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RESEARCH ARTICLE

DIFFUSE AXONAL INJURY IMAGING (DAII) AND FUTURE PROSPECTIVE: A COMPARATIVE STUDY WITH RECENT ADVANCES APPLICATION IN SYSTEMATIC REVIEW OF LITERATURE

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ABSTRACT

Background: Diffuse axonal injury (DAI) is the brain injury in which damage in the form of an extensive lesions in white matter tracts occurs over a widespread area. DAI is one of the most common and devastating types of traumatic brain injury (TBI).

Material and Methods: We reviewed from from different data set like pubmed/medline and google resources were retrospectively we reviewed to identify patients underwent both CT and MRI examinations of the head and patients were found with diagnostic images were available for DAI and de-identified images reported by ealier world literature. Presence of any injury, intracranial hemorrhage, diffuse axonal injury (DAI), and skull fracture also reviewed here in systematically.

Results: It occurs in about half of all cases of severe head trauma and outcome is frequently coma, with over 97% of patients with severe DAI never regaining consciousness. Those who do wake up often remain significantly impaired. So DAI can occur in every degree of severity from very mild or moderate to very severe. MRI more frequently reported intracranial findings of CT scanning. No statistically significant difference observed between CT and MRI in the detection of any intracranial injury.

Conclusion: The multimodal MRI approach in patients with DAI results differentiated representation of the underlying pathophysiological changes of the injured nerve tracts. It helps to improve the diagnostic and prognostic accuracy of MRI. But we should be ignored CT findings for DAI for decission making.

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INTRODUCTION

Diffuse axonal injury (DAI) is a brain injury in which damage in the form of extensive lesions in white matter tracts occurs over a widespread area. DAI is one of the most common and devastating types of traumatic brain injury (TBI) (Iwata *et al*., 2004). DAI having major cause of unconsciousness and persistent vegetative state after head trauma (Wasserman and Koenigsberg, 2007; Vinas and Pilitsis, 2006) DAI can occur in every degree of severity from very mild or moderate to very severety (Vik *et al*., 2006; Smith and Meaney, 2000). Unlikely, brain trauma occured due to direct impact and deformation. The brain, DAI is the result of traumatic shearing forces that occur when the head is rapidly accelerated or decelerated, occur in auto accidents, falls, addiction and assaults (Sivák *et al*., 2005; Wolf *et al*., 2001). It was usually results from rotational forces or severe deceleration (Sanders and McKenna, 2001; Shepherd, 2004).

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Vehicle accidents most frequent cause of DAI the result of child abuse (Hardman and Manoukian, 2002). It is like as in shaken baby syndrome (SBS) (Smith and Greenwald, 2003). The major cause of damage in DAI is the disruption of axons in the neural processes. It allows one neuron to communicate with another Tracts of axons (Vik *et al*., 2006). This appeared white due to myelination, are referred to as white matter. Acceleration due causes shearing injury are damage inflicted as tissue slides over other tissue. When the brain is accelerated by parts of differing densities. Distances from the axis of rotation slide over each other stretching axons. That traverse junctions between areas of different density at junctions between white and grey matter, Two thirds of DAI lesions occur in areas point at (grey and white matter meet).

MATERIALS AND METHODS

We reviewed from from different data set like pubmed/medline and google resources were retrospectively we reviewed to identify patients underwent both CT and MRI examinations of the head and patients were found with diagnostic images were available for DAI and de-identified images reported by ealier world literature. Presence of any injury, intracranial hemorrhage, diffuse axonal injury (DAI), and skull. THe important studies published from 2000 to 2016 on the topic of head trauma, even mild head injury, neurocognitive deficits, medical imaging has assumed preeminence for detecting abnormalities associated with TBI. Advanced MRI modalities such as DTI and MRS have an important role in the diagnosis of lesions for TBI patients were taken into account of this review.

RESULTS

It occurs in about half of all cases of severe head trauma and outcome is frequently coma, with over 97% of patients with severe DAI never regaining consciousness.

Table 1. (Comparison of various imaging modalities in DAI)

Sl.No:	Characteristics	Cases	Controls	p-value
1.	Patientage mean	10 .5 ± 6.8 years		
2.	Male Sex in %	65.2%		
3.	Head Traumain%	98.5%		
4.	Mildto moderatein%	75.8%		
5.	Very Severe in%	97.5%		
6.	X-Ray			
	Male(p)	20(69%)	14(70%)	
	Male(a)	9(31%)	6(30%)	0.11
	Female(p)	16(88.9%)	8(80%)	
	Female(a)	2(11.1%)	2(20%)	0.452
7.	CT			
	Male(p)	25(86.2%)	19(95.0%)	
	Male(a)	4(13.8%)	1(5.0%)	0.356
	Female(p)	17(94.4%)	10(100%)	
	Female(a)	1(5.6%)	0(0%)	0.667
8.	NCCT			
	Male(p)	24(80%)	14(30.0%)	
	Male(a)	6(20%)	6(30.0%)	0.565
	Female(p)	14(77.8%)	8(80.0%)	
	Female(a)	4(22.2%)	2(20.0%)	0.452
9.	MRI			
	Male(p)	28(87.5%)	17(85.0%)	
	Male(a)	4(12.5%)	3(15.0%)	0.631
	Female(p)	26(88.9%)	10(100%)	
	Female(a)	2(11.1%)	0(0%)	0.281

N.B. P:present,a:absent and p-value lesser then.0005 considered as significant.

Those who do wake up often remain significantly impaired. So DAI can occur in every degree of severity from very mild or moderate to very severe. MRI more frequently reported intracranial findings of CT scanning. No statistically significant difference observed between CT and MRI in the detection of any intracranial injury. The mean age of the patients cohort varies 10 .5 ± 6.8 years, and 65.2% were male. The mean Injury Severity Score (MESS) varies 15.7 ± 8.2.The mean Glasgow Coma Scale score (GCSS) was 10 ± 5.8. No statistically significant difference between CT and MRI observed majority of the papers till date (attached table no1 and interesting Figures (1 to 9).

Interesting Images of X-Ray, Ct, Ncct, Mri Of Dai

Fig shows X-ray head diffuse axonal injury (DAI)

Fig. 1. X ray DAI control

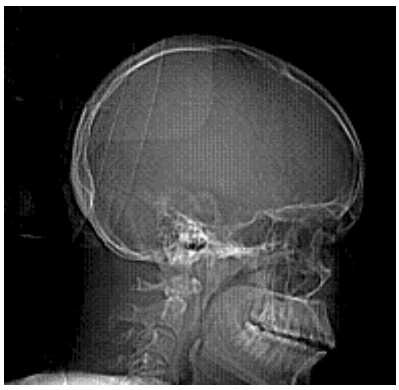

Fig. 2. X ray DAI cases

Fig. 3. X ray DAI cases

Fig shows CT head diffuse axonal injury (DAI)

Fig. 4. Shows CT (DAI

Fig. 5. Case CT (DAI

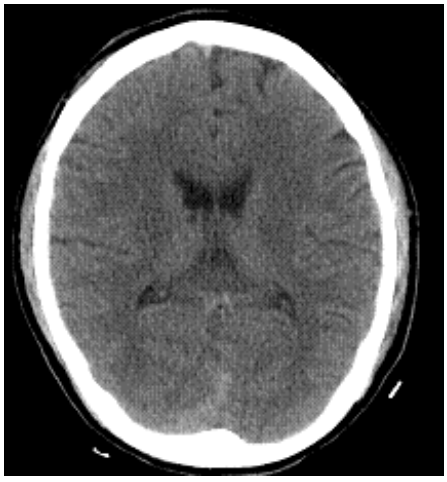

Fig. 6. Control CT (DAI)

DISCUSSION

Older approach and comparison

MRI as sensitive as CT scanning in the detection of THI, DAI, and intracranial hemorrhage.

Fig shows NCCT head diffuse axonal injury (DAI) comparing with MRI

Fig. 7. Shows NCCT (DAI)

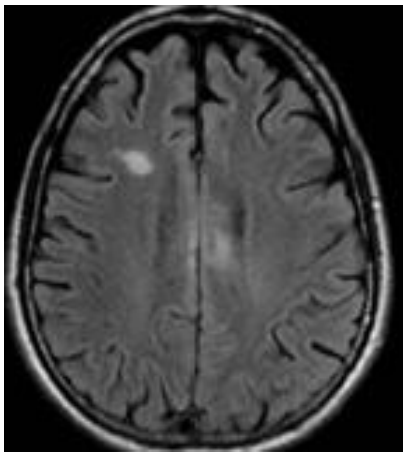

Fig. 8. Shows MRI (DAI)

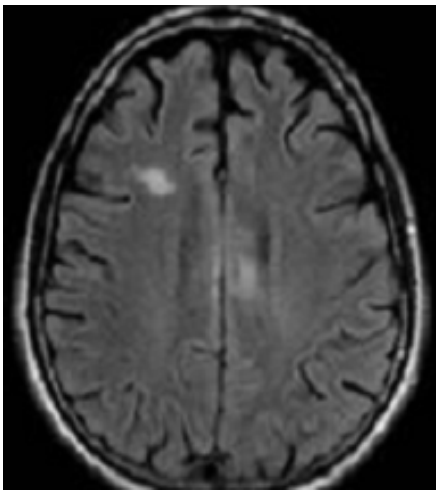

Fig. 9. ShowsT1 weighted MRI (DAI)

We still missed out skull fractures among patients. MRI may be a useful alternative to CT scanning in select stable patients with mild THI&DAI neuroimaging made clinical decision to easier (Roguski *et al*., 2015).

Traumatic brain injury (TBI) result in immediate long-lasting coma. So far attention has been given to predict this outcome. From the initial examination because these predictions guide future treatment and interactions with the patient's family. DAI in these cases have ascribed the coma to widespread damage located in the deep white matter that disconnects the hemispheres from the ascending arousal system (AAS). Brainstem lesions are also present in the AAS interrupt at the brainstem level. This review examined that autopsy and imaging literature that assesses the presence, extent, and predictive value of lesions in both sites in DAI. An evidence suggests that diffuse injury to the deep white matter is not the usual cause of immediate long-lasting posttraumatic coma (LLPTC). Brainstem lesions in the rostral pons or midbrain are always cause not only if the lesions but also bilateral.

Recovery is possible if critical brainstem inputs to the AAS are spared. In precise localization of the latter is subject to ongoing investigation with advanced imaging techniques using magnets of very high magnetic gradients were very Limited availability. As of this equipment plus the need to verify the findings continue to require meticulous autopsy examination (Rosenblum, 2015). Diffuse axonal injury (DAI) plays a major role after traumatic brain injury (TBI). Its imaging is based on computed tomography (CT) or magnetic resonance imaging (MRI). DAI in a histological diagnosis, histopathological findings on survival after TBI are very rare reported that global macrostructural damage commonly associated with traumatic axonal injury (TAI). It contributes to structural disconnection of anatomically distributed regions that underlie ToM. This study suggests that SWI may be a valuable imaging biomarker to predict outcome and recovery of social cognition after pediatric TBI (Ryan *et al*., 2015).

The SWI technique is extremely sensitive to blood breakdown to products and appear as small signal voids at three locations, at the gray-white interface, in the corpus callosum and in the brain stem. Functional MRI comprises a group of constantly developing techniques that have a great potential in optimal evaluation of the white matter in patients after craniocerebral trauma. These imaging techniques allowed the visualization of changes associated with shear injuries, such as functional impairment of axons and decreased blood flow including an abnormal metabolic activity of the brain parts affected.

The multimodal MRI approach in patients with DAI resulted in a more detailed and differentiated representation of the underlying path physiological changes of the injured nerve tracts and helps to improve the diagnostic and prognostic accuracy of MRI. If DAI is suspected multimodal MRI should be performed as soon as possible after craniocerebral injury (Mallouhi, 2014). This prospective approach improve in moderate-severe TBI patients were to investigate volume change in cortical gray matter (GM). Moreover, hippocampus, lenticular nucleus, lobar white matter (WM), brainstem and ventricles be analyzed using through design and repeated MRI. So in the early phase (1-30 days) and 4 and 12 months postinjury and to assess changes in GM apparent diffusion coefficient (ADC) in normal appearing tissues be varified throughly.

Recent advances

In addition to the cortex, hippocampus and brainstem. The impact of Glasgow Coma Scale (GCS) score at admission, duration of post-traumatic amnesia (PTA), and diffusion axonal injury (DAI) grade on brain volumes and ADC values overt the time was assessed and determined if MRI-derived brain volumes. Higher ADC values were detected in the cortex in individuals with severe TBI, DAI and PTA > 2 weeks, from 3 months. There were no associations between ADC values and brain volumes, ADC values did not predict outcome in better way (Brezova *et al*., 2014). Neuroimaging is commonly used for the assessment of children with traumatic brain injury and has greatly advanced how children are acutely evaluated emphasis has been given on how advanced magnetic resonance imaging (MRI) methods can detect subtler injuries. It could be related to the structural underpinnings of the neuropsychological and behavioral alterations frequently occured. We examined several methods used for the assessment of pediatric brain injury (PBI). Susceptibility-weighted imaging is a sensitive 3-dimensional high-resolution technique in detecting hemorrhagic lesions associated with diffuse axonal injury (DAI). Magnetic resonance spectroscopy acquires all metabolite information. This serves as a proxy for neuronal (and glial, lipid, etc). Structural integrity and provides sensitive assessment of neurochemical alterations in Diffusion-weighted imaging (DWI) is useful for the early detection of ischemic and shearing injury. Diffusion tensor imaging (DTI) allows better structural evaluation of white matter tracts. These methods more sensitive than conventional imaging in demonstrating subtle injury that underlies a clinically child's symptoms. It is an increasing desire to develop computational methods to fuse imaging data to provide a more integrated analysis of the extent to which components of the neurovascular unit are affected in the future of traumatic brain injury (TBI) neuroimaging research is promising and will lead to novel approaches to predict and improve the better outcomes (Ashwal *et al*., 2014).

Future prospective

Our view provides a summary of some of the important studies published from 2000 to 2016 on the topic of MRI findings in head trauma. With the growing realization that even mild head injury can lead to neurocognitive deficits, medical imaging has assumed preeminence for detecting abnormalities associated with TBI. Advanced MRI modalities such as DTI and MRS have an important role in the diagnosis of lesions for TBI patients care fully (Moen *et al*., 2014). Neuroradiologists endanger diagnostics and lead to false treatment decisions and medico-legal problems and faced trouble. Standardized quantitative imaging analysis programs and advances in MRI technology should be utilized to improve radiological TBI diagnosis (Laalo *et al*., 2014). We summarized in this paper adds significantly to the creation of a fundamental knowledge for the improvement of bicycle helmets as well as other head protective measures to be taken care. We also described investigations and experimental results are of crucial importance in DAI cases. We also add DAI information for forensic research angel to neural recovery of an injured cingulum following brain injury.

In head trauma had consistently reduced axonal spike amplitude. The susceptibility of an axon to trauma could be modulated by the function of an ATP-dependent sodium-potassium pump suggest a mechanism by concussive mTBI could lead to the immediate impairment of signal propagation through the axon and the emerging dysfunctional neuronal information exchange (Seo *et al*., 2014).

Conclusion

DAI result in immediate long-lasting coma. So, attention has been given to predicting this better outcome from the initial examination.These predictions guide future treatment and interactions with the patient's family. Reports of diffuse axonal injury (DAI) in these cases have ascribed the coma to widespread damage in the deep white matter that disconnects the hemispheres. It from the ascending arousal system (AAS), brainstem lesions re present in such cases.AAS may be interrupted at the brainstem level in patients with DAI. Therefore, diagnosis might have more severe cerebral injury. Hence, the identification process, one should pay attention to the possible missed diagnosis and misdiagnosis, and meanwhile avoid relying on those evidences provided only by CT and MRI only. Particularly, this review examines autopsy and imaging literature that assesses the presence, extent, and predictive value of lesions in both sites as well. Anevidence suggests that diffuse axonal injury (DAI) to the deep white matter is not the usual. Because of this immediate long-lasting posttraumatic coma. Even brainstem lesions in the rostral pons or midbrain are almost always the cause.

The lesions are bilateral and recovery is possible if critical brainstem inputs to the AAS are spared. So, the precise localization of the latter is subject to ongoing investigation required with advanced imaging techniques. We were using magnets of very high magnetic gradients and Limited availability of this equipment plus. This need to verify the findings continue to require meticulous autopsy examination (MAE).Multimodal MRI approach (MMA) in patients with DAI results in a more detailed. We differentiated representation of the underlying path physiological changes of the injured nerve tracts and helps to improve the diagnostic and prognostic accuracy of MRI. This study helps to new and innovative protocol development in future progress of diagnostic and prognostic value.

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Conflict of Interest: NILL

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