Disclosing the "hidden" anatomical structures of the cranium: morphological and metrical assessment of pterygopalatine fossa and intrapetrous internal carotid artery through 3D segmentation on CT-scan

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The pterygopalatine fossa (PPF) and the intrapetrous carotid artery (IPCA) are among the most unexplored anatomical regions of the cranium, as they cannot be directly visualized, with consequent limits in research and didactics. Yet, the precise knowledge of PPF and IPCA is important in different surgical fields [1,2]. 3D segmentation software can overcome this limit, obtaining a 3D model of anatomical structures from CT and MRI scans. The present study aims at applying the 3D segmentation procedures to the identification of PPF and IPCA from 100 CT-scans (50 males. 50 females aged 18-91 years). Both the structures were manually segmented through ITK-SNAP segmentation software and the following measurements were assessed: height and volume from PPF, and angles of the posterior and anterior genu, diameter and length of the horizontal portion and volume from IPCA, respectively. Statistically significant differences according to sex and side for all the measurements were assessed through two-way ANOVA test (p<0.05). On average PPF height was 24.1±3.5 mm in males, and 22.8±3.4 mm in females, whereas volume was 0.930±0.181 cm3 in males and 0.817±0.157 cm3 in females, with statistically significant differences according to sex (p<0.05), but not to side (p>0.05). For what concerns IPCA, on average the posterior genu angle was 120.1±10.4° in males, 119.5±9.2° in females, whereas the anterior genu angle was 118.0±10.0° in males, 117.6±10.3° in females. Average length and diameter of the horizontal part were respectively 25.5±2.9 mm and 5.8±0.8 mm in males, and 24.0±2.3 mm and 5.3±0.8 mm in females. The volume of IPCA was 0.941±0.215 cm3 in males, and 0.752±0.159 cm3 in females. Length and diameter of horizontal portion, and volume of IPCA showed statistically significant differences according to sex (p<0.05). This study shows that 3D segmentation may be useful for the morphological and metrical assessment of "hidden" anatomical structures.

References

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