

Skeleton Examination Used in Victim Disaster Identification

Shweta Jaiswal¹

Available online at: www.xournals.com

Received 7th March 2020 | Revised 28th March 2020 | Accepted 08th April 2020

Abstract:

Identification means determination or establishment of the individuality of a person, living or dead on the basis of some physical findings or data. It required in cases of fire, explosions, in railway, ship and air-craft accidents (Mass-disaster), and mutilated dead-bodies, skeleton remains etc. The goal of identifying skeleton remains is to establish the identity of particular bones that have characteristic features belongs to a particular diseased person. Forensic anthropologists will develop linked between a victim and their bones through the determination of age, sex, race, stature, and also the biological profile of the remains. Generally the identity of victim estimated by comparing or matching the antemortem and post-mortem data. But in disaster cases there is less chance to recover expected clues about the victim, so no possibility to found current data because the victim's body not recovered as a proper way or sometimes found only a part of the body. In this review paper, the establishment of identity of a victim disaster has been done on the basis of age, sex, height of the bone.

Key Words: Skeleton Remains, Victim Disaster, Identification, Bones.

Authors:

1. Department of Forensic Science, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, INDIA.

Introduction

It is a very challenging task for forensic anthropologists to identify disaster victims. They play an important role during the identification process while applying anthropological techniques in a consistent performance, objective, efficiency, analysis, and develop the biological profile of the remains. When there any bone like, whole, large piece, or any fragment of bone founded in burnt, bleached, or damaged condition, the microscopy used for confirmation of the material is bone which detects the presence of haversian canals in the bone. The determination of species of bone is also reliable and can be observed through macroscopically or microscopically both. A Plexiform bone in which the haversian canals arranged in geometric manner and bind with each other with no bone present between them which is present only in animals but in humans, the haversian canals present in a continuous manner and there is bone between them (**Siegel and Mirakovits, 58-61**). After that all in this study the process of identification of disaster victims through age and height of the deceased. Forensic Odontology is one of the most identifiers for identification of a victim of mass disaster and it is considered to be a specialized and reliable method.

Age of Deceased

The determination of age of the deceased, the following data should be collected:

Height and Weight: These are not of much importance in the case of adults but important in the case of a fetus. This can be done through the measurement of length from crown to heel in centimeters. During the first five months of gestation, the square root of length gives the approximate age of the fetus in months, and during the last five months of gestation, the length is divided by five. It is difficult to established age till dentition in the absence of documentary evidence but with the help of X-ray by showing different ossification areas of bone.

Number of Teeth Present: This is one of the most reliable methods through the eruption and formation of teeth at different ages. There are charts available showing significant differences of teeth mature.

Table No. 1: Number of total Teeth at different Ages

S. No.	Age	Teeth
1.	12 Months	12 Temporary Teeth

2.	18 Months	16 Temporary Teeth
3.	24 Months	20 Temporary Teeth
4.	6 Years	24 Teeth (20 Temporary + 4 Permanent)
5.	7 Years	24 Teeth (16 Temporary + 8 Permanent)
6.	9 Years	24 Teeth (12 Temporary + 12 Permanent)
7.	10 Years	24 Teeth (8 Temporary + 16 Permanent)
8.	12 Years	24 Permanent Teeth
9.	14 Years	28 Permanent teeth
10.	18 Years or above	32 Permanent Teeth

Examination of Lower Jaw: It is also important to identify the age of deceased through:

- **Medico-legal:** This angle formed by the upper border of jaw with anterior border of ramus. In infants, it is obtuse, in adults at right angle and in olds it is obtuse.
- **Anatomical:** This angle formed by lower border of jaw with posterior border of ramus.
- **Mental Foramen:** It is close to the inferior border in infants. In adults, it is mid-way between upper and lower border. In olds, it comes closer to the upper border.

State of Ossification of Bones: Bones growing with specific phases are depends on age. X-ray examination of ends of long bones at different ages helps us to identify age through:

Appearance of ossification centre in epiphysis, starting, progress, and completion of ossification of epiphyseal cartilage and union between epiphysis and diaphysis.

Elbow Joint

Symphysis Pubic: It probably the best single criteria for determining age and in dead-bodies it can be observed after opening joint surfaces:

- The symphyseal surface before 20 years has a layer of compact, near its surface and above 20 years it is marked irregular or uneven, further the ridges run transversely across the articular surface.
- In between 25-35 years, the ridges gradually disappear and the surface has a granular appearance. Ventral and Dorsal margins are completely defined.
- At about 50 years, the symphyseal phase has an oval, smooth surface with raised upper and lower extremities.
- Nearing 60 years, a narrow beaded rim develops on the margin, and beyond 60 years, erosion of surface and breakdown of ventral margin begins.
- At the age of 70 years or more, the surface becomes irregularly eroded.

Determination of Higher Ages: It could be analyzed by x-ray examination of the following:

- The sutures of skull would start disappearing by about 35-40 years, inner table uniting 5 years earlier than the outer.
- Thyroid or costal cartilages may be ossified by 45-50 years.
- Three component parts of sternum by 45-50 years, xyphoid with body of sternum and manubrium with body at old age commonly above 16 years
- In very old age after 60-70 years, the alveolar process of mandible appears rounded radiologically.

Height of Deceased - Stature

Pearson *et al.* (1898), first time introduced “Karl Pearson’s formula” is used to estimate the height of an individual from long bones like femur, tibia, humerus, and radius. According to this formula:

- The space of the out stitch upper limb at a right angle to the body from the tip of one middle finger to tip of the other hand’s middle finger is man’s height.
- A man’s height is equal to 2 × length of one arm + 13.5 inches (12 inches for clavicle and 1.5 inches for sternum).
- Man’s height is equal to 4 × length of femur + 4 inches.

- Man’s height is equal to 6 × length of humerus + 6 inches.

Recently “Trotter and Gessler’s formula” is widely accepted and this is to measure the length of long bones multiplied with a given factor and then adding a fixed factor in inches. This is also known as “Regression formula” and the anthropologist considers all six upper and six lower long bones that is humerus, radius, and ulna of both the hands and femur, fibula, and tibia of both the legs. Through this method, an accurate estimation of height could be ascertained and it also includes a standard error.

$$\text{Stature} = (\text{Length of Bone} \times \text{Multiplying factor}) + \text{Additional factor} \pm \text{Standard Error.}$$

An idea about the height of the victim or deceased from skeleton remains is derived through multiplying the length of a long bone with a multiplication factor (**Sharma, 1184**). The value of multiplication factors of long bones are as follows:

Table No. 2: Multiplication Factor of Long Bones

S. No.	Long Bone	Multiplication Factor
1.	Humerous	5.2
2.	Radius	6.5
3.	Ulna	6.0
4.	Femur	3.7
5.	Tibia	4.3
6.	Fibula	4.4

Review of Literature

Wenzel (1956), reported that the data on sexual dimorphism in the manubrium and sternum. He concluded that the length of the manubrium is almost equal in both the male and female and the mesosternum is longer in males as compared to females. So, the manubrium of the female sternum is at-least twice as long as the manubrium.

Lal CS *et al.* (1972), worked on the population of 258 in Bihar whose aged from 12 to 21 years for estimation of height from long bones such as tibia and ulna. They concluded that the multiplication factor of ulna gives the most appropriate height when the identity of an individual id not known.

Mondal *et al.* (2012), studied that height of an individual increase till the teenage and then decreases at last because of vertebral column erosion. This approach will also helpful for finding an unknown population in the future but the regression formula

proposed will be greatly used in medico-legal, anthropological, and archeological studies in which total height can be estimated if the length of the ulna bone is known.

Solan and Kulkarni (2013), studied that some differences found in mean values of the femoral segments and total length of the femur when compared to other studies. This was due to some factors like age, sex, race, and environmental factors which affect bone growth such as, nutrition, genetic factor, and physical changes. Furthermore, these range of differences could be based on the differences in anatomical reference points which are taken as a principle in the measurements of bones.

Forrest (2019), reviewed that forensic odontology relatively plays an important role in the identification of victim mass disaster incidents. It is dependent on the availability of subsequent ante-mortem dental records together with the skull and methodology of the post-mortem examination of the structure of the dentition and nearby tissues. Finally the effective and accurate comparison of these ante-mortem and post-mortem observations.

Discussion

In this present review paper, we discussed that the identity of a deceased of mass-disaster events can be

co-relate with the most appropriate parts of the skeleton remains like the dental part and any long bone such as femur, tibia, fibula, humerus, ulna, and radius which found at the scene. Many scientists worked on related to different techniques or methods. **Trotter et al. (1952)**, estimated the stature of Americans and Negroids from ulna bone and applied regression expression on it. Here also discussed that the height of the deceased increases at a certain time period and after that it decreases. The ossification of bones and eruption of teeth at a particular age also gives valuable information about the disaster victim.

Conclusion

After studied many research papers on this topic, it is concluded that the factors age and height can give an absolute idea about the victim disaster. There are many other techniques for the identification of an individual from the remains like digital fingerprinting, superimposition of the face, etc. But sometimes, it is not necessary that the parts covered from the scene are in good condition, it may be mutilated, decomposed, or burnt. So, this review paper may help in a case where a part of bone recovered from the scene and estimated age and height of decease.

 References:

Ashley, G. T. "A Comparison of Human and Anthropoid Mesosterna." *American Journal of Physical Anthropology*, vol. 14, no. 3, 1956, pp. 449–465., doi:10.1002/ajpa.1330140320.

Ellis, Peter. "Modern Advances in Disaster Victim Identification." *Forensic Sciences Research*, vol. 4, no. 4, Feb. 2019, pp. 291–292., doi:10.1080/20961790.2019.1678798.

Forrest, Alex. "Forensic Odontology in DVI: Current Practice and Recent Advances." *Forensic Sciences Research*, vol. 4, no. 4, Feb. 2019, pp. 316–330., doi:10.1080/20961790.2019.1678710.

Lal CS, Lala JK. "Estimation of Height from the Tibial and the Ulnar Lengths in North Bihar." *Journal Indian Medical Association*. Vol. 58, no. 4, 1972, pp. 120-121.

Pearson, Karl. "IV. Mathematical Contributions to the Theory of Evolution.—V. On the Reconstruction of the Stature of Prehistoric Races." *Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character*, vol. 192, 1899, pp. 169–244., doi:10.1098/rsta.1899.0004.

Sharma, B. R. *Forensic Science in Criminal Investigation & Trials*. Fifth ed., Universal Law Publishing / Lexis Nexis, 2016.

Siegel, Jay A., and Kathy Mirakovits. *Forensic Science: The Basics*. CRC Press, 2016.

Solan, Shweta, and R Kulkarni. "Estimation of Total Length of Femur from Its Fragments in South Indian Population." *Journal of Clinical and Diagnostic Research*, 2013, Oct; 7(10): 2111-2115. DOI:10.7860/jcdr/2013/6275.3465.

Trotter, Mildred, and Goldine C. Gleser. "A Re-Evaluation of Estimation of Stature Based on Measurements of Stature Taken during Life and of Long Bones after Death." *American Journal of Physical Anthropology*, vol. 16, no. 1, 1958, pp. 79–123., doi:10.1002/ajpa.1330160106.