

Forensic age estimation in living children: how accurate is the Greulich-Pyle method in Sabah, East Malaysia?

ABSTRACT

Background: The Greulich and Pyle's Radiographic Atlas of Skeletal Development of the Hand and Wrist (GP Atlas) is the most widely used method of determining the bone age (BA) of a child. It is also a widely accepted method for forensic age determination. As there is limited local bone age data for forensic age estimation, the purpose of this study was to assess the accuracy of the GP Atlas for forensic age determination in living Sabahan children. Method: This study recruited 182 children between the ages of 9 years to 18 years. BA estimation of the left-hand anteroposterior radiographs were performed by two experienced radiologists using the Greulich-Pyle method. Results: The BA estimates from two radiologists had very high interobserver reliability (ICC 0.937) and a strong positive interobserver correlation ($r > 0.90$). The GP method, significantly and consistently underestimated chronological age (CA) by 0.7, 0.6 and 0.7 years in overall children, boys and girls respectively with minimal errors. Mean absolute error and root of mean squared error for overall children was 1.5 and 2.2 years respectively, while mean absolute percentage error was 11.6%. This underestimation was consistent across all age groups but was statistically significant only at 13–13.9 and 17–18.9 years old age groups. Conclusion: Despite high interobserver reliability of BA estimation using the GP Atlas, this method consistently underestimates the age of the child in all children to a significant degree, for both boys and girls across all age groups, with an acceptably low level of error metrics. Our findings suggest that locally validated GP Atlas or other type of assessments (artificial intelligence or machine learning) are needed for assessment of BA to accurately predict CA, since current GP Atlas standards significantly underestimated chronological age with minimal error for children in Sabah. A larger population-based study would be necessary for establishing a validated atlas of a bone age in Malaysia.