A107 Correlation Between Body Size and Intracranial Capacity in Korean Youth

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After attending this presentation, attendees will understand how to estimate the intracranial capacity from body size and vise versa.

This presentation will impact the forensic science community by providing estimation equations between body size and intracranial capacity.

Cranial capacity is an important parameter in the fields of evolutionary biology and anthropology and is closely related to brain size. Therefore, cranial shape and capacity are important parameters in evolutionary research, physical anthropology, and forensic sciences.

Four methods are currently available to obtain intracranial volume: (1) a balloon and water filling method; (2) cephalometric measurements and calculations based on estimation equations; (3) the small grain-packing method; and, (4) measurements based on radiological tools, including computed tomography and Magnetic Resonance Imaging (MRI). In this study, 3D modeling of intracranial volume based on MRI data obtained from living subjects was used, not dry skulls of unknown origin.

The subjects were recruited through advertisements at the Korea University web page and local community newspapers. The research purpose and procedures were fully explained to the subjects. History taking (including alcohol consumption) and physical examination were performed by a neurologist of the Korea University Medical Center. MRI was performed on a 1.5-Tesla Magnetom vision after measuring body height and weight. The Digital Imaging and Communications in Medicine (DICOM) format data were imported into the V-work 3.5 program. The MRI signal of the cranial bone was identified under the direction of a radiologist, the intracranial 3D volume model was constructed, and the volume was calculated automatically by the program based on voxel information.

The relationships of body height and weight with intracranial capacity volume differed according to sex. The intracranial capacity volume was correlated with body height in males (R=0.39, p <0.05), but not in females (R=0.24, p >0.05). The correlation coefficient for intracranial capacity and body height markedly increased to R=0.71 (p <0.01) when male and female subjects' data were combined. Conversely, intracranial capacity (volume) correlated with body weight in females (R=0.38, p <0.05), but not in males (R=0.16, p >0.05). The correlation coefficient of body weight and intracranial capacity volume reached R=0.63 (P <0.01) when the data from all subjects were included in the analysis. Further stepwise linear regression analyses revealed that body height is a key variable for intracranial capacity volume, which can be expressed by the following equation: intracranial capacity volume (cm^3)=(11.440 x body height)–420.03, R^2=0.51. The overall correlation coefficient between intracranial volume and brain volume is 0.894 (P <0.01), and linear regression provides the following equation: brain volume (cm^3)=58.3+(0.84 x cranial capacity), R^2=0.795.

In this study, it was shown that intracranial capacity in Korean youth is significantly influenced by body height, and intracranial capacity strongly correlated with whole brain volume. These data will be used to characterize physical anthropological aspects of Koreans and provide a useful tool for forensic application.

Skull Capacity, Body Weight, Body Height

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