STRUCTURE, COMPOSITION AND FORMATION MECHANISM OF AORTIC VALVE CALCIFIC DEPOSITS

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The structure and chemical composition of valve calcific deposits were investigated. The deposits were chosen arbitrarily and subjected to chemical analysis, observation with scanning electron microscope, semi-quantitative determination of Ca, Mg, Na, K, P and C elements by energy dispersive X-ray, X-ray diffraction and Fourier transform infrared spectroscopy.
These deposits were found to have non-uniform internal structures composed of layers of a structureless aspidinic inorganic material, substantial amounts of voluminous organic material and in a few samples small spheres were also present. Two groups of deposits with distinctly different chemical compositions were identified: one group with a low Ca/P molar ratio (1.59) and the other group with a high (1.82) Ca/P molar ratio.
The deposits belonging to the group with a low Ca/P molar ratio contained higher concentration of magnesium and consisted of increased amount of amorphous calcium phosphate. The deposits with a high Ca/P molar ratio contained low concentration of magnesium and consisted predominantly of carbonated hydroxyapatite. The inorganic material was identified as a poorly crystalline carbonate hydroxyapatite containing molecular water with the average formula $Ca_{9.1}Mg_{0.4}(Na,K)(PO_4)_{5.8}(CO3)_{0.3}(OH)_2$.
The actual chemical composition of the apatitic solid phase varied not only from deposit to deposit but also within the same deposit. The non-uniform internal structure of the deposits, the occasional presence of spherical particles and the variable composition between specific areas of the individual deposits indicate that their formation did not proceed under constant conditions. The organic debris formed as a consequence of injured tissue, acted as an inducer of calcium phosphate crystallization through heterogeneous nucleation processes.

Keywords: aortic valve calcific deposits, chemical analysis, EDAX, SEM, FT-IR, X-ray diffraction