A21   A Computed Tomographic Evaluation of the Vertebrochondral Joint for Age Estimation

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Learning Overview: The goal of this presentation is to provide the scientific community with a new method of age estimation that involves computed tomographic visualization of the vertebral ends of ribs for assessing the degree of ossification of the heads of ribs. Linear regression models developed using these scores can help forensic anthropologists in estimating age.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by shedding light on a novel method of age estimation that scores the degree of ossification of heads of the ribs. Linear regression models developed using these scores can help forensic anthropologists in estimating age. The scores themselves can be used to ascertain whether an individual has attained the medicolegally significant ages of 16 and 18 years.

Age estimation is a crucial part of the identification process. It has significant medicolegal implications in the living, in both civil and criminal law. Age estimation is routinely conducted in cases of individuals participating in sports events, applying for jobs, pensions, etc. It is done in the identification of unaccompanied minors, asylum seekers, and refugees lacking proper documentation indicative of their age. It is vital in the process of assigning criminal responsibility, and is also done in victims of child labor, prostitution and pornography. The most common methods of age estimation are the ones that assess the degree of ossification/fusion of certain indicators of skeletal maturity.

While most of these indicators have been researched thoroughly, one of the less explored anatomical regions whose degree of ossification may have the potential to be used in age estimation practices is the heads of the ribs. The ossification centers pertaining to the heads of the ribs appear by the age of puberty and attain complete maturity by 22–25 years of age. Only a few studies globally have investigated the time of ossification of heads of ribs, and all of these have been conducted on skeletal remains. However, the advent of Computed Tomography (CT) has allowed scientists to visualize previously inaccessible indicators of skeletal maturity in the living. CT can be used to visualize the heads of the ribs, which are attached to the vertebrae by means of an articular facet. The present study visualized the heads of all the ribs of 148 participants (74 males and 74 females) aged 10 to 25 years using CT and scored their ossification status using a modification of the system used by Rios and Cardoso.[1] It was observed that the mean age at any stage of ossification for both the sexes was higher for the anterior and posterior ribs as compared to the middle ribs, indicating that the middle ribs ossify later than the anterior and posterior ones. No bilateral differences or sexual dimorphism was observed ($p > 0.05$). A statistically significant positive correlation ($p < 0.001$) was observed between the ossification scores of each ribs' heads and the chronological age of all the participants. Regression models to estimate age were generated using the rib ossification scores. It was observed that depending on the degree of ossification of the heads of the ribs, it can be ascertained whether an individual has attained the medicolegally significant ages of 16 and 18 years.

This study is the first of its kind, as no other study which uses CT to observe degree of ossification of the heads of ribs for age estimation has ever been performed. The results of this study will provide forensic anthropologists and medicolegal experts from across the globe with a novel method of age estimation. The regression models developed in this study can be used to estimate age using rib head ossification in the Southeastern Asian population.

Reference(s):

[1]   Luis Ríos and Hugo F.V. Cardoso. Age Estimation from Stages of Union of the Vertebral Epiphyses of the Ribs. *American Journal of Physical Anthropology* 140, no. 2 (October 2009): 265–74, https://doi.org/10.1002/ajpa.21065.

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