Biological Control of Bone Resorption in the Middle Ear

—Clinical Importance—

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Bone resorption and remodeling lead to the complications of chronic otitis media with and without cholesteatoma. Additionally, otosclerosis is a localized disorder of bone remodeling within the otic capsule. Although a number of factors lead to the initiation of bone resorption in these diseases, ultrastructural studies of regions of active resorption in the human middle ear have shown that bone removal is achieved principally by the action of osteoclasts upon adjacent bone. Osteoblastic activity, bone deposition, generally follows resorption and is thought to be a "coupled" process. Therefore, one of the most important research questions regarding middle ear bone resorption should be directed at an understanding of the factors that stimulate and inhibit osteoclast recruitment and activation at a local site.

Substances produced by the cholesteatoma itself or by the subepithelial tissue may directly or indirectly lead to osteoclast activation. The factors which may influence resorption at a local site are local application of pressure or strain, arachidonic acid metabolites, cytokines such as interleukin 1 (IL1α and β), and tumor necrosis factor (TNFβ), or acids produced within cholesteatomas. Additionally, there is now some evidence that resorptive processes may be under neural control; sympathectomy stimulates resorption in vivo and guanethidine and vasoactive intestinal peptide (VIP) result in increased resorption in vitro.

Inhibitors of localized osteoclastic activity may block the progress of bone destruction seen in chronic otitis media and otosclerosis. Cyclooxygenase inhibitors and bisphosphonates inhibit the localized bone resorption and may be clinically useful.