DIFFUSION TENSOR IMAGING IN DIFFUSE AXONAL INJURY (DTI IN DAI)

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BACKGROUND:

Magnetic Resonance (MR) imaging can provide better insight into the extent and severity of primary and secondary brain damage.

Diffusion Tensor Imaging (**DTI**) is an MRI-based neuroimaging technique which makes it possible to estimate the location, orientation, and anisotropy of the brain's white matter tracts.

It provides valuable additional information about white matter lesions and structural damage, and is therefore particularly suited to characterize the presence and degree of injury.

METHOD:

Having this idea behind, we have reviewed around 20 patients who presented with weakness due to traumatic brain injury of various severity and phases, in 3 Tesla Siemens MRI machine (SKYRA, SIEMENS, ERLANGEN GERMANY).

The two major approaches for analyzing DTI in Traumatic Brain Injury (TBI) are: (1) region of interest (ROI) analysis and (2) whole brain (WB) tractography.

The major approach used here in our study is on the basis of Region of Interest (ROI) analysis.

The ROI taken in our study are from Corpus callosum (genu & splenium), Superior longitudinal fasciculus, corticospinal tract and posterior limb of the internal capsule.

STUDY DISCUSSION:

The study (n=20) taken revealed low FA values on ipsilateral side of corpus callosum [n=18] (90%), Posterior limb of internal capsule [n= 17] (85%) and Superior longitudinal fasciculus [n= 10] (50%) on comparison with the contralateral side of the same patient.

LIMITATIONS:

Standardization is the most difficult issue in the use of DTI for TBI since analyzing DTI is complex.

Furthermore, studies of larger numbers of patients and multicenter studies that incorporate DTI are needed to evaluate the relevance of DTI as a diagnostic and prognostic tool for TBI in the acute and chronic phase.

FINAL IMPRESSION:

The cases discussed here shows the efficacy of DTI in traumatic brain injury patients who present with weakness whereas standard diffusion weighted images failed to show any abnormality.

Diffusion Tensor Imaging (DTI) – is well suited to the interrogation of white matter microstructure, the most important location of pathology in Traumatic Brain Injury.

In summary, DTI provides a robust measure of clinically important TAI at cross-sectional studies, despite the variability in characteristics of patients, mode of injury as well as study differences in data analysis methods.

Nevertheless, DTI holds great promise to unmask the pathology which are unseen in the standard MRI protocol and to better characterize damage and see the effects in both acute and chronic phase of Diffuse Axonal Injury (DAI), track disease processes, and establish a more accurate prognosis in patients with TBI.

REFERENCES:

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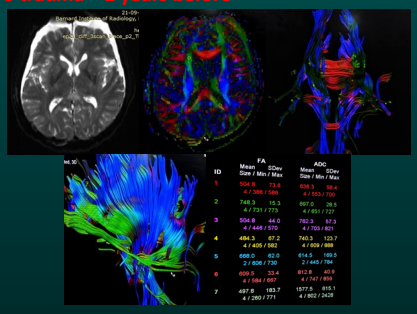
CASE NO. 1

38 Year old male presented with c/o weakness of left upper and lower limb since the trauma .
Past h/o trauma – 2 years before



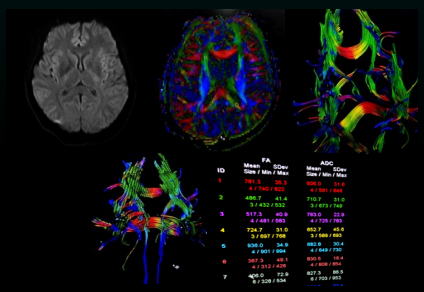
Standard MR images shows chronic bilateral frontal hygroma.

But no lesion / diffusion restriction visualised in the Diffusion weighted image of the patient.

The FA values of the Region Of Interest (ROI) taken shows low values on the right side on comparison with left side.

CASE NO. 2

48 Years old male came with complaints of difficulty in using right upper and lower limb - 7 months.
Motor power on both right upper & lower limb – 4/5
H/o trauma – one year ago

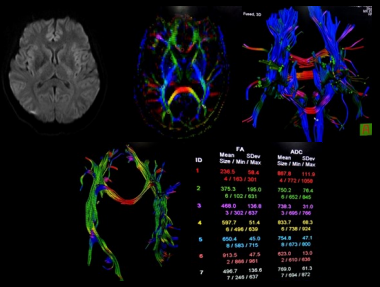


The standard MRI sequences showed no abnormal diffusion restriction in the regions of interest.

In DTI, it showed significantly low FA values in the left Corticospinal tract and posterior internal capsule.

CASE NO. 3

16 year old female presented with complaints of weakness of left upper and lower limb
Since traumatic episode 1 month back



The standard MR images shows multiple blooming foci in the parenchyma – diffuse axonal injury.

DTI speculated markedly low FA values in genu of corpus callosum, corticospinal tract and posterior limb of internal capsule on right side.