Case Report

Age estimation of a skeletonized human remains using the mann and lamendin methods: a case report

Indah Maydila Sandi[1]
Oktavinda Safitry[2]
Antonius Winoto Suhartono[1]
Ira Zefanya Pattihahuan[2]
Elza Ibrahim Auerkari[1*]

[1]Forensic Odontology Specialist Study Program, Department of Oral Biology, Faculty of Dentistry, University Indonesia, Jl. Salemba Raya No. 4 Central Jakarta, 10430 Indonesia
[2]Departement Forensic and Medicolegal, Faculty of Medicine, University Indonesia, Jl. Salemba Raya No. 6, Central Jakarta, 10430, Indonesia

* Correspondence:
eiauerkari@yahoo.com

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ABSTRACT

Introduction: An autopsy examines a deceased body to determine the cause of death. Forensic science applies scientific methods to aid law enforcement. After death, the body progresses through five decomposition stages: fresh, bloated, active decay, advanced decay, and skeletal, each providing crucial information for investigations. This case report purpose is to described age estimation of a skeletonized human remains using the mann and lamendin methods. **Case Report:** The body was in the skeletonization phase with partial soft tissue remaining on various body parts. No signs of trauma or bleeding were found on the bones. A total of 22 teeth were present, and three teeth were missing post-mortem. The biological age of the individual was estimated using Mann's method, which calculates age based on the palatal suture, followed by Lamendin's method, which uses the periodontosis, root height, and the transparency of the teet **Conclusion:** The estimation of the individual was more than 50 years using Mann's method, and between 64 to 70 years using Lamendin's method. This case demonstrates that forensic odontology provides a non-invasive, cost-effective, and accurate approach for determining the age of a skeletonized remains by analyzing the sutura palatina and teeth.

KEYWORDS

Skeletal, age, forensic odontology

INTRODUCTION

An autopsy, derived from the Latin term *autopsia*, meaning "body surgery," refers to the examination of a deceased individual to determine the cause of death.[1,2] In Indonesia, it is defined as a surgical examination aimed at identifying the cause of death.[1,3] Medically, it involves analyzing the body's organs and structures, particularly in cases involving injuries or surgical procedures. Autopsies are closely associated with forensic science, which applies scientific methods to legal matters such as victim identification and cause-of-death determination in criminal cases. Forensic science plays a crucial role in supporting law enforcement and the administration of justice by offering expert insights.[3,4]

Forensic examinations conducted by medical professionals are essential in criminal investigations, as they help establish whether illegal activities were involved. Internal examination through clinical autopsy is necessary to uncover the full truth, as external examination alone is often insufficient. In cases involving unidentified bodies, confirming the victim's identity is of paramount importance. Following death, the body undergoes several post mortem changes, including livor mortis (blood pooling), rigor mortis (muscle stiffening), and algor mortis (body cooling).[2,6–8] Algor mortis refers to the gradual cooling of the body, with a temperature decrease of about 1.5°F per hour. Rigor mortis results from ATP

depletion, leading to muscle stiffening, which begins within a few hours and typically resolves after approximately 24 hours. Livor mortis causes blood to pool in the dependent parts of the body, resulting in purplish discoloration that becomes fixed after approximately 12 hours. [9]

Subsequently, decomposition progresses through five stages: fresh, bloated, active decay, advanced decay, and skeletal.[2,7] Bloating occurs due to microbial activity, leading to gas accumulation, while tissue rupture during active decay accelerates the decomposition process. As decomposition advances, high-resistance tissues such as cartilage and hair remain, wheras bones gradually become exposed in the skeletal stage.[6,7,10]

Skeletonization, in which more than half of the skeletal elements are exposed, typically occurs around two months after death but usually ranges from two to nine months. During this period, bones become exposed, with only a residue of greasy material remaining or fully dry bones visible. Complete bone exposure usually observed six months after death, though environmental factors can accelerate the process, leading to bone erosion and bleaching as early as three weeks post-mortem.[9,10]

The Indonesian National Police is one of the institutions authorized to request an autopsy examination by a forensic doctor, in accordance with Article 133 Paragraph 1 of the Criminal Procedure Code, which states: "In the event that an investigator, for the benefit of justice, handles a victim who is injured, poisoned, or deceased under circumstances suspected to be related to a criminal act, they have the authority to request expert testimony to a judicial medical expert, doctor, and/or other experts". Therefore, in the event of the discovery of a skeleton, authorities have the right to request an autopsy to determine whether violence occurred before death.[1,11]

The identification of unknown bodies is an essential aspect of medicolegal death investigations, playing a crucial role in legal and humanitarian matters within our society.[3,12] Visual analysis of soft tissue characteristics is the most commonly used method of personal identification. However, its scientific reliability is questionable, and the potential for error is significant. A more reliable method for identifying soft tissue is the examination of ridge patterns or fingerprints. Identifying victims becomes particularly challenging in cases where the body is in an advanced state of decomposition, has sustained severe burns, or has been dismembered.[12–15]

DNA analysis is essential in forensic investigations, aiding in the identification of individuals and the differentiation of mixed remains or the reassociation of separated body parts from dismembered body. However, the cost of DNA testing can be substantial. Furthermore, even a limited number of common dental characteristics can create a rare and distinctive dental pattern, which is highly useful for identification purposes.[12] Therefore, forensic odontologists can contribute to identification through dental analysis, even when the body has reached the skeletalization stage. Antemortem records can also provide valuable information for establishing an individual's identity. Additionally, anthropological analysis of the skull itself can assist in determining an individual's identity.[14–16]

Forensic odontology plays an crucial role in human identification when fingerprint or DNA analysis is unavailable. The durability and unique characteristics of teeth make dental analysis a reliable method in forensic investigations. Additionally, forensic odontology aids in age estimation by assessing regressive dental changes such as occlusal attrition, secondary dentine formation, and root transparency. Various methods exist for determining biological age; however, selecting the most suitable approach requires considering factors such as practicability, cost-effectiveness, and invasiveness. While this particular case is uncommon, it is nonetheless significant, and several methods exist for precise age determination. These factors underscore the importance of dental evidence in establishing identity and estimating age, making it an indispensable aspect of forensic science.[14,17]

The novelty of this case report lies in its combined application of the Mann and Lamendin methods to estimate the age of a skeletonized individual, providing a comparative evaluation of skeletal and dental parameters under real forensic conditions in Indonesia. This integration offers a practical and cost-effective approach for cases where DNA or radiographic analyses are unavailable. This study aims to describe the application of these two methods in a single forensic case to demonstrate their complementary value in producing accurate biological age estimation in skeletonized remains.

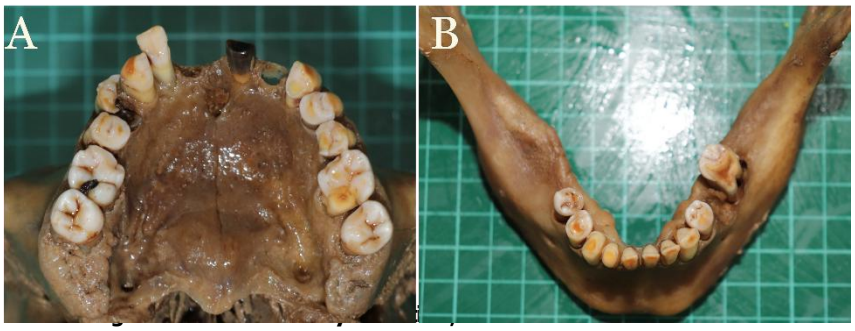
Case Report

On 20 January 2024, the body arrived wrapped in an orange body bag. The body was dressed in a short-sleeved t-shirt, cotton material, brown color, without brand and size, which was torn to tatters, stained with a brown liquid and other matter. An undershirt, sleeveless, cotton, mesh pattern, cream color, brand 'CROCODILE', size 'XL', was shredded and similarly covered in brown liquid and matter. A pair of trousers, cotton material, grey color, no brand, and size, was stained with brown liquid and matter, with an empty pocket.

Additionally, a pair of underwear, cotton, purple color, no brand, no size, was torn to tatters, covered in brown liquid and matter. Beside the body, two pillows with an abstract pattern in green-white-red color were found, along with a rubber bracelet inscribed with the words 'CHAMPION'.

Figure 1. The body condition

The body was found in the skeletonization phase inside a house, with remnants of skin tissue present on parts of the abdomen, right forearm, right and left thighs, right lower leg, and both feet. Both eyes, nose, ears, mouth, tongue, and release hole were not found. The cartilage bone was absent, and the nasal septum was missing bent to the right. No visible signs of blunt force or sharp force trauma were observed on the bones, and no sign of bleeding was detected, including on the mandible.



Both the maxillary and mandibular regions are covered in a mass. The palatal suture exhibits significant closure, and a small torus maxillary is present. The maxilla contains 13 teeth, with one tooth retaining its root. The mandible has 9

teeth, with 4 teeth retaining their roots. Two teeth are missing post-mortem from the maxilla, and one tooth is missing from the mandible. The majority of the teeth show signs of attrition.

DISCUSSION

Forensic odontology plays a role in determining age, gender, and ancestry. This is achieved by conducting assessments using various methods, including osteoscopy, osteometry, dental morphology, and dental morphometrics.[14,18] In this case, the Mann method, which uses the palatal suture, and the Lamendin method, which evaluates periodontosis, root height, and tooth transparency, were used. This report integrates several methodologies from previous research to determine the biological profiling, utilizing both palatal suture analysis and dental examination, which can be easily conducted by assessing the palatal area and extracting teeth for further analysis.

Forensic anthropologists are often asked to estimate the age of the deceased. It is interesting to study how the palatine suture fuses with age. Palatine sutures may contribute to age estimation, at least before the age of 60. Mann's method classifies palatine sutures into five groups, ranging from no closure to complete closure.[18,19] The method is subdivided into four sections of the palatine suture: the transverse palatine suture (TP), the incisive palatine suture (IN), the posterior median palatine suture (PMP), and the anterior median palatine suture (AMP). Mann divides age into five stages: less than 20 years, 20-24 years, 25-29 years, 30-50 years, and over 50 years.[19]

The palatine sutures are fully obliterated, as evidenced by the transverse palatine suture (TP) and the incisive palatine suture (IN). The posterior median palatine suture (PMP) and the anterior median palatine suture (AMP) still appear as a visible suture line, suggesting substantial closure but not complete fusion. Based on these suture closure pattern, it is estimated that the individual was over 50 years old at the time of death.

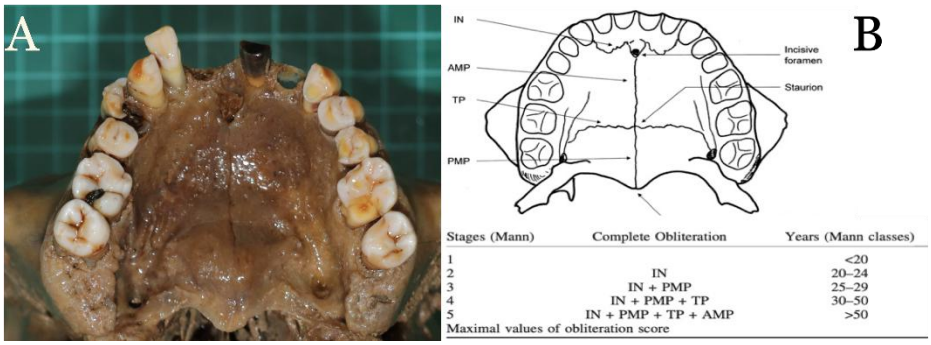


Figure 3. a. Palatine suture, b. Mann Method of palatine suture to determine age.

This study also presents a methodology for estimating the age of adults using single-rooted teeth. The methodology is based on the assessment of three dental characteristics: root height, tooth transparency, and periodontosis height.[20–23] The prevalence and severity of periodontitis were evaluated by measuring the maximum distance between the cementoenamel junction (CEJ) and the soft tissue attachment. This area exhibited a yellowish or brownish discolouration in the cervical region of the tooth, contrasting with the surrounding root surface.

The translucency of a single-rooted tooth is measured by exposing it to a bright light source and recording the translucency from the apex of the root to the area near the neck on the labial surface. This translucency height is measured with a caliper on both the labial and distal surfaces of the tooth. The highest measurement obtained is recorded as the final translucency height. In some cases, it is greater on the distal surface.[23] The highest value was recorded as the final translucency height. The measurement was occasionally higher on the distal surface. According to the Lamendin equation, age estimation is 0,18 times

Periodontosis (periodontosis height devide by root height and multiple by 100) plus 0.42 times translucency (translucency high devided by root height and multiple by 100) and added by 25,53.[18,20,24]

Figure SEQ Figure * ARABIC 3. Measuring the root length.

The calculation of tooth 45 yielded the following results: P = 10/15.7 * 100 = 63.69 and T = 11.5/15.7 * 100 = 73.24. The P and T values were then entered into the formula for age estimation. (0.18*P)+(0.42*T)+25.53, resulting in 67.7 years. This falls within the range of 67 years and 8 months, with a standard deviation of 3.3 months or 3 years and 4 months for individuals over 50 years old. This indicates that the body is approximately 64 years and 4 months to 70 years and 11 months old. As the results from Mann's method the body is over 50 years old and from Lamendin's method the body is between 64 to 71 years, it can be concluded that the body at the time of death is 64 old to 71 years.

The combination of Mann's and Lamendin's methods provided a more accurate age estimate, with Mann's method indicating that the individual was over 50 years old and Lamendin's method refining this to 64-70 years old. While palatal suture closure is a reliable indicator of age up to around 60 years, its accuracy is less reliable at this point. The Lamendin method, which uses dental characteristics, was shown to have a more accurate estimate in older individuals, highlighting the importance of integrating both skeletal and dental methods in forensic age determination.

Forensic odontology plays a critical role in estimating the age of skeletonized remains in a non-invasive, efficient, and cost-effective manner. Through the analysis of dental structures, forensic odontologists can determine a reasonably accurate age range, even in cases where soft tissue is absent. The durability and developmental stages of teeth offer reliable indicators for age estimation, allowing for precise assessments in forensic investigations. The limitation of not having dental radiographs at the time meant that there are fewer methods available for age estimation. The limitation of available sources could impact the analysis.

CONCLUSION

The two identification methods proposed by Mann and Lamendin yielded similar age estimates for the victim, indicating an age above 50 years, specifically ranging from 64 to 71 years. It can be reasonably inferred that the individual in question is indeed the presumed person, the resident of the house. However, the implication of this study is that, even with these constraints, a forensic odontologist can still provide a reliable age estimate by examining the sutura palatina and teeth.

Author Contributions: I.M.S., I.Z.P., and O.S. have participated to do the autopsy. I.M.S., O.S., A.W.S., and E.I.A contributed to the interpretation of the result. I.M.S., A.W.S., and E.I.A. wrote the final manuscript. All the author contributes to review the manuscript critically and approves the version for publication. All author have read and approves the final manuscript.

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Institutional Review Board Statement: Ethical review and approval for this case report were waived by the Ethical Clearance Committee - Faculty of Dentisry, University of Indonesia number 15/KEPKG/FKGUI/VIII/2024. Furthermore, the decision was made not to share the identity of the victim.
Informed Consent Statement: Informed consent was not obtainable as the individual is deceased and no legal next of kin or family members were available. This case report was prepared in accordance with ethical guidelines and institutional policies, ensuring that all identifying information has been removed to protect the individual's privacy.
Conflicts of Interest: The authors declare that there were no conflicts of interest related to this case report.

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