



A37 The Assessment of Jugular Growth Plate (JGP) Ossification for Age Estimation

Brittany S. Walter, PhD*, Defense POW/MIA Accounting Agency Laboratory, Offutt Air Force Base, NE 68113; Katherine Skorpinski, PhD, Defense POW/MIA Accounting Agency, Offutt Air Force Base, NE 68113

Learning Overview: After attending this presentation, attendees will understand the accuracy and utility of JGP ossification as a skeletal indicator for estimating age at death of human remains.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how JGP ossification is not a reliable or useful skeletal indicator for age estimation and by establishing that jugular canal size may influence JGP ossification.

When estimating age from human remains, cranial skeletal indicators of age are useful when postcranial age indicators are absent or damaged. These methods typically provide large/open-ended age intervals for adults (e.g., cranial sutures and third molar development). Previous studies have suggested the ossification of the JGP, located on the posterolateral wall of the jugular canal, as a possible age indicator; however, these studies are limited and contradictory.

Anatomical literature cites JGP ossification to begin by 25 years of age, though the validity of this assertion was not tested until the 1990s. Two published studies have evaluated age at death using JGP ossification.^{1,2} Maat and Mastwijk assessed JGP ossification of 98 skulls by removing part of the occipital to determine if ossification was present.² In their sample, there was no evidence of ossification until 22 years of age, and all males exhibited bilateral JGP ossification by 36 years of age. Hershkovitz et al. used radiographs and macroscopic analysis of 1,869 crania to assess age of JGP ossification.¹ This study concluded that if there is no evidence of ossification, the individual is likely less than 20 years of age; further, it found no effect of laterality and observed unossified JGPs in individuals above 70 years of age.

The purpose of this study is to assess the validity of previous studies that have quantified JGP ossification patterns for age estimation using an independent sample.^{1,2} Crania from individuals of known age ($n=65$) were visually examined for ossification of the JGP. All crania were from identified American World War II (WWII) service members from the USS *Oklahoma* loss at Pearl Harbor on December 7, 1941. The sample population comprised White, Black, and Asian males aged 18.7–48.5 years at death. Ossification of the JGP was independently scored in the blind for each side as “unossified” if there was no evidence of ossification or “ossified” if any evidence of ossification was present.

In the study sample, the youngest age exhibiting JGP ossification is 18.7 years, the youngest age in this sample; and the oldest age at which the JGPs remained bilaterally unossified is 34.3 years. Individuals 44.7 years of age and older ($n=2$) exhibit bilateral ossification. Age estimation following Hershkovitz et al. (i.e., no evidence of ossification for either side indicates <20 years of age) provides a 19.0% correct classification rate, and following Maat and Mastwijk (i.e., bilateral ossification indicates at least 36 years of age) provides an 18.5% correct classification rate.^{1,2} Contrary to Hershkovitz et al., laterality had a significant effect on JGP ossification, with a higher frequency of unossified JGPs on the right side compared to the left side ($p<0.00$, $\chi^2=17.82$).¹ Post hoc analyses suggest that this may be an effect of jugular foramen size, which was observed to be larger on the right side in the sample ($p=0.03$, $\chi^2=4.57$). Additionally, inter-observer analyses indicate substantial agreement between the authors ($K=0.78$, $p<0.00$).

To conclude, though inter-observer agreement is substantial, the use of JGP ossification to estimate age is not recommended due to low correct classification rates and the effect of laterality. The youngest individuals in the study sample exhibit both bilaterally ossified and unossified JGPs, indicating that additional data from younger individuals is needed to establish the age of earliest occurrence of ossification. Though bilateral ossification occurs by 44.7 years of age ($n=2$), the limited age range of this sample may not capture ossification status at older ages. Previous observations of unossified JGPs in individuals over the age of 70 suggest that JGP ossification is an unreliable age indicator for older age groups.¹ Additionally, both observers found that on several occasions, the view of portions of the JGP was obscured by surrounding bone, inhibiting scores to be observed and further limiting the utility of this method.

Reference(s):

1. Hershkovitz I., Latimer B., Dutour O., Jellema L.M., Wish-Baratz S., Rothschild C., and Rothschild B.M. The elusive petrooccipital articulation. *Am J of Phys Anthropol.* 1997; 103:365-373.
2. Maat G.J.R. and Mastwijk R.W. Fusion status of the jugular growth plate: An aid for age at death determination. *Int J of Osteoarchaeol.* 1995; 5:163-167.

Age Estimation, Jugular Growth Plate, Biological Profile