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Research Article

When is the Ideal Time to Perform Brain MRI in Patients with Transient Global Amnesia? Analysis of Case Series with Transient Global Amnesia from Previous Studies, based on Imaging Findings of Diffusion MRI According to Time Criteria

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Abstract

Objective: To determine the role of diffusion-weighted imaging (DWI) magnetic resonance studies in diagnosis of Transient Global Amnesia in patients who fulfilled the clinical diagnostic criteria.

Methods: In this systemic review study, 214 patients from 17 previous studies, who fulfilled the clinical diagnostic criteria of transient global amnesia were analyzed, based on imaging findings of DWI MRI according to temporal criteria. PubMed was meticulously searched.

Results: DWI findings in at least one hippocampus were found in 180 of 214 patients, regardless of the time the MRI performed. This accounted for the majority, 84.1%, of all patients who met the diagnostic criteria for TGA. Hippocampal DWI lesions were more common on the left one. The percentages of positive neuroimaging findings compared to the time the episode of TGA begins and the clinical signs are apparent as follows: 84,1% in general, 26%, when the examination is performed within the first day, 71,9% in approximately 24 hours, 87,2% at 36 hours, 82,3% at 48 hours, 72,7% at 72 hours, 42,8%, when performed in the first days but after 72 hours and 0%, when performed on a remote date, indicating the transient nature of the episode.

Conclusion: According to the results of the present study, the best time to perform cranial MRI DWI seems to be between 36 to 48 hours after the initiation of the clinical semiology of transient global amnesia.

Keywords: DWI; MRI; Transient Global Amnesia; Hippocampus

Abbreviations

DWI: Diffusion Weighted Imaging; TGA: Transient Global Amnesia

Introduction

Transient global amnesia (TGA) is a benign memory disorder of unknown origin. The clinical picture lasts up to 24 hours [2-4] and

is characterized by transient prospective and retrospective amnesia with neither disturbance of the level of consciousness nor focal neurologic signs [5-8]. High signal isolated punctate hippocampal lesions, at DWI, in CA1 area of the hippocampus, as a manifestation of dysfunction of this area, is a very common finding [6,9,10-11].

At the onset of the condition, in almost 80 - 90% of patients, there is transient disturbance in the DWI of the hippocampus [12]. These neuroimaging findings are absent after two weeks, as are findings from the T2 and FLAIR sequences [6].

With the present study, we start from the fact that high signal at MRI DWI in the medial temporal lobes is a very common finding in patients with TGA [13-15] and we try to identify what is the best time to perform DWI. We reviewed case reports and case series of patients with TGA, independently of their years of age, to stratify the imaging findings of DWI MRI according to time criteria.

Materials and Methods

PubMed was used to identify studies, case reports and case series, which described the findings of MRI diffusion sequence in patients who met the diagnostic criteria of transient global amnesia. We used the following terms to investigate our subject: TGA, MRI, DWI, time criteria. Patients of any age with TGA were selected. Only studies in the English language published from 1998 to the first months of 2020 were selected. In case of studies that were conducted in the same country with common authors, we selected only the one with the highest number of cases, to ensure objectivity, by avoiding recurrence of the same cases, and greater representativeness through the largest number of patients. An absolute selection criterion of the studies was the clear documentation of the time of the MRI DWI examination compared to the time of presentation. With this methodology, 17 studies were selected from total 58 studies. Subsequently, the patients who met the diagnostic criteria for transient global amnesia, were accounted and stratified about the presence of high signal in hippocampus at the DWI, according to the time between the onset of memory impairment and when MRI was performed. Diffusion disorders were observed exclusively in one or both hippocampi and reported. Otherwise, patients with findings in other cerebral locations, as in the thalamus or cerebellum, were excluded. The results of the analyses are shown in detail in the table below (Table 1).

No	Study/year	n	Nt < 24h	Nt = 24h	Nt = 36h	Nt = 48h	Nt = 72h	Nt > 72h	Nt ~
1	Demas 2019 [2]	2/2				1/1 1B	1/1 1B		
2	K.Jan and S. Chuin 2018 [10]	1/1			1/1 1R				
3	Inokuchi 2016 [11]	1/1	0/1	1/1 1B					
4	Abreu Junior 2018 [3]	5/5	0/1	2/2 1L,1B	3/3 1L,1R,1B				
5	Bartsch 2006 [7]	30/41	8/14 4L,1R,3B	5/7 3L,1R 1B		8/12 4R,4L	6/9 4R, 1B,1L	1/1 1R	
6	Jian Li 2012 [8]	1/1 1B	1/1 1B	0/1					
7	Jungeun Kim 2012 [13]	96/111		78/111 32L 30R 16B	96/111 37L,28R 31B				
8	Sedlaczek 2004 [14]	26/31 15L,6R,5B	2/31	23/31		26/31		0/2	
9	Strupp 1998 [4]	7/10 3B,4L	2/2	4/4	2/2			0/2	
10	CianFoni 2005 [12]	4/4				2/2	1/1	1/1	0/1

11	Kuan-Yu Lin 2020 [16]	1/1 1R				1/1 1R			
12	Matsui 2002 [17]	1/1 1R				1/1 1R			0/1(14d)
13	Wilkinson 2013 [18]	1/1 1B				1/1 1B			0/1(23d)
14	Alastair John Stewart 2015 [19]	1/1 1B				1/1 1B			
15	Della Marca 2010 [15]	1/1 1L			1/1 1L				0/1(60d)
16	Atsuhib Sugiyama 2015 [20]	1/1 1R						1/1 1R(5d)	0/1 (> 100d)
17	Jone Bocos-Portillo 2018 [21]	1/1 1B				1/1 1B			
	Total	180/214	13/50	113/157	103/118	42/51	8/11	3/7	
	Percentage %	84,1%	26%	71,9%	87,2%	82,3%	72,7%	42,8%	0%

Table 1

Table 1 the serial number of the study, Study/Year: we mention the first name of the author of each study and the publication date, in order to certify that there are no repetitive results, having the same source of patients. n: the number of positive results divided by the total number of MRI exams in each study. Nt < 24h: the number of patients who had findings in DWI when the examination was performed in up to 24 hours of the beginning of the clinical presentation, divided by the number of patients who had an MRI at this time period. Nt = 24h: the number of patients who had findings in DWI when the examination was performed at 24 hours of the beginning of the clinical presentation, divided by the number of patients who had an MRI at this time period. Nt = 36h: the number of patients who had findings in DWI when the examination was performed at 36 hours of the beginning of the clinical presentation, divided by the number of patients who had an MRI at this time period. Nt = 48h: the number of patients who had findings in DWI when the examination was performed at 48 hours of the beginning of the clinical presentation, divided by the number of patients who had an MRI at this time period. Nt = 72h: the number of patients who had findings in DWI when the examination was performed at 72 hours after the beginning of the clinical presentation, divided by the number of patients who had an MRI at this time period. Nt > 72h: the number of patients who had findings in DWI when the examination was performed at the first days after the beginning of the clinical presentation, and after 72 hours, divided by the number of patients who had an MRI at this time period. Nt ~: the number of patients who had findings in DWI, when the examination was performed in a long time, after the day of the episode, divided by the number of patients who had MRI exam in that time. B: bilateral finding in the hippocampus. L: finding only in the left hippocampus. R: finding only in the right hippocampus.

Results

We found that in 180 of 214 patients there were imaging findings in DWI, in at least one hippocampus, regardless of the time the MRI performed. This accounted for the majority, 84.1%, of all patients who met the diagnostic criteria for TGA. Some patients underwent more than one MRI examinations. The total number of MRI examinations with findings in the DWI sequence were 248. Of these 103 showed localizations with high signal in the left hippocampus, 79 in the right hippocampus and 68 had bilateral findings. The findings included mostly spotted areas of high signal either in one area or multiple, including multiple areas of the same hippocampus. In all patients who underwent follow-up neuroimaging, in a time frame of over 2 weeks, the initial findings had resolved.

The percentages of positive neuroimaging findings compared to the time the episode of TGA begins and the clinical signs are apparent as follows: 84,1% in general, 26%, when the examination is performed within the first day, 71,9%, when performed in approximately 24 hours, 87,2%, when performed at 36 hours, 82,3%, when performed at 48 hours, 72,7%, when performed at 72 hours,

42,8%, when performed in the first days but after 72 hours and 0%, when performed on a remote date, indicating the transient nature of the episode.

Discussion

Transient global amnesia (TGA) is a disease of unknown cause. The clinical picture lasts up to 24 hours and is characterized by transient prospective and retrospective amnesia with neither disturbance of the level of consciousness nor focal neurologic semiology [5,6,16,17]. High signal focal lesions, at MRI DWI, in CA1 area of the hippocampus, as a manifestation of dysfunction of this area, is a very common finding [6,9].

Caplan first formulated the diagnostic criteria of TGA, which Hodges and Warlow, and subsequently Quinette., *et al.* Later analyzed and certified [1].

Despite the various proposed theories about etiology, TGA remains a disease of unknown cause. At the onset of the condition, in almost 80 - 90% of patients, there is transient disturbance in the MRI DWI of the hippocampus, as we can see in this study. These neuroimaging findings are absent after two weeks, as are findings from the T2 and FLAIR sequences [6].

According to the present study an imaging finding of diffusion disturbance in the hippocampus is quite specific to the diagnosis of TGA and particularly sensitive, especially when the examination is performed within the first three days from the start of the episode. The sensitivity of the MRI-DWI examination in diagnosing TGA is variable and depends largely on the time it was performed following the beginning of the episode. The percentages of positive neuroimaging findings have the following distribution: 84,1% in general, 26% when the examination is performed within the first day, 71,9% in approximately 24 hours, 87,2%, when performed at 36 hours, 82,3% at 48 hours, 72,7% at 72 hours, 42,8% when performed in the first days but after 72 hours and we have no neuroimaging findings when performed on a remote date, indicating the transient nature of the episode.

Combining the above percentages with the standard knowledge that the clinical semiology of transient global amnesia resolves at most in 24 hours, we can interestingly conclude that the imaging findings in the DWI sequence appear, mainly, after the clinical semiology and obvious symptomatology of transient global amnesia have resolved. That is, the imaging findings are absent when clinical semiology is present, while on the contrary we have positive imaging findings when the semiology has almost completely receded.

In this study we recognize that there are some limitations. First, we do not have accurate information for all patients studied, for instance the presence of vascular risk factors or for about the duration of the episode, somewhat that differentiate the pure TGA from the transient epileptic amnesia [1]. Additionally, and most importantly in only 6 studies of the 17 the patients underwent follow-up brain MRI. Based on that someone would raise the objection that the different percentages of positive neuroimaging findings compared to the time the episode of TGA begins could be random and that the clinical episodes were transient ischemic attacks rather than TGA. All the objections are rational and reveal some limitations about this study. However, in the last question we can answer that hippocampal infarctions from posterior cerebral artery ischemia, have different size and different topography, compared to the localization of the diffusion restriction on MRI in patients with transient global amnesia affecting the CA1 region and the punctuated distribution that are highly characteristic in TGA [22].

Conclusion

According to the results of the present study, the best time to perform MRI DWI seems to be between 36 to 48 hours after the initiation of the clinical features of transient global amnesia preferably observed by a clinician. We believe that a more detailed prospective study with accurate information about personal and family medical history precipitating incidents, vascular risk factors, episode duration and a plan of neuroimaging follow-up for all patients on a remote date after the clinical incident, could be more precise.

Study Funding

No targeted funding reported.

Conflict of Interest

Nothing to declare.

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