Vitamin C deficiency-induced hearing loss and ossicular changes in transgenic mice

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Outcome Objectives:
Certain forms of hearing loss (HL) are life-long disabilities that critically affect the development of language and cognition. Recent studies show that vitamin C (ascorbic acid; AA) can protect from hearing loss1; while vitamin C deficiency (VCD) accelerates long bone loss2. Humans are particularly sensitive to VCD due to genetically evolved disability to synthesize AA and require dietary supplementation. However, the effect of VCD on the ossicles and the underlying mechanisms have not been understood. In this study we utilized a transgenic VCD mouse model (six mice) to determine whether VCD can affect the maturation of the ossicles.

Methods:
The behavior and body weight of VCD (GULO−/−) and control (GULO+/-) mice were evaluated. Auditory function in VCD (GULO−/−) and control (GULO+/-) mice was measured with auditory brainstem responses (ABR). The middle ears were dissected and the morphological characteristics of the ossicles in six and control mice were evaluated with a stereoscopic microscopy. MicroCT was used for scanning the temporal bones, operating at 90 kV and 150 A over 120 seconds. The images of ossicles were reconstructed from 512 projections and the 3-D data was analyzed using computer software.

Conclusion:
1. These findings suggest that VCD can induce ossicular mineral decrease in the thin bone including manubrium and stapes, but not the solid bone, eg. The incudomalleolar joint and orbicular apophysis of the malleus.
2. VCD can induce hearing loss in VCD mice.
3. Further studies will illustrate the underlying mechanisms of ossicular changes related to osteoblast differentiation.

References:

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