



E13 Human Bones and the Estimation of the Postmortem Interval (PMI): An Experimental Study

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Learning Overview: After attending this presentation, attendees will have the results of an experimental study performed to define the PMI. Several authors have distinguished the forensic relevant postmortem interval between PMI <50 years and PMI >50 years. For these reasons, it is very important to define simple techniques that could be applied in every forensic laboratory to establish the PMI of human bones.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing experimental data of a study conducted in order to define the PMI on human bones. Several techniques were tested in this experimental study, and the histological and immunohistochemical examinations have shown a pivotal role in the determination of PMI.

Determining the PMI of human skeletal remains is a challenging part of the daily practice of forensic osteology. To clarify if further criminal investigations by law enforcement agencies are necessary, the PMI plays an important role. Skeletal remains can either be historical or recent. In a historical case, there will most likely be no interest in criminal investigations. On the contrary, further criminal investigations may be needed if human skeletal remains turn out to be recent. Therefore, it is of criminal interest to distinguish between historical and recent human skeletal remains by estimating their PMI.

The present study seeks to analyze the technical applications to define the best techniques to determine the PMI with simple techniques that could be applied in all forensic laboratories. All samples were selected analyzing documentations of all autopsies performed by the Institute of Legal Medicine of Foggia from 2001 to date (about 1,700 autopsies). Five cases of human bones were analyzed: in case 1, the bones were found in a natural ambient; after the forensic investigation, it was defined that they belonged to a subject who died ten years before the study. In case 2, the bones were buried in a glass box, considering that it was believed that they belonged to a saint's death in 232 AD; after the radiocarbon analysis it was established that they were dated between 200 and 400 AD. In case 3, the bones were found in a ravine 15 years after the death. In case 4, the bones were recovered under the natural soil; after the radiocarbon analysis, the bones were dated between 1300 and 1500 AD. Finally, in case 5, the bones were collected during the exhumation operation of a man had died and was buried 60 years before.

After the selection of the cases, all bones were worked in blind by the personnel of the forensic laboratory in order to define if each case was of forensic interest (PMI <50 years). Different non-invasive techniques were applied: a luminol test, an Ultraviolet (UV) -induced fluorescence test, histological tests (Hematoxylin-Eosin [H&E] and Masson's trichrome stains), and an immunohistochemical test (Glycophorin A antibody).

The results of the present study allowed the determination that only cases 1 and 3 are of forensic interest (PMI <50 years), while cases 2, 4, and 5 have a PMI >50 years. The differences are marked for all techniques comparing all cases, with an exception for case 5. Indeed, the PMI determination for this case was more complex: to define if it was of forensic interest, the application of the histological and immunohistochemical techniques were discriminant. Indeed, both the evaluation at luminol test and UV-induced fluorescence test were not able to define with certainty the PMI >50 years. In this particular case, to define the PMI, the histological and immunohistochemical examinations identified several changes in the bone cells that allowed the classification of the case as of non-forensic interest.

In conclusion, the results of the present study put in light the possibility of applying several non-invasive techniques to define, through the PMI, if the case can be considered of forensic or non-forensic interest. Moreover, the luminol test and UV-induced fluorescence test could be used as a preliminary investigation because their exclusive use is not always sufficient to define the correct PMI, while histological and immunohistochemical examinations could be very helpful for the forensic examiner.

Skeletal Remains, Postmortem Interval (PMI), Immunohistochemical Stain