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The relevance of studying the temporal bone styloid process when examining decomposing or skeletonized bodies

Abstract

This article seeks to address the relevance of studying the temporal bone styloid process when examining decomposing or already skeletonized bodies. It is common knowledge that the fracture of the temporal bone styloid process is a normal finding in cases of homicide due to neck constriction, also known as suffocation. Indeed, in many cases, due to the advanced state of decomposition of the corpse, and even in the skeletonization phase, the bones can be an important source of information when studying the etiology of the death of the subject being examined.

Keywords: styloid process, temporal bone, skeletonized bodies, homicide, neck constriction

Volume 12 Issue 2 - 2024

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Received: March 16, 2024 | **Published:** April 02, 2024

Introduction

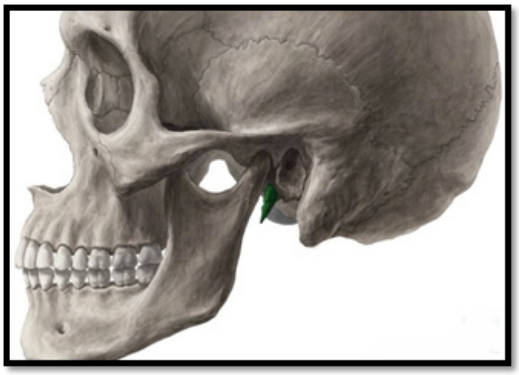
It is common knowledge that one of the main objectives of forensic anthropology is human identification, namely a scientific procedure that is carried out through the comparative analysis of antemortem records (medical records, x-rays, odontograms, or other comparable data) and post-mortem records (comprising the osteobiographical analysis of the individual). In addition to the positive identification of the victim, forensic anthropology proves to be equally important for elucidating the circumstances of death, including the cause thereof, the type of instrument that caused it, the types of injuries and the time at which they occurred, as well as the analysis of elements found together with the corpse, such as clothing and belongings.

Bones have plastic and elastic characteristics that vary according to the amount of organic matter they contain and which, together with the morphology of the bone, enable them to respond to day-to-day tension, compression and traction forces. Fractures occur when one or more of these forces exceeds the deformation limit that allows the bones to withstand them, leading to the rupture of the bone structure.[1],[2] Soon after the occurrence of bone trauma, when the individual is still alive, the organism begins the healing process that will lead to the repair of the fractured bone, and which leaves a series of signs, among which the most obvious is the formation of a consolidated bone callus.[3] However, when fractures occur close to the moment of death, the bone repair process cannot be detected in the skeletal material, either because it has not begun to take place, or because it is incipient, leaving no recognizable macro signs. Thus, these fractures are classified in the specialized literature as perimortem because they occurred very close to the moment of death, irrespective of whether the individual was alive or recently deceased when it occurred. They have specific characteristics that potentially allow them to be differentiated from those occurring in bones that are already dry (post-mortem fractures). These findings are extremely important, as they make it possible to identify the fracture event at the time of death, which is relevant when investigating homicide crime.

Anatomy

The styloid process (apophysis) is a spicular projection of the lower aspect of the temporal bone. It originates prior to the stylomastoid foramen (hole), which houses the facial nerve (cranial nerve VII) and the stylomastoid artery. It corresponds to a thin bony projection approximately 25 mm in length. It is located between the internal and external carotid arteries, posterior to the pharynx, where the stylohyoid, styloglossus and stylopharyngeus muscles are located.[4]

In the picture to the right, the temporal bone styloid process shown in green, surrounded by a red circle.



[1]Browner BD, Levine AM, Trafton PG, et al. *Skeletal trauma: Basic science, management, and reconstruction (3a)*. WB Saunders. 2003.
[2]Ubelaker DH, Adams BJ. Differentiation of perimortem and postmortem trauma using taphonomic indicators. *Journal of Forensic Science*. 1995;40(3):509–512.
[3]Black S, Ferguson E. *Forensic anthropology*: 2000 to 2010. CRC Press. 2011.
[4]Gray Herny. *Gray Anatomy*. 29th edition. Pgs. 113 and 140. Rio de Janeiro - RJ: Editora Guanabara Koogan SA. 1988.

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The Mastoid Process is a conical projection that can vary in size and shape located in the posterior part of the temporal bone (mastoid portion). The sternocleidomastoid, splenius of the head and dorsalis longus muscles are attached to its external surface.

The relevance of the anatomical position of this process is its close relationship with the styloid process, which is of paramount importance in understanding the genesis of the styloid process fracture in the crime of homicide by suffocation.

In the picture on the right, the mastoid process of the temporal bone is shown in green.

Forensic asphyxiology

Asphixia, a term coined by Galen, etymologically signifies an absence of pulse. In Forensic Medicine, however, it means a morbid entity in which there is a concomitant reduction in the supply of oxygen to the tissues and an increase in the levels of carbon dioxide in circulation. This can be simplified: hypoxia (deficiency in quantities of oxygen) and hypercapnia (excess concentrations of carbon dioxide).[5]

Among the various classifications of mechanical asphyxia is that of Thoinot.[6]

I. Mechanical asphyxia by constriction of the neck - hanging, strangulation by a noose and strangulation by hand (suffocation).

II. Mechanical asphyxia by occlusion of the external respiratory orifices (direct suffocation).

III. Mechanical asphyxia due to obstacles to chest movements (indirect suffocation).

IV. Mechanical asphyxia due to breathing in a liquid or powdery solid medium (drowning and burial).

V. Mechanical asphyxia resulting from occlusion of the airways by foreign bodies (direct suffocation).

Suffocation - Thoinot referred to suffocation as strangulation with the hands.[7] Suffocation is the constriction of the neck with the hands. There is no furrow (sulcus). There may be finger and nail marks (digital and/or nail stigmas). In general, it causes far more serious internal injuries than in cases of strangulation. Frequent findings are the fracture of the cartilaginous skeleton of the larynx, amidst profuse hemorrhagic infiltration of the soft tissues of the cervical region under pressure.

It is exclusively homicidal.

It requires undoubtedly disproportional strength between the attacker and the victim, or else the victim must be unable to defend himself or herself due to a previous blow, under the influence of drugs. In the engraving on the right,[8] taken from the internet, we demonstrate the disproportion of strength between attacker and victim.

Bibliographical review

Temporal bone styloid fracture is a common finding in cases of homicide by constriction of the neck, also known as suffocation. When a person is suffocated, the pressure exerted on the neck can cause temporal bone styloid fracture. The presence of temporal bone styloid fracture can be a strong indicator of homicide by constriction of the neck, especially when combined with other autopsy findings, such as hemorrhages in the soft tissues of the neck and damage to the cervical vertebrae.

Research has been conducted on this subject

The specialized literature is plentiful in claiming that styloid process fractures can be associated with suffocation, as in the report to be found in Professor Genivaldo Veloso França's book.[9] In a study published in 2005 in the Forensic Science International journal, the researchers evaluated the characteristics of temporal bone styloid fractures in 24 cases of homicide by neck constriction. In the end, they concluded that the temporal bone styloid fracture is a finding highly suggestive of strangulation and that its detection can be useful in the investigation of suspicious deaths. Another study, published in 2019 in the Forensic Science Medicine and Pathology journal, examined 43 cases of homicide by constriction of the neck and found that temporal bone styloid fracture was found in 88% of the cases. This research indicates that temporal bone styloid fracture can constitute an important piece of evidence in the investigation of cases of homicide by constriction of the neck.

Experiment conducted

In order to demonstrate the possibility of the etiology of the fracture found in the temporal bone styloid process being due to asphyxiation in the form of suffocation, as described in the literature, the author – a Forensic Expert – performed radiological clinical tests. With duly documented informed consent, as well as taking all the necessary radiological protection, using a female volunteer, a simulated reproduction of the facts was conducted, in which, by means of a radiological examination, images were taken of the hands of a male participant, in the cervical region of the female volunteer. These images revealed the contact between the attacker's hand and the mastoid process and, as previously demonstrated, this has a close

[5]Apostila professor Roberto Blanco Fasciculo IV. 2005. p. 268.
[6]Croce Delton. *Forensic Medicine Manual*. São Paulo: Saraiva. 2012.
[7]Apostila professor Roberto Blanco Fasciculo IV. 2005. P. 377.
[8]https://milwaukee-criminal-lawyer.com/wp-content/uploads/2019/05/Strangulation-and-suffocation-1024x683.jpeg
[9]Genivaldo Veloso França. 11th edition. p. 166.

Citation: Chambriard CJ. The relevance of studying the temporal bone styloid process when examining decomposing or skeletonized bodies. *Forensic Res Criminol Int J*. 2024;12(2):104–106. DOI: 10.15406/frcij.2024.12.00403

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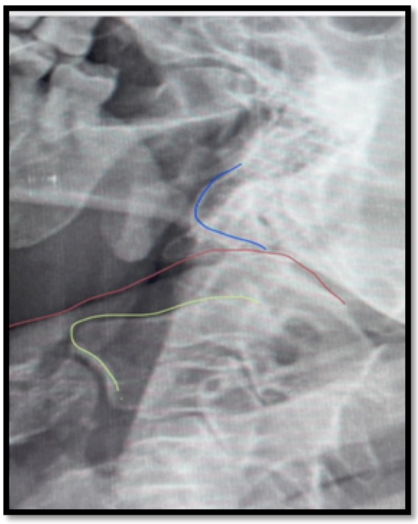
relationship with the styloid process which, due to its small thickness and length, is not perceived in routine radiological examinations.

In the image to the right, the distinct possibility that the styloid process fracture is caused by the force of the attacker's hands on it can be clearly seen.

In green, the edge of the distal phalanx (bone) of the attacker's thumb is outlined.

In red, the edge of the soft tissue (skin) of the attacker's thumb is outlined.

The outline of the mastoid process of the temporal bone is outlined in blue.



Concluding remarks

From the experiment presented here, it can be seen that the positioning of the attacker's hand when constricting the victim's neck in the act of suffocating is closely related to the mastoid process of the temporal bone and, as previously mentioned, this is anatomically positioned next to the styloid process, confirming that the attacker's hand reaches it when squeezing the cervical region. It is worth noting that, during the simulation of the homicidal constriction action, the grip of the attacker's hand positions his finger closer to the styloid process, which was not performed here for obvious reasons.

Conclusion

It is the author's conclusion, based on the literature and the experiment presented herein, that the perimortem fractures found in corpses in a state of putrefaction, and even in skeletonized corpses, can serve as an indication of the legal cause of death, guiding and directing future investigations. Work performed at the regional technical-scientific police precinct in Niterói dimagem diagnóstico por imagem ltda.

Acknowledgments

None.

Conflicts of interest

The author declares there is no conflict of interest.

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