

The bone diagenesis: post-mortem alterations in human bone

Petra Rita Basso¹, Alberto Colombo², Mario Raspanti¹

¹Dipartimento di Medicina e Chirurgia, Università dell'Insubria, Varese

²ASST Sottelaghi, Ospedale di Circolo, Varese

Post mortem interval (PMI) estimation is a crucial issue in forensic science. Post-mortem microscopic changes of bone structure were first reported in the second half of the XIX century, yet there is still no general consent about the onset or the speed of these degenerative changes. An "exogenous model" of bioerosion, which hypothesizes that the alterations are brought about by environment-associated microorganisms acting once the hard tissues are skeletonized [1], is opposed to an "endogenous model" where the alterations are caused by bacteria already present in the human body [2]. In the present research 74 human bone samples were collected from the cranial vault of thirty-seven donors during neurosurgical procedures (craniectomy); each sample consisted of a small, irregularly shaped full-thickness bone fragment, with a major axis of approximately 10-12 mm. The specimens were tested for sterility and then exposed *in vitro* for as long as 48 weeks to a mixture of six strains of harmless microorganisms harvested from the oral cavity of 12 healthy patients. In time the bone specimens showed a progressive demineralization and, starting from the fifth week of incubation, revealed an unexpected complete equivalence of the diagenetic phenomena with the ones we ourselves observed in forensic bone samples and in archaeological bone. These observations indicate that post-mortem morphological changes in bone (a) can result from the interactions between various harmless bacterial strains; (b) are consistent with the endogenous model, being caused by bacterial strains already present in the oral cavity; (c) can be visible as soon as five weeks after exposure, well before the skeletonization as is usually hypothesized.

References

- [1] Fernández-Jalvo et al. (2010) Early bone diagenesis in temperate environments. Part I: surface features and histology, *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 288(1-4):62–81.
- [2] White et al. (2014) The origin of bacteria responsible for bioerosion to the internal bone microstructure: Results from experimentally-deposited pig carcasses. *Forensic Sci Int.* 239:92-102.

Key words

Bone, diagenesis, forensics.