**Abstract**

**PROBLEM:** To evaluate the effect of osteoporosis on the rabbit middle ear ossicles under light microscopy.

**METHODS:** Ten female New Zealand white rabbits (2-4 kg) were used. Rabbits were sacrificed 16 weeks after oophorectomy. Middle ear ossicles were taken out for investigation under light microscopy.

**RESULTS:** Osteoporosis enhanced osteoclastic bone resorption of the ossicles.

**CONCLUSION:** Osteoporosis seemed to increase the resorption of the middle ear ossicles, and this may further cause the hearing loss.

**SIGNIFICANCE:** Prevention of the effects of the osteoporosis in humans may help to decrease the hearing loss.

**Introduction**

Hearing function in older adults may be related to bone health, and hearing sensitivity may be adversely affected by osteoporotic bone loss. Premenopausal bone loss may be multifactorial, one of which may be osteoporotic bone loss. One third of the individuals above the age of 72 are affected by osteoporosis. In human populations, the incidence of osteoporotic hip fracture increases exponentially with age (1), thus a correlation between osteoporosis and hearing loss has been suggested.

**Introduction**

Bone mineral density (BMD) is determined by the balance between bone resorption by osteoclasts and formation by osteoblasts. Demineralization of the cochlear capsule and the internal auditory canal has been associated with hearing loss, and the degree of hearing loss has been directly related to degree of demineralization of otic capsule (2). Clark et al. (3) showed that the presence of a hearing loss increased the risk of having low femoral BMD (3). We have planned this study to investigate the effect of osteoporosis on the middle ear ossicles by light microscopy in rabbits.

**Methods and Materials**

Thirteen female New Zealand White rabbits (2-4 kg) were included in this study. They were housed one per cage and fed with standard rabbit chow and tap water ad libitum. Ears of the rabbits were divided into two: control group and oophorectomy group. Oophorectomized rabbits included in osteoporotic group whereas only skin incision and suture with without any abdominal intervention was done in controls. Laparotomy was performed to remove the ovariens of the animals in oopherectomized rabbits. Under ketamine anesthesia, all of the rabbits were sacrificed by intravenous potassium chloride 16 weeks after the laparotomy. Timpanoceleat flaps were elevated and posterosuperior external auditory canal wall was removed to better visualize the ossicles. Malleus, incus, and stapes were removed carefully from the middle ear cavities of control and oophorectomized rabbits to examine the morphology of the auditory ossicles.

**Results**

The specimens were fixed and filled with formalin consisting of formaldehyde (10% formalin). The bones were embedded in paraffin and serially sectioned at a thickness of 12μm. Following the staining of the 20th section with hematoxylin & eosin (HE) and Van-Gieson stain, two pathologists examined the sections by light microscopy blindly.

**Discussion**

In the present study, we found that the ossicles of ears of the oopherectomized rabbits demonstrated clear evidence of progressive and abnormal remodelling process and bone resorption that was not observed in the controls. A notable feature was the occurrence of focal, hypercellular areas of the ossicles showing bone resorption and deposition, resembling the lesions of the active osteoclasts (4). This resemblance may be the result of increased rate of bone remodeling.

Even though several authors have suggested that the mineralized bone mass was determined in the osteoporotic ears, 15/16 (93.7 %) of the osteoclastic areas showed focal or generalized bone resorption features when compared to controls. Especially extensive resorption of the faceteroprocessus and elevation of osteoclastic bone resorption of auditory ossicles in rabbits has been noted in this study. Therefore, it is not possible to comment on whether certain areas within each ossicle are preferentially resorbed or not. Furthermore, some of the auditory ossicles showed elevation on the articulated face in osteoporotic ears. In some areas of the middle ear cavities, calcification lesions which integrated middle ear air space were established. We could speculate that these light microscopic changes in the ears of the rabbits may have an adverse effect on hearing, but the influence of these findings on hearing level needs to be determined by future studies.

**Conclusion**

The ossicles of osteoporotic ears of the rabbits demonstrated clear evidence of a progressive and abnormal remodeling process and bone resorption, which may further cause the hearing loss.

**Bibliography**