Sizing Up the Frontal Sinus: Clinical Implications of Sinus Size and Complexity

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Introduction:

Human frontal sinuses have been described as the "fingerprint" of the skull because of the high degree of variability in presence, size, and complexity between individuals. However, the relationship between sinus size and overall morphology is still unknown. Understanding this relationship can have important clinical implications, such as assessing frontal sinus disease and developing surgical guidelines.

Objective:

The purpose of this study is to investigate the relationship between frontal sinus size and complexity. Our hypothesis is that sinus complexity increases with sinus size.

Methods:

Thirty 3D-frontal sinus models segmented from CT scans were aligned in Frankfort orientation. 2D-sinus outlines were automatically generated and underwent elliptical Fourier analysis to evaluate complexity. 2D-area, linear dimensions, and the number of arcades were also collected.

Results:

Principal component analyses on the outlines indicate PC1 (54.28% of the variation) represents the height-to-breadth dynamics of the sinuses. Pearson correlations indicate significant relationships between sinus size and complexity, particularly between area and height (R=0.957; p<0.0001), and between PC1 and height (R=0.806; p<0.0001). Chi-square tests also indicate associations between number of arcades and sinus size (X^2=17.429; p=0.002).

Discussion:

Early analysis indicates a strong positive correlation between sinus size and height, as well as sinus size and complexity. Future analysis should focus on variation between males and females, and the relationship between other aspects of sinus size and shape. The ultimate goal will be to explore how sinus variability impacts surgical procedures and recovery and if standard expectations of these processes is possible.