

The use of DTI for Traumatic Brain Injury - A Review of the Evidence

Comments:

1. The evidence for the use of DTI to support, quantify, localize, target neurorehabilitation for, and render a prognosis for TBI has mounted over time, and is now widely accepted both in medical and legal arenas
2. NBII works with multiple advanced neuro-imaging departments across the country so that TBI patients may obtain DTI imaging with the requisite specific imaging protocols
3. Dr. Eduardo Gonzalez-Toledo, Neuroradiologist and DTI Subject Matter Expert, is our resident expert who we work closely with for DTI interpretation and expert witness work
4. All facets of NBII's DTI program are overseen by our Medical Director and Traumatic Brain Injury Specialist Dr. Huma Haider

Date	Article/Case Study/Academic Paper	Notable excerpts	Shortened URL
2/28/2019	Excerpt from textbook entitled Concussion and Traumatic Encephalopathy	"Numerous MR techniques currently identify trauma-related neuropathology, with potential candidate biomarkers of CBI listed in Table 6.1. The MRI method known as diffusion tensor imaging (DTI) has become the most frequently employed MRI metric in CBI research. DTI is an established neuroimaging procedure used diagnostically..."	https://urizs.com/XcR2b
1/29/2018	Federal Court Upholds the Admissibility of Diffusion Tensor Imaging in TBI Case; Marsch v Celebrity Cruises, Inc., Case No. 1(17-CV-21097-UU)	1. "The United States District Court for the Southern District of Florida has ruled that diffusion tensor imaging (DTI) satisfies the Daubert standard for admissibility." 2. "...court rejected Celebrity's argument, finding that DTI findings and testimony has been deemed reliable and admitted by numerous courts across the country for almost a decade."	https://urizs.com/kxysK
1/26/2016	Federal Court in Louisiana Admits DTI into Evidence; Andrew v Patterson Motor Freight, Inc.	1. "Plaintiff retained Dr. Eduardo Gonzalez-Toledo who administered Diffusion Tensor Imaging, which according to Dr. Gonzalez-Toledo demonstrated evidence of traumatic brain injury pathology" 2. "...the Court finds plaintiff has submitted sufficient evidence to show the reliability of DTI. In sum, the evidence submitted shows DTI has been tested and has a low error rate; DTI has been subject to peer review and publication; and DTI is a generally accepted method for detecting TBI. Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 593-94. The Court additionally notes DTI testimony has been admitted by several courts. See e.g. Ruppel v. Kucanin, 2011 WL 2470621 (N.D.Ind.); Hammar v. Sentinel Ins. Co., Ltd., No. 08-019984 (Fla.Cir.Ct.2010); Booth v. Kit, 2009 WL 4544743 (D.N.M.). Accordingly, the Court denies defendants' motion to the extent it seeks to exclude evidence and testimony regarding DTI"	https://urizs.com/nqHvq
8/15/2014	White matter correlates of cognitive dysfunction after mild traumatic brain injury	1. "Conclusions: Acute mild/moderate traumatic brain injury is characterized by increased tissue FA, which represents a clear neurobiological link between cognitive dysfunction and white matter injury after mild/moderate injury" 2. "Our study in a large cohort of patients with mild and moderate TBI has shown extensive increases in MD but these were accompanied by increased FA at the acute time point. These changes were strongly correlated with underperformance on cognitive testing and show a clear neurobiological basis for dysfunction postinjury."	https://urizs.com/3b4BF
3/18/2014	Clarifying the Robust Foundation for and Appropriate Use of DTI in mTBI Patients	1. "The misleading and often entirely unsubstantiated opinions and positions of Wortzel, Tsiouris, and Filippi (2014), in opposition to diffusion tensor imaging (DTI) as a useful measure in mTBI, are at odds with the clear consensus of the scientific literature regarding mild traumatic brain injury (mTBI), its clinical assessment, and its natural history." 2. "...the overwhelming consensus of a substantial body of scientific inquiry supports DTI for detecting pathology in mTBI patients."	https://urizs.com/6VsTk
12/1/2012	Decreased Fractional Anisotropy Evaluated Using Tract-Based Spatial Statistics and Correlated with Cognitive Dysfunction in Patients with Mild Traumatic Brain Injury in the Chronic Stage	"DTI is sensitive to the diffusion characteristics of water (such as the principal diffusion direction and diffusion anisotropy) and has been developed as a tool to investigate the integrity of brain tissues such as white matter tracts8 and to uncover discrete axonal injury" 1. "DTI permits the interrogation of the brain's microstructure, allowing for a more refined characterization of white matter and the complex network of nerve fibers connecting different brain areas." 2. "Whereas conventional MRI has failed to correctly estimate the extent of damage following head injury, DTI provided information regarding injury severity as well as markers predictive of outcome and may therefore serve as a potential biomarker of recovery (Mayer et al. 2010)." 3. "In a recent study, whole-brain analysis of head injury survivors at least 6 months after the injury revealed significant bilateral decreases in anisotropy in the major of white matter bundles evaluated and increases in diffusivity in most of the cortex, likely reflecting secondary damage. In the same cohort, impairment of learning and memory correlated with diffusivity in the left posterior cingulate, left hippocampal formation, and left temporal, frontal, and occipital cortices (Salmond et al. 2006)." 4. "Even in children, DTI has proved sensitive to white matter injury at 3 months following moderate to severe head injury, even in brain regions appearing normal on conventional MRI. Thus, DTI measures, especially those derived from fiber tracking analysis, can be good markers of outcome as they were related, in the same patients, to global outcome and cognitive processing speed (Levin et al. 2008)."	https://urizs.com/beRWz
6/1/2011	MR Diffusion Tensor Imaging: A Window into White Matter Integrity of the Working Brain	1. "I would like share with you some observations from eight years of evaluating traumatic brain injury cases, the vast majority of which I obtain neuropsychological testing and advanced MR imaging: 1) people with TBI are frequently misdiagnosed, often by multiple physicians; 2) the most frequent diagnostic category given is psychiatric—anxiety, depression, conversion disorder; 3) two neuropsychologists studying the same patient may differ considerably regarding existence of TBI; 4) TBI symptoms overlap considerably with those of "primary" psychiatric disorders; 5) without the ability to "see" the brain injury with imaging, there is no completely objective way to determine what is TBI and what is something else, e.g., posttraumatic stress, conversion, malingering; 6) people with brain injury seem to vary considerably in severity of symptoms and recovery in the face of similar falls, crashes, etc." 2. "In summary, DTI is able to "visualize" diffuse axonal injury from TBI. In some cases location of lesions appears to correlate with specific symptoms but generally the severity of DAI as indicated by DTI is strongly predictive of general neurocognitive disability."	https://urizs.com/VT8Q5
1/4/2010	Written Testimony of Dr. Randall Benson before the House Judiciary Committee	"...the applications of DTI are rapidly increasing because the technique is highly sensitive to changes at the cellular and microstructural level."	https://urizs.com/h3a1F
7/1/2008	Diffusion Tensor Imaging of the Brain	1. "At every time point, DTI was more sensitive to injury than conventional magnetic resonance imaging, and relative anisotropy distinguished injured from control mice with no overlap between groups. Remarkably, DTI changes strongly predicted the approximate time since trauma. These results provide an important validation of DTI for pericontusional TAI and suggest novel clinical and forensic applications." 2. "In summary, we have demonstrated that DTI is capable of detecting pericontusional white matter injury in a mouse model of TBI at a range of acute to subacute time points. DTI appears more sensitive than conventional MRI for this purpose at all of the time points studied. Furthermore, DTI offers information on the timing of injury such that subacute injuries (7 d to 1 month old) can be differentiated from acute injuries (1-4 d old) with a high degree of accuracy at the level of the individual scan." 3. "...DTI has tremendous potential as a clinical tool in the assessment of TBI"	https://urizs.com/qsahU
10/31/2007	Diffusion Tensor Imaging Reliably Detects Experimental Traumatic Axonal Injury and Indicates Approximate Time of Injury	1. "Conclusions: Disruption of the corpus callosum and fornix in patients with nmTBI without macroscopically detectable lesions is shown. DTI is sensitive enough to detect abnormal neural fibres related to cognitive dysfunction after nmTBI." 2. "Our results suggest that DTI was able to objectively show abnormalities in patients with nmTBI with cognitive impairments but without macroscopically detectable lesions."	https://urizs.com/Ndhai
3/23/2006	Evidence for white matter disruption in traumatic brain injury without macroscopic lesions	1. "CONCLUSION: DTI reveals changes in the white matter that are correlated with both acute GCS and Rankin scores at discharge. DTI may be a valuable biomarker for the severity of tissue injury and a predictor for outcome." 2. "Our data demonstrate that DTI is feasible in the setting of TBI..."	https://urizs.com/HJTtU
3/25/2004	Diffusion Tensor Imaging as Potential Biomarker of White Matter Injury in Diffuse Axonal Injury		https://urizs.com/4cCvE