

A Review Study to Determine the Age and Sex by using Forensic Anthropology

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ABSTRACT

Forensic anthropology is the application of the science of anthropology and its various subfields. A forensic anthropologist can assist in the identification of deceased individuals whose remains are decomposed, burned, mutilated or otherwise unrecognizable. Anthropometric characteristics have direct relationship with sex, shape and form of an individual. These factors are intimately linked with each other and are manifestation of the internal structure and tissue components that in turn, are influenced by environmental and genetic factors. To review the studies to determine a victim's age and sex using forensic anthropology. Using physical markers present on a skeleton, a forensic anthropologist can determine the victim's age and sex by identifying physical characteristics of the individual. Forensic anthropologists can use skeletal abnormalities determine cause of death, past trauma such as broken bones or medical procedures, as well as diseases such as bone cancer. During the course of an investigation, anthropologists are often tasked with helping to determinate an individual's sex, stature, age, and ancestry. Sex is considered as one of the easiest determinations from the skeletal material and one of the most reliable if essential parts of the skeleton are available in good condition. The most often chosen bones for the determination of sex are the pelvis and the skull although the round heads of the ball joints also provide very reliable means of determining sex. The ribcage and shoulders of males are generally wider and larger than that of females. The male femur is thicker and joins the pelvis at a straighter angle than the female femur. Determination of age can be done by long bones. The long bones are those that grow primarily by elongation at an epiphysis at one end of the growing bone. A forensic anthropologist can reasonably estimate an individual's sex and age at the time of death by examining biological changes that took place during that person's life. There may be the personal error and technical error of measurement which can be prevented by using standard procedures which are internationally recognized.

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INTRODUCTION

Anthropology is the scientific study of all aspects of human development and interaction. Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are intimately linked with each other and are manifestation of the internal structure and tissue components that in turn, are influenced by environmental and genetic factors. Forensic anthropology is the application of the science of anthropology and its various subfields. Physical anthropology studied human differences and forensic anthropology studied these identifying characteristics on the remains of an individual. In 1800s, scientists began the study of skulls. In 1939, William Krogman published Guide to the Identification of Human Skeletal Material [1, 11, 12]. Anthropological measurements of the skeleton and the comparison with existing standard data must then be applied and may help to differentiate between male and female [16]. This has become useful in recent times due to mass disasters like plane crash, mass suicide, forest fires, and earth quakes [7]. Soldiers killed in World War II are identified using anthropologic techniques. DNA was also used as a new tool to analyze skeletons [4, 14] and objective of this review study was to determine a victim's age and sex using forensic anthropology.

MATERIAL AND METHODS

Using physical markers present on a skeleton, a forensic anthropologist can determine a victim's age and sex. Identifying physical characteristics of the individual, forensic anthropologists can use skeletal abnormalities to determine cause of death, past trauma such as broken bones or medical procedures, as well as diseases such as bone cancer. One of the main tools for forensic anthropologists to use in the identification of remains is their knowledge of osteology and the various differences that occur within the human skeleton. Determination of gender can be done by skull, pelvis, rib cage, long bones and cranium. Approximation of age can be done by growth of long bones etc.

RESULTS AND DISCUSSION

The most often chosen bones for the determination of sex are the pelvis and the skull although the round heads of the ball joints also provide very reliable means of determining sex [8-10].

Table 1: difference between male and female Characteristics

Male Characteristics	Trait	Female Characteristics
More square	Shape of eye	More rounded
More square	Mandible shape from underside	More V-shaped
Thick and larger	Upper brow ridge	Thin and smaller

Male Characteristics	Trait	Female Characteristics
Present	Occipital protuberance	Absent
Low and sloping	Frontal bone	Higher and more rounded
Rough and bumpy	Surface of skull	Smooth
Straight	Ramus of mandible	Slanting
Rough and bumpy	Nuchal crest	Smooth

Determining Sex using the pelvis

- Pelvis is the best bones (differences due to adaptations to childbirth).
- females have wider subpubic angle.
- females have a broad pelvic inlet.
- females have wider subpubic angle.
- females have a broad, shovel-like ilium.
- females have a flexible pubic symphysis.
- Subpubic angle: Females have greater than 90°. In males, it is less than 90°.
- Sciatic notch: In females have more than 68° and in males, it is less than 68°.
- Sacrum is straighter in women than in men. The ribcage and shoulders of males are generally wider and larger than that of females.

In addition, about one person in twenty has an extra rib. This is more common in males than in females. Normally, the long bones alone are not used to estimate gender. However, if these bones are the only ones present, there are characteristics that can be used for sex determination.e.g. Maximum length of humerus in females is 305.9 mm, while it is 339.0 mm in males. The male femur is thicker and joins the pelvis at a straighter angle than the female femur [6, 15, 13, 7].

Asala [2] used femur head to determine sex in South African whites and blacks from Raymond Dart collection. He took two variables i.e. vertical femoral head diameter and transverse femoral head diameter and concluded that these can be used successfully for sex determination in absence of complete bone.

Determination of Age: Attallah and Marshal [3] described a method to estimate chronological age from different body segments in British boys and girls using somatometric techniques. At birth, there are 450+ bones in the skeleton. In adults, there are 206 bones

Epiphysis line appears where cartilage is replaced by bone. When the cartilage is fully replaced, the line is no longer visible. This information can be used to approximate a skeleton's age.

Age Determination: Use of Teeth: At the ages of 0-5, teeth are best indicator of forensic odontology. Baby teeth are lost and adult teeth erupt in predictable patterns.

At the ages 6-25, epiphyseal fusion – fusion of bone ends to bone shaft. Epiphyseal fusion varies with sex and is typically complete by age 25.

At the ages 25-40 it is very hard to determine the age. At ages 40+, there is basically wear and tear on bones. There are various periodontal disease, arthritis, breakdown of pelvis, etc. Ossification of bones can also be used such as those found in the cranium.

Determination of Age by Skull: By about age 30, the suture at the back of the skull closes. At about age 32, the suture running across the top of the skull, back to front, closes. By the age 50, the suture running side to side over the top of the skull, near the front, closes. Epiphyseal Fusion is also a general guide for age determination. In spite of several multivariate statistical studies of specific measurements of the skull and a few long bones, this is still one of the most problematic areas i.e. skeletal identification [5].

The figures below are of the Epiphyses of the femur or thigh bone (the ball end of the joint, joined by a layer of cartilage). The lines in the illustrated Image 1 show the lines or layers of cartilage between the bone and the epiphyses. The lines are very clear on the bone when a person, either male or female is not out of puberty. In Image 2, you see no visible lines. This person is out of puberty. The epiphyses have fully joined when a person reaches adulthood, closing off the ability to grow taller or in the case of the arms, to grow longer.

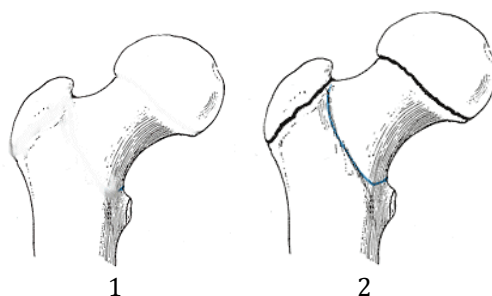


Fig 1: Epiphyses of the femur or thigh bone

CONCLUSION

A forensic anthropologist can reasonably estimate an individual's sex and age at the time of death by examining biological changes that took place during that person's life. There are many challenges in forensic anthropology. There may be the personal error and technical error of measurement which can be prevented by using standard procedures which are internationally recognized.

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