Cerebrospinal Fluid Research

BioMed Central

Oral presentation

Open Access

Human arachnoid granulation probability of occurrence and surface area quantification

Deborah M Grzybowski*[1,2], Edward E Herderick[2], Kapil G Kapoor[3] and David W Holman[2]

Address: [1]Department of Ophthalmology, The Ohio State University, Columbus, OH 43210, USA, [2]Biomedical Engineering Department, The Ohio State University, Columbus, OH 43210, USA and [3]College of Medicine and Public Health, The Ohio State University, Columbus, OH 43210, USA

Email: Deborah M Grzybowski* - grzybowski.3@osu.edu

* Corresponding author

from 50th Annual Meeting of the Society for Research into Hydrocephalus and Spina Bifida
Cambridge, UK. 30 August – 2 September 2006

Published: 21 December 2006

Cerebrospinal Fluid Research 2006, **3**(Suppl 1):S13 doi:10.1186/1743-8454-3-S1-S13

Background

We developed a method to measure the en-face surface area of human arachnoid granulations (AGs) on a standardized superior view of the brain. This technique permits the topographical mapping of AG distribution on the surface of the brain. Surface area measurements are correlated with donor age, sex, and race.

Materials and methods

Formalin fixed brains were imaged with a 35 mm Nikon camera set at a fixed distance. Images were segmented and AGs identified in Adobe Photoshop by two independent investigators. Twenty-five fiducial points were identified in a standard method for each cerebral hemisphere, and an average hemisphere template was calculated. Each segmented image was transformed to the standard template; an average hemisphere template was calculated. The transformed images were used to calculate a probability-of-occurrence map that depicts the spatial distribution of AGs. A linear regression was used to assess reproducibility.

Results

Images have been analyzed from 56 brains. Regression analysis confirms reproducibility of AG identification between independent researchers ($r^2 = 0.98$). Topographic probability distribution is primarily along the longitudinal fissure.

Analysis of these brains has revealed an average AG surface area of 75.1 mm^2 for age group 38–53 years old, 67.5 mm^2 for 54–68, and 82.3 mm^2 for > 68. The proportional analysis of AG surface area to total brain surface area indicates a positive relationship with age which was not statistically significant. Total brain surface area broken down by age shows a trend which declines with age.

Analysis also revealed an average AG surface area of 58.9 mm^2 for females and 103.5 mm^2 males, a difference which was statistically significant. Proportion of positive AG surface area broken down by age and sex indicates that females have a smaller proportion surface area in most age groups. A statistically significant difference in race was also found, with whites having a smaller proportion of positive area compared to African Americans.

Conclusion

The probability-of-occurrence maps, based on the image analysis methods, show that AGs are localized in a characteristic distribution with regions of high and low probability. These measurements provide age-related surface area quantification data as absolute values and proportional area with respect to total brain area. Statistically significant differences in AG surface were found between sex and race. Additional brain specimens will provide greater statistical power for determination of the effects of inde-

pendent variables such as age, sex, race, height, weight, and BMI on the topographic distribution and quantity of human AGs.