Research Article

Forensic osteology: application in examination of human remains

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Abstract

Forensic osteology, as a science, has to help determine the causes and circumstances of human death from the features of bony remains. This subject has long been of interest to anthropologists and forensic pathologists. This paper reviews the role of forensic osteology in examination of skeletal remains.

Key Word: forensic osteology, human remains, identification, anthropology.

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INTRODUCTION

Osteology is the sub-specialty of Anatomy that deals with the scientific study of structure and function of bones. Forensic osteology therefore implies the application of the principles and knowledge of osteology to the administration of law. Forensic osteology, as a science, has to help determine the causes and circumstances of human death from the features of boney remains. This subject has long been of interest to anthropologists and forensic pathologists. Currently public awareness, regarding forensic osteology has reached a higher level. This is because of increased media coverage of cases where human remains are subjected to forensic examination. Though detecting cause and circumstances of death from bones remains largely in the domain of traditional forensic pathologists, forensic osteology has emerged as the corner stone of inter-disciplinary research. Apart from helping construct a biological profile (identification) of the subject, Forensic osteology has taken an important role in the investigation of human remains related to criminal cases, mass graves, torture and genocide.

HUMAN IDENTIFICATION

The forensic osteologist aims to establish the biological identity o f the subject. They try to determine the sex, age, stature, and ethnic background of an individual from their skeletal remains.

DETERMINATION OF SEX

Many techniques are available for the osteological determination of sex in the adult human.[1] Those are primarily based on morphology of human bones and the distinct structural markers of sex .The entire skeleton provides ample information to determine sex with almost cent percent accuracy.[2] The skull and pelvis, inclusive of the innominate.[3,4] are the most sexually dimorphic bones in humans. Even post cranial bones, especially long bones have been successfully used to determine sex. Population specific discriminant functions have been obtained from various studies whereby different bones have been assigned to proper sex. The bones like sternum[5] and hyoid[6,7] have been used to determine sex in adult skeletal remains.

DETERMINATION OF STATURE FROM BONES

Stature is usually a relatively straightforward parameter to establish in the adult. In the juvenile, it is naturally

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correlated with age but is complicated by differences in rates of growth, racial, nutritional and other interrelated factors. Even regression equations vary between the sexes and between individuals of different racial origin[8] Long bones like the femur, tibia, and radius even clavicle have been used to determine stature using regression formulae. The methods of stature estimation from post-cranial long bones have been well studied in medical literature. Of the mathematical methods, regression equations have been successfully used for estimation of stature. Population specific formulae produce more accurate results. Several such works have been documented. In India, studies have been reported on regression equation of fragment of other bones (radius and humerus) using collection from the southwestern part of the country (Maharashtra State) by Mysorekar N L *et al*.[9] As a long bone of the lower extremity, the femur has been extensively used for stature estimation. Earlier works from India by Pan on Hindus of Bengal, Bihar and Orissa are noteworthy.[10] In another work, researchers calculated the percentile length of each segment and compared to total length and thereby established that height could be calculated with the help of a small fragment of femur[11] Stature can be estimated from fragments of long bones as well.Investigations with fragments of long bones were also used in several studies on European and African population.[12] Previous study by Dan *et al* on tibia of Bengali showed satisfactory results in a population specific study.[13] In another study Mukhopadhyay *et al*.[14] established the correlation between epicondylar breadth and maximum femoral length and subsequently its application in stature estimation in Indian Bengali population. Estimation of stature is an important part in establishing the biological profile of skeletal remains. This would help in identification of unknown skeletal remains using principles of osteoology.

ESTIMATION OF AGE FROM SKELETAL REMAINS

There are several markers to estimate age in the young skeleton.[15] These are primarily based on structural and morphological changes with age and development. The appearance of centers of ossification is based on strict chronological sequence. They also fuse with the respective diaphyses following a time schedule. Age can be estimated from those changes in skeletal remains. Morphometry of several bones like clavicle can also be used as a marker of age. Also some bones like the symphysis pubis, undergoes a series of morphological changes with age. The cranial suture closure has been used to determine the age in the mid adult phase and older group. Determination of age becomes less accurate with ageing.

DETERMINATION OF RACE FROM HUMAN REMAINS

Determination of ethnic identity is the least reliable and is influenced by extensive racial mixing and lack of data on many populations. Scheuer in a monumental work has reviewed the principal methods used to establish identity and comments on their reliability and accuracy in the forensic context.[16] Structural features unique for a specific racial origin have been well documented. This includes bones as well as teeth. The forensic osteologist has to work with these problems to contribute towards human identification.

SKELETAL REMAINS

Skeletal remains are usually examined by forensic pathologist to determine the cause and Nature of death. Bones being resilient to decomposition are often recovered from crime scene a referred for forensic investigation. Also bony peculiarity, diseases or deformity further enhance the capacity to establish the identity of the subject or victim of violent crimes. The skeletal remains are used to document injuries like fracture, cut bullet and post mortem changes. The osteologist provides valuable input in this regard as a member of the investigating team.

MASS GRAVES

Investigation of the remains of mass graves has attained much importance these days. This involves identification, of the victims, cause of death, and documentation of signs of any specific importance like homicide or torture. Often commingled remains are examined to solve forensic cases of violent crimes involving human remains.

DISASTER VICTIMS

Identification of the individual in disaster and mass deaths are often the prime requirement of investigatingn agencies.The forensic osteologist can help by providing expert opinion in this regard.

CONCLUSION

It is thus seen that forensic osteology has much to offer to the systematic examination of human remains and forms the basis of research on physical anthropology and forensic sciences. It needs to develop in accordance with the progress in scientific investigation of death and crime in a changing society.

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