mm) and 21 patients with Flex 28 electrode (28mm). Surgery was performed with full electrode insertion through the round window.

Preoperative high resolution temporal bone CT scans were 3D reformatted in the axial and oblique coronal planes to measure the A value - the diameter of the basal turn of the cochlea from the round window to the outer wall. The latter is done at the RWM soft tissue-air interface called Ac and the estimate RWM location called AcM (Figure 1).

Post operative plain XRs in Townes, Caldwell and lateral views of the skull were examined by a neuroradiologist to determine the degrees of electrode insertion and the number of electrodes within the cochlea (Figure 2).

With images formatted in the oblique coronal plane of the basal turn of the cochlea and using a standard curved measuring tool, the outer and midscalar lengths of the cochlea duct were measured to 720 degrees (Figure 2b and 3)

The CT scanner used was a GE Lightspeed Plus 64 detector. The axial images are at 0.625mm thickness and the coronal and sagittal images are at 0.6mm thickness.

DISCUSSION

Larger A values correlated radiologically with longer cochlear duct lengths for both outer wall and mid scalar measurements. The greatest predictor of cochlear duct outer wall length is the A value in the oblique coronal plane. (Chart 1). This finding is similar to previously published studies in the literature.

Patients who had the Flex 28 electrode had deeper insertions than Flex 31 electrode as evidenced by greater insertion angles. This may suggest some post operative migration of the longer electrode. Patients who received the shorter electrode also had more channels inserted and in larger cochleae allowed a deeper insertion.

Some of the weaknesses of the study include the fact that plain XRs are not always accurate in determining the number of electrodes within the cochlea. Changing the bony window of the CT may also affect measurements of both the A value and the linear lengths. This study also assumes that the electrodes remained postoperatively within the scala tympani with no transcalar migration.

CONCLUSIONS

1. This study demonstrates that standard radiological software can be used to measure the cochlear duct length.
2. The basal turn diameter or “A” value may be used as a surrogate for cochlear duct lengths
3. Cochlear duct lengths vary between individuals and may be a consideration when choosing from electrodes of lengths

REFERENCES