

Association of AHI and Other Patient Factors with Calvarial Thickness

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Background and Hypothesis: Temporal spontaneous cerebrospinal fluid (sCSF) leaks occur when spinal fluid leaks through defects in the skull base bone. Patients with sCSF leaks have approximately 22% thinner skulls but no change in extracranial bone thickness, suggesting an intracranial process causes skull thinning and the development of sCSF leaks. Approximately 83% of sCSF leak patients have obstructive sleep apnea (OSA) as measured by the apnea-hypnea index (AHI) and OSA is associated with spikes in intracranial pressure. We hypothesize that AHI is associated with isolated skull thinning in the general population.

Experimental Design: High resolution head CT images from patients with diagnostic sleep studies at IU health from 2010 to 2017 were analyzed (IRB approved) using 3D slicer to measure skull thickness of the squamous temporal bone. Age, body mass index (BMI), race and diabetes recorded. Mixed model analysis was used to determine the effect of a number of factors on skull thickness.

Results: 344 CT scans were analyzed. Increased AHI was significantly associated with thinning of the calvarium [2.68 mm - 0.003x, (x = AHI point) P<0.02], while thickening of the calvarium was associated with age [CI = 0.005 to 0.011 per year, P<0.001] and BMI [CI = 0.003 to 0.015 per mg/kg², P<0.003]. Female gender (P=0.016) and diabetes (P=0.005) were linked to thickening of the calvarium. Hypertension had no effect on calvarial and zygoma thickness (P=0.244 and 0.575, respectively). The extracranial zygoma thickness was not associated with AHI (P=0.54) or BMI (P=0.811) but the zygoma thinned significantly with age [CI = -0.01 to -0.002, P<0.002] and female gender (P<0.001).

Conclusion and Potential Impact: OSA is associated with skull thinning and may play a pathologic role in the development of sCSF leaks over time.