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Cranial anatomical variants: frequency of foramina depicted by the human skull

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Abstract

Background: The human skull depicts a great number of anatomical variations namely in the number and morphology of foramina, grooves, ossicles, sutures and tubercules [1]. Despite their value in clinical and surgical investigations, as well as in trauma analysis and personal identification of human remains [1,2,3,4], no uniformization exists on the data of the frequency of these traits. **Objective:** This work aims to review the reported frequency of selected cranial foramina in different populations and document their presence in the Identified Skeletal Collection of CESPU (CEIC). **Methods:** The following keywords were used to scope PubMed® with a time-limit of 26 years: "Dry human skulls" AND "mental foramen" OR "mastoid foramen" OR "nasal foramen" OR "occipital emissary foramen" OR "meningo-orbital foramen" OR "supraorbital foramen variation" OR "infraorbital foramen variations" OR "parietal foramen" OR "zygomaticofacial foramen". Reviews, case reports and studies conducted only with imaging technology were excluded. In addition, a preliminary observational screening was conducted on skulls from the CEIC to record the presence of the traits reported in literature. **Results:** A total of 52 papers were considered, concerning the accessory mental (AMF), mental (MF), meningo-orbital (MOF), supra (SOF) and infraorbital (IOF), parietal (PF), nasal (NF), mastoid emissary (MEF), occipital (OF) and zygomatic (ZF) foramina. Regarding the MF, most studies focus on the frequency of the AMF, which is overall low. Differences in the MOF were observed within the same population. One-sided absence of the SOF has been reported. The IOF was present in all studies. A relevant percentage of skulls presented no NF in the only study assessed. Different populations show, overall, a high frequency of the MEF and the ZF. The preliminary screening of skulls (n=15) from the CEIC confirmed the presence of several of the above-mentioned traits, including those affecting the frontal, parietal, orbital, maxillary, and occipital regions. These traits were observed in different frequencies within the screened sample, with higher proportions in the parietal and frontal regions and lower in the temporal and mandibular regions. **Conclusions:** The frequency of cranial foramina is variable across different countries. Preliminary observations in the CEIC confirm the presence of these variants and highlight their potential relevance as complementary non-metric traits for forensic human identification.

Keywords: Non-metric traits; Foramina; Frequency; Forensic human identification

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