Temporal Lobe Perfusion in the Deaf: MR Measurement with Pulsed Arterial Spin Labeling (FAIR)

D.K. Shibata, E. Kwok, J. Zhong, D.A. Shrier, H.Z. Wang, Y. Numaguchi, University of Rochester, Department of Radiology, Rochester, New York, USA

PURPOSE:
The function of "auditory" cortex in the prelingually deaf is not well understood, but recent studies with fMRI activation mapping have suggested that the superior temporal gyrus may be recruited towards visual and language tasks (1). The BOLD (Blood Oxygen Level Dependent) mapping technique used in fMRI indirectly measures fluctuations in blood flow, but does not allow quantitation of metabolic activity or perfusion.

This study was performed to noninvasively evaluate the baseline relative perfusion of the temporal lobes using the FAIR (Flow-sensitive Alternating Inversion Recovery) technique.

METHOD/MATERIALS:
26 students from a college for the deaf were compared to 15 control subjects of similar ages. Using an adaptation of the FAIR sequence on a 1.5 T scanner, a single 7mm slice was obtained through the superior temporal gyrus parallel to the Sylvian fissure while subjects were resting in the scanner.

Perfusion maps were calculated by the method of Kwong et al and regions of interest were drawn segmenting the grey matter of the temporal and occipital lobes (2). The ratio of temporal to occipital lobe perfusion was then obtained.

RESULTS:
The relative perfusion of the superior temporal gyrus (STG) was slightly less in the deaf (right STG = 0.79 +/- 0.16, left = 0.93 +/- 0.20) compared with the hearing (right STG = 0.90 +/- 0.14, left = 0.98 +/- 0.31) when normalized to the occipital cortex, but the differences were not statistically significant. However when reviewing for right versus left asymmetry, the deaf showed a larger asymmetry with decreased right versus left perfusion (P < 0.01). While there was also greater left-sided perfusion in the hearing subjects, the difference did not achieve statistical significance.

CONCLUSIONS:
These results support data from the fMRI mapping studies which suggest there is substantial cortical reorganization in early deafness which results in nonauditory functions replacing auditory processing in parts of the superior temporal gyrus.

Even in the resting state there is substantial metabolic and presumed electrical activity in the superior temporal gyrus, the usual locus of auditory function. This together with the asymmetry suggests caution in temporal lobe surgery in deaf patients.

ACKNOWLEDGMENTS:
The National Technical Institute of the Deaf at the Rochester Institute of Technology, Rochester, New York provided assistance with subjects for this project.

REFERENCES:
1) Shibata DK, Yoshiura T, Kwok E, Zhong J, Shrier DA, Numaguchi Y. Deaf cortical reorganization of visual processing in the temporal lobe, ISMRM, Sidney, Australia, April 1998