

Diffuse Axonal Brain Injury: the Dos and Don'ts

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Diffuse Axonal Injury DAI

- Sometimes called «shearing Injuries»
 - injury mechanism
- Diffuse axonal injury ↔ focal brain injury
 - more widespread distribution
- «Axonal Injury»
 - white matter lesions

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DAI - History

- Patients who have sustained TBI manifesting
 - prolonged unconsciousness
 - coma
 - profound morbidity
 - no overt focal brain lesion
- typically on postmortem examinations:
 - petechial hemorrhage in corpus callosum and rostral brainstem and
 - axonal swelling and /or beading corpus callosum, parasagittal white matter, internal capsule and thalamus

– Strich, S.J. (1961). Lancet 278, 443–448

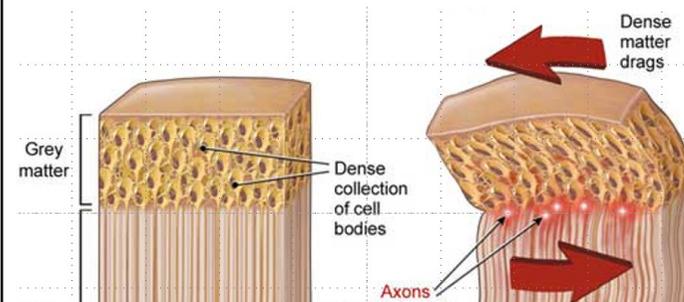
– Gennarelli, T.A. (1982). Ann. Neurol. 12, 564–574.

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DAI - Mechanism



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DAI - Mechanism

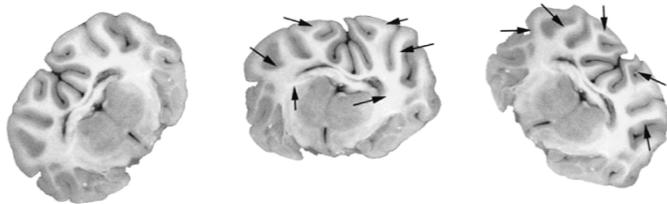
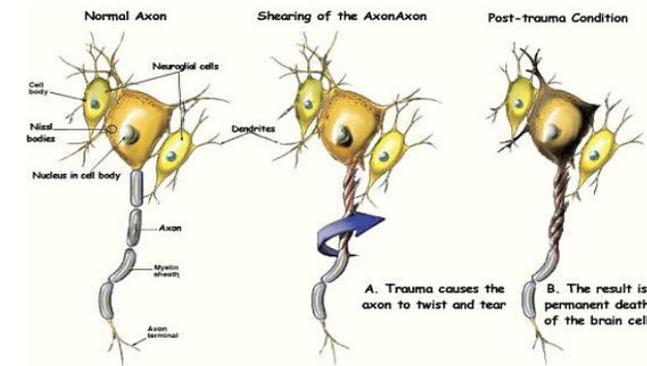


Fig 1. Rapid rotational acceleration/deceleration of the head of a pig in the coronal plane. On the left, the brain is at rest; in the middle, the brain is rapidly accelerated; on the right, the brain is rapidly decelerated. This inertial loading to the brain induces dynamic shear, tensile, and compressive strains within the white matter leading to dynamic tissue deformation (arrows), and ultimately, diffuse axonal injury.

Smith D. (2003) *J Head Trauma Rehabil.* 18, 4, pp. 307–316

DAI - Mechanism



A. Trauma causes the axon to twist and tear
B. The result is permanent death of the brain cell

DAI - Histology

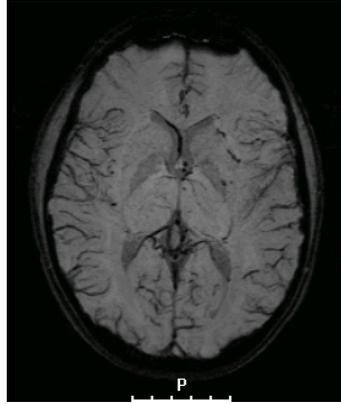


Accumulation of amyloid precursor protein (APP) as varicose swellings along the length of the axon and as axonal bulbs at disconnected axon terminal

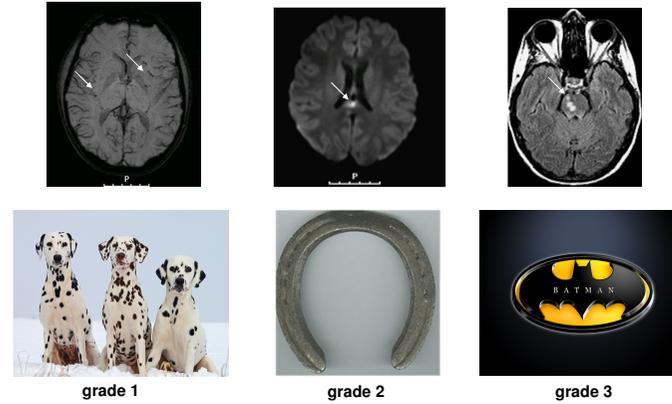
Smith D. (2013) *Journal of Neurotrauma.* 30(5): 307-323



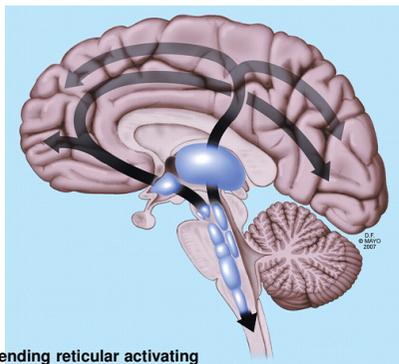
DAI – Diagnostics MRI?



DAI – MRI Distribution



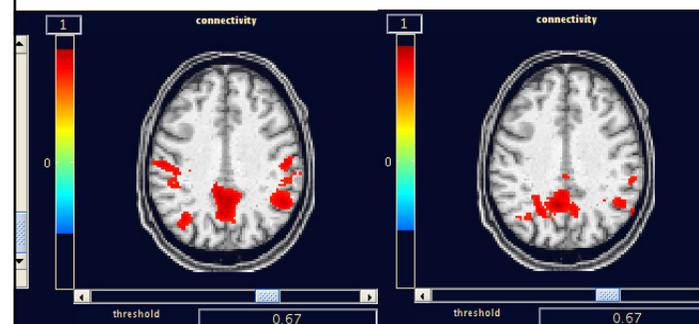
DAI – connectivity networks

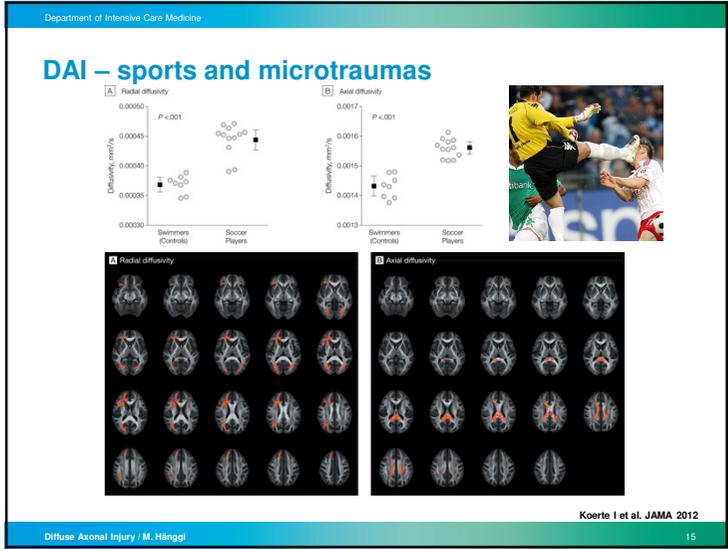
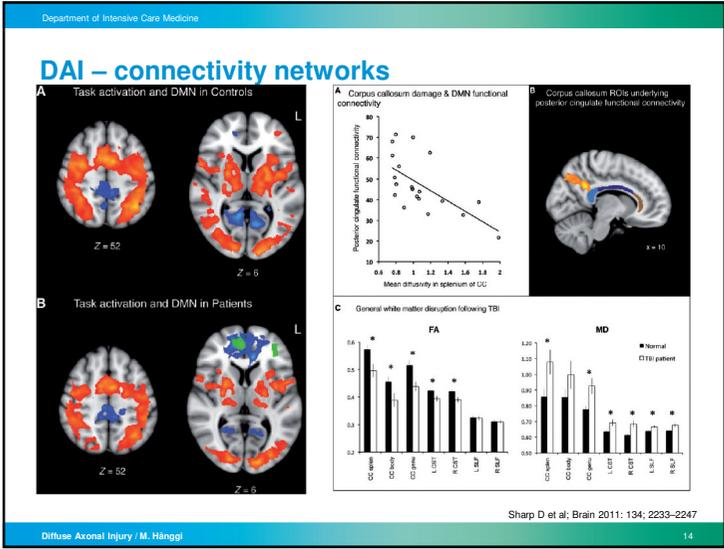
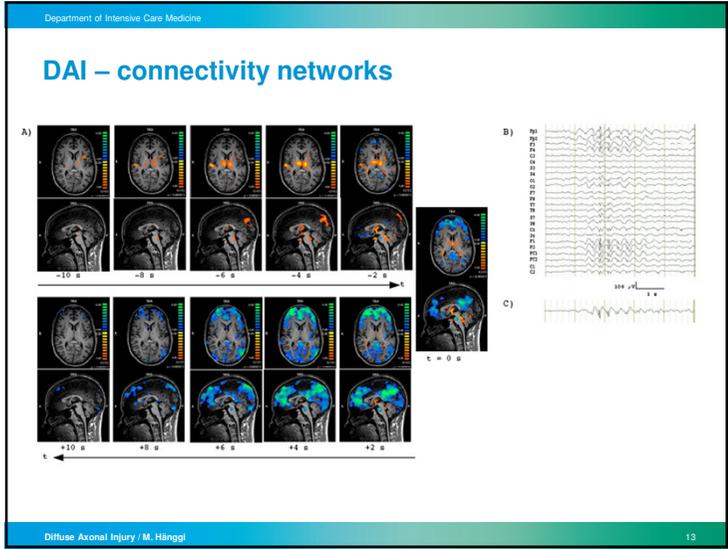


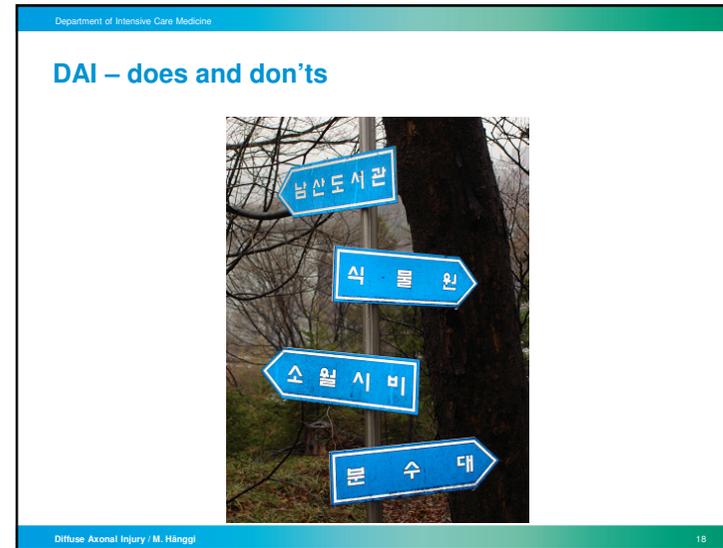
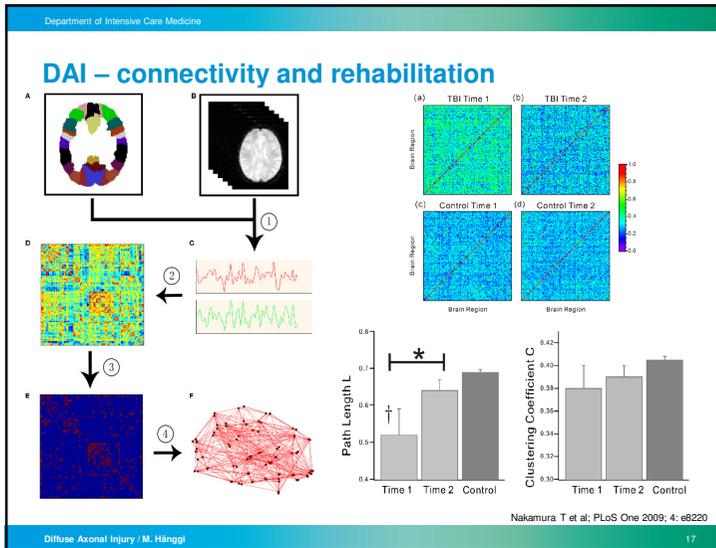
Ascending reticular activating system (ARAS)

Pract Neurol 2010;10:51-6

DAI – connectivity networks







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DAI – dos and don'ts

- Do always consider DAI in patients with trauma with depressed level of consciousness
- Do not expect to see microscopic alterations of axons in CT/MRI
- Do minimize secondary insults in TBI patients
- Do wait in younger patients with DAI before prognostication – reconnection takes time!

Figure illustrating DAI – dos and don'ts. The image shows a signpost with four directional signs: 남산도서관 (Namsan Library), 식물원 (Botanical Garden), 소월시비 (Sowol Poetry Monument), and 분수대 (Fountain).

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DAI

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