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White Matter Changes in Comatose Survivors of Anoxic Ischemic Encephalopathy and Traumatic Brain Injury: Comparative Diffusion-Tensor Imaging Study

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Abstract Full Text Figures References Supplemental Materials Cited by PDF

Purpose

To analyze white matter pathologic abnormalities by using diffusion-tensor (DT) imaging in a multicenter prospective cohort of comatose patients following cardiac arrest or traumatic brain injury (TBI).

Materials and Methods

Institutional review board approval and informed consent from proxies and control subjects were obtained. DT imaging was performed 5–57 days after insult in 49 cardiac arrest and 40 TBI patients. To control for DT imaging–processing variability, patients' values were normalized to those of 111 control subjects. Automated segmentation software calculated normalized axial diffusivity (λ_1) and radial diffusivity ($\lambda_\perp$) in 19 predefined white matter regions of interest (ROIs). DT imaging variables were compared by using general linear modeling, and side-to-side Pearson correlation coefficients were calculated. *P* values were corrected for multiple testing (Bonferroni).

Results

In central white matter, λ_1 differed from that in control subjects in six of seven TBI ROIs and five of seven cardiac arrest ROIs (all $P < .01$). The $\lambda_\perp$ differed from that in control subjects in all ROIs in both patient groups ($P < .01$). In hemispheres, λ_1 was decreased compared with that in control subjects in three of 12 TBI ROIs ($P < .05$) and nine of 12 cardiac arrest ROIs ($P < .01$). The $\lambda_\perp$ was increased in all TBI ROIs ($P < .01$) and in seven of 12 cardiac arrest ROIs ($P < .05$). Cerebral hemisphere λ_1 was lower in cardiac arrest than in TBI in six of 12 ROIs ($P < .01$), while $\lambda_\perp$ was higher in TBI than in cardiac arrest in eight of 12 ROIs ($P < .01$). Diffusivity values were symmetrically distributed in cardiac arrest ($P < .001$ for side-to-side correlation) but not in TBI patients.

Conclusion

DT imaging findings are consistent with the known predominance of cerebral hemisphere axonal injury in cardiac arrest and chiefly central myelin injury in TBI. This consistency supports the validity of DT imaging for differentiating axon and myelin damage in vivo in humans.

Online supplemental material is available for this article.

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