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Identification of Human Corpses (Remains) Based on Bone Fragments

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The process of identifying remains as well as human corpses is a complex research procedure. It all depends on the state of the biological material. Today, the genetic method is most often used, which is considered the most accurate. However, this does not mean that other studies have gone down in history. Bone-specific testing methods also work well.

Keywords*: human remains, bones, bone fragments, identification.*

Ідентифікація людських трупів (залишків) за фрагментами кісток

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Процес ідентифікації залишків, а також людських трупів, є складною дослідницькою процедурою. Усе залежить від стану біологічного матеріалу. Сьогодні найчастіше використовують генетичний метод, який уважають найточнішим. Проте це не означає, що інші методики застаріли. Методи, специфічні для дослідження кісток, також добре себе зарекомендували.

***Ключові слова**: людські залишки; кістки; фрагменти кісток; ідентифікація.*

The memory of the deceased is written in the bones…

There's no problem with recognizing a human skeleton. It is much more difficult to recognize individual bones, especially those that are damaged. Identification as a research process is the domain of forensics, but it should be remembered that in the case of biological material (and bone fragments are such material), cooperation with medical professionals is essential. There is nothing new, and even more revealing, because forensic medicine and forensics have been closely linked for many years. No one here competes with anyone, but they work together to find out the truth.

Identification of human remains on the basis of individual bones is sometimes easy (especially long bones), other times much more complicated (hand bones, metatarsal bones). The identification process is multi-stage (the level of determining species affiliation — group identification and the level of individual identification equivalent to the identity of the subject of research). The purpose of this report is to draw attention to the possibilities of modern science in this area. Bone remains or bone fragments are not unique in forensic research. They are found in different places, different circumstances. They require species and, if possible, individual identification.

The human skeleton is made up of bones, like other mammals. It is worth pointing out here that "In an adult, the skeleton consists of about 206 bones — this number is higher in children due to the many ossification points (about 270 in a newborn and 350 in a 14-year-old); it only falls when, for example, the stems have joined the roots. In older people, there may be less than 206 bones due to the fusing of the skull bones. The average skeletal weight is 10 kilograms in women and 12 kilograms in men" [1].

The literature shows that bones are made of two basic components: osine (organic component) and phosphoric and carbonic acid (mineral component). In terms of the structure of (bone) two beings can be distinguished — the clumped and the spongy [2, p. 53]. In anatomy textbooks dedicated to medical students, human bones are divided into: long, flat, short and pneumatic. Examples of long bones are the femur, humerus or tibia. Each long bone consists of a stem and two roots (articular surfaces). Inside the stem of the long bone there is a marrow cavity with bone marrow. Flat bones consist of two plaques of compacted bone, between which there is a sponge. Short bones have different shapes and are built "like the base of a long bone and a flat bone" [3, p. 21]. Pneumatic bones are characterized by the fact that they contain spaces lined with mucous membrane and filled with air [3, p. 20—21].

Human bones are connected to each other by joints or sutures. Recognizing a complete human skeleton is not a problem. It's a little different for single bones (vertebral bone, metatarsal bone, metatarsal bone or rib bone). Such bones show some resemblance to animal bones and only medical osteologists are able to accurately determine the species affiliation. Bones carry a lot of information, including genetic code. They are also a very durable and relatively resistant to destruction biological material. Of course, they are destructible under the influence of high temperature and as a result of the action of strong liquors [4, pp. 254—262 ; 5, pp. 163—165]. In forensic examinations, in particular of dismembered corpses (debris), bones are a carrier of information about how the body is dismembered. On the bones there are traces of tools used for the dismemberment of corpses [5].

In the literature of the subject there is no shortage of descriptions of homicides in which the perpetrator (or perpetrators) after committing the crime remove the corpse by destroying it (chipping, burning, using chemical substances — e.g. burnt lime, strong acids, pouring concrete) [6, p. 13—16].

Human bones are a common material that forms the basis of the identification process. In the case of a complete skeleton, this is relatively simple in that it can be measured, the sex of the person from whom it originates, and the living age of the deceased.

It is also possible to determine the time elapsed to death, if only on the basis of the forensic caesories of the decomposition of corpses. Single long bones (the femur, humerus or tibia) are useful for calculations to determine the height of the individual from which they originate. T. Marcikowski writes that in order to assess the growth of an individual (based on preserved long bones), the most important is the correlation between bone length and height of a person. The author states that when there is doubt as to the origin of carcasses (or from the same person) the elbow-thigh index is calculated (the value of the ulna length is divided by the value of the femur length. According to the author, the index is 0.57. If this value deviates significantly from the accepted pattern, it is assumed that the bones do not come from the same person. When determining the height of an individual (on the basis of long bones — separately for men and separately for women), the tables of Rollet (according to Baltazard) and Manouvier are used [7, p. 102—105]. This method is very useful not only in forensic medicine, but also in archaeology. D. Lorkiewicz-Muszyńska is of the opinion that "Bone material testing methodology, particularly in the identification aspect, has been significantly expanded and modernized, largely due to the possibility of cooperation with other fields of medical, biological or technical sciences. The basic methods of research in human identification are based on the assumptions and research procedures of anthropometry and anthroposcopy, sciences forming part of the Department of General Anthropology. These sciences deal with the description and classification of the characteristics of the human body according to specific rules and research procedures. With respect to human bone remains, using descriptive and metric methods, we can describe the characteristics, measure, calculate indicators, estimate and then reconstruct the morphological characteristics and properties that make up the biological profile of humans. Studies of the qualitative (descriptive, non-measurable) and metric features of the skeletal system, as well as the opportunity to look into their structure, allow to establish a lot of valuable information about a person who died hundreds ... or even thousands of years earlier. Identification studies conducted in a comprehensive and interdisciplinary way, including the use of the latest technological advances, are therefore also applicable to the historical investigation of human bone remains, and thus to archaeology" [8]. Experiments in this regard allow for more and more precise determination of the age of an individual at the time of death and other characteristics. In the 21st century, DNA is isolated from bone material, which, of course, allows individual identification, provided that comparative material is available. Narrowing down the essence of genetic research on humans and human cadavers, examination of bone-isolated material is infrequent. The human skeleton is characterized by certain individual elements within the human races. Despite belonging to the same species, the bones of people of different races are distinctly different, although, it should be stressed, these differences are noticeable to anthropologists and forensic scientists.

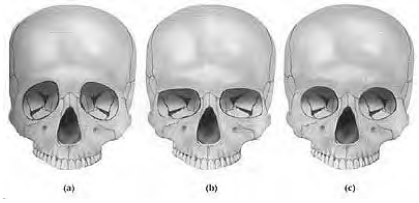

Fig. 1. Skull bones: white race, black race and yellow race [«Cranial construction, differences A - white race, B - black race, C - yellow race « Source:»Introduction to Forensic Anthropology: A Textbook (2nd Edition) (Hardcover) - Steven N. Byers»]

In practice, the most difficult are the examinations of small bone fragments, for example the orbital bone or the lunate bone. The latter is small in size with a characteristic appearance, and its small fragment is even smaller. In the case of the bones of the skull cap, suture synechiae are of importance. If the subject of the examination is a bone (fragment) in which there is union, it can be identified and on this basis the approximate age of the individual can be indicated.

The suture bones of the skull are divided into real and pseudo. Within the former, suture bones, fontanelle bones and isolated bones are distinguished.

J. Nowak, S. Pawlak, W. Poniewierski, M. Adamiec, B. Iwańczyk and A. Wojtowicz write «The suture bones (ossa Suturalia), also known as the worm bones (ossa Wormiana) are non-permanent but fairly common bones within the sutures of the skull. Statistical data indicate the presence of suture bones in approx. 8—15% of the general population. Their presence causes the formation of additional ossification points (punctum ossificationis) within the non-mineralized mesenchymal membrane – the matrix on which all bones of the skull are formed. The formation of suture bones is possible only as long as there is a mesenchymal membrane between the forming bones of the skull. The factors inducing the formation of said additional ossification points may be mechanical external stimuli, and genetic factors are also suspected. Often worm bones are present in patients who have been diagnosed with a genetic disease of the bone system. In themselves, they are treated as anatomical variability and do not give any symptoms, but they arouse the interest of, among others, anthropologists, anatomists, maxillofacial surgeons, neurosurgeons and radiologists. They are also used in radiological diagnostics and forensic medicine"[9].

The cited authors indicate that worm bones are found only in some representatives of a certain population and do not have pathological features in themselves. Moreover, the etiology is still unknown [9]. From the perspective of individual identification, establishing the presence of worm bones can be extremely valuable, as these bones are not common. They are definitely more often associated (coupled) with diseases of genetic origin. The authors referred to above are of the opinion that worm bones are associated with clavicle-cranial dysplasia [9]. Such an anomaly may be a guideline for searches in radiograph collections of medical facilities or genetic disease clinics. Crouzon and Saethre-Chotzen syndromes are other cases of cranial suture ossification anomalies. Both syndromes are characterized by premature ossification of cranial sutures and are genetically determined [10]. In addition to these syndromes, there are also others, including Aperta syndrome. For skeletal corpses or single human bones, they are valuable research material. The determination of the surviving age is not a major problem at present, as is the determination of sex (especially when it is a complete bone).

Interesting are the research experiments on the morphology of the hip bones, which have been obtained in Japan. The authors of these studies emphasize the anthropological nature of the research. The results obtained are useful for individual identification [11].

Osteological (anthropological - including anthropometric) studies are used to identify victims of armed conflicts and homicides. Andrzej Ossowski, Jarosław Piątek, Piotr Brzeziński, Grażyna Zielińska and Mirosław Parafiniuk described a case of identification of the skeletons of three men buried next to each other. According to the authors, "age was determined on the basis of assessment of cranial sutures, analysis of tooth clashes by Gierasimov method, analysis of pubic junction by Todd and Vandervel method" [12]. They emphasize that in some cases it was possible to use historical as well as anthropological and genetic research. The cited work presents cases that were identified individually on the basis of identity marks found on the skeletons [12]. It is impossible not to pay attention to an extremely important problemfrom the perspective of not only forensic medicine, criminology, but also other areas of law, including civil law. Jarosław Bednarek presented methods of assessing the age at death based on histomorphometry of the compact bone tissue [13]. The particular importance of the tests in question is that they do not require a large amount of test material [13]. Examination of human bone remains accounts for

a small proportion of forensic expertise. During wars, exhumations from mass graves, bone fragments are very numerous. Some are small, some are bigger. Each such element requires an assessment, an examination of how the results contribute to the identification of the remains. It should be emphasized here that these fragments are just as valuable a source of material for genetic research, as are complete (whole bones).

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Перспективи розвитку дактилоскопічного обліку в Україні

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Розглянуто деякі актуальні питання дактилоскопічного обліку й ефективність його застосування. Проаналізовано можливості передавання цифрової інформації за допомогою робочого місця (АРМ) експерта для розкриття і розслідування злочинної діяльності, а також необхідність унесення змін у чинний наказ МВС № 785-01 або розроблення нового наказу з додаванням пункту про обов'язкове поповнення слідотеки всіма державними спеціалізованими установами судових експертиз.

Ключові слова*: дактилоскопічний облік; ідентифікація злочинця; робоче місце (АРМ) експерта; поповнення слідотеки.*