Significance of carbonic anhydrase on the repair process after bone fracture

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The repair process of the fracture induced experimentally in Japanese quail's foot bone was studied by modifying carbonic anhydrase activity with its inhibitor. Administration of acetazolamide, an inhibitor of carbonic anhydrase, retarded this process, imcoplete and less amount of the callus formation at the lesion being formed in early stage.
Even if acidosis found in acetazolamide injected birds was corrected with sodium bicarbonate, this delayed process was not accelerated.
Osteoclasts showing acid phosphatase activity were found on the neighboring endosteal tissue in the early stage after fracture. In birds treated with acetazolamide, the osteoclast were swollen and weakly stained for this enzyme and remained till later stage in this place. These results suggest that carbonic anhydrase and the osteoclast may play a major role in repair process after bone fracture.

Immunohistochemical localization of carbonic anhydrase in the bone of of normal, calcitonin- and 1α-(OH)D_3-treated rats

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In order to clarify the biological significance of carbonic anhydrase isozyme II (CA-II) in bone tissues, we made the histometric comparison between CA-II and ACP staining pattern under a few hormonal conditions.

To the first group, 1α-(OH)D_3 2.5μg /kg was administered. To the second, eel calcitonin 10 units, to the third, normal saline solution was injected in amount of 1 ml. Twelve hours after the administration, the tibiae were removed.

CA-II was stained with peroxidase-labeled antibody method and ACP revealed enzyme-histochemically, then on staining cells, their number and area were measured with a digitizer.

After 1α-(OH)D_3 treatment, both CA- and ACP-staining cell count increaced signficantly. In the calcitonin-trearted group, mean size and count of CA-staining cells (osteoclast-like) decreased far more apparently than those of ACP.

These data suggested that high active CA-II could be one of the most reliable markers for osteoclastic function and further more osteoclast mediate bone resorption.

Immunohistochemical localization of carbonic anhydrase in giant cell tumor of bone. -Ultrastructural observation-

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Many reports have been published about giant cell tumor of bone since its initial description in 1818 by Cooper. However, giant cell tumors of bone still present a special problem with respect to the nature of their cellular constituents. The electron microscopy or enzyme histochemistry demonstrated the similarity of multinucleated giant cells to osteoclasts, but the reports on enzyme activities of stromal cells vary from case to case.

In our present study, for ultrastructural observation, the sections obtained from benign giant cell tumor of ischial bone were stained with the direct peroxidase-labeled antibody method, using anti CA-II IgG Fab' fragment.

As a result, CA-II staining was demonstrated in the cytoplasm of some of giant cells and some of type 2 stromal cells (macrophage-like) in various intensity. The findings suggest the view that giant cells and type 2 stromal cells are histogenetically related. Moreover, we also demonstrated the similarity of multinucleated giant cells to osteoclasts.

Cytochemical localization of Ca -ATPase activity in the spinal cord neuroepithelium of rat embryos

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Ultrastructural localization of the Ca^{++}-ATPase activity in the neuroepithelium of the developing spinal cord, especially in the roof plate, of rat embryos was investigated.

Embryos on day 11-15 of gestation were immersed in the aldehyde mixture for 1 hour, and transversely sectioned with a Microslicer at the level of the forelimb. Tissue sections were incubated in medium for Ca^{++}-ATPase (Ando, et al., 1981) at 37°C for 30 min.

The intense activity of Ca^{++}-ATPase was first demonstrated in the roof and floor plates of the spinal cord. In the roof plate, the area showing this intense activity became to be limited in the small area along the middle line during development. Under electron microscopy reaction products for Ca^{++}-ATPase activity were densely demonstrated in the lateral plasma membranes of neuroepithelial (matrix) cells. These cells formed a large amount of the extracellular spaces called the roof plate channels in the basal side. After day 14 of gestation, reaction products were also found in the luminal surface of these roof plate cells.