Original Paper

Magnetic Resonance Imaging Criteria for Thrombolysis in Hyperacute Cerebral Infarction

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ABSTRACT: Purpose: Selection of patients with cerebral infarction for MRI that is suitable for thrombolytic therapy as an emerging application. Although the efficiency of the therapy with i.v. tissue plasminogen activator (tPA) within 3 hours after onset of symptoms has been proven in selected patients with CT, now these criteria are determined by MRI, as the data we gather are fast and accurate in the first hours. **Material and methods:** MRI screening in patients with acute cerebral infarction before application of thrombolytic therapy was done in a UCC Mannheim in Germany. Unlike trials with CT, MRI studies demonstrated the benefits of therapy up to 6 hours after the onset of symptoms. We studied 21 patients hospitalized in Clinic of Neuroradiology at University Clinical Centre in Mannheim-Germany. They all undergo brain MRI evaluation for stroke. This article reviews literature that has followed application of thrombolysis in patients with cerebral infarction based on MRI. **Results:** We have analyzed the MRI criteria for i.v. application of tPA at this University Centre. Alongside the personal viewpoints of clinicians, survey reveals a variety of clinical aspects and MRI features that are opened for further more exploration: therapeutic effects, the use of the MRI angiography, dynamics, and other. **Conclusions:** MRI is a tested imaging method for rapid evaluation of patients with hyperacute cerebral infarction, replacing the use of CT imaging and clinical features. MRI criteria for thrombolytic therapy are being applied in some cerebral vascular centres. In Kosovo, the application of thrombolytic therapy has not started yet.

KEYWORDS*: diffusion, perfusion, cerebral infarctions, MRI, thrombolysis.*

Introduction

The use of MRI in selection of patients with hyperacute cerebral infarction that are suitable for i.v. or i.a. application of thrombolysis is an emerging technique. Until a few years ago the selection of patients for thrombolytic therapy with acute stroke was based on CT imaging [1, 2]. Only data from NINDS has demonstrated efficiency of administration of i.v. tPA within first 3 hours with variable primary outcome, while a current survey suggests that benefits of tPA administration can be extended up to 4.5 hours [3].

Random scientific studies with MRI have suggested that MRI is a more sophisticated method for selection of patients for thrombolysis. Unlike CT, MRI diffusion (DWI) can demonstrate ischemic changes within several minutes after onset. MRI perfusion (PWI) defines areas of hypoperfusion (the tissue at risk) that are potentially recoverable. PWI/DWI mismatch, determines brain tissue with reduced perfusion that extends beyond the margins of diffusive abnormalities acquired on DWI, and these areas are supposed to be in risk of extension of the brain tissue infarction, and could be potentially saved [4, 5].

The aims of this study are:

Selection of patients with cerebral infarction for MRI that is suitable for thrombolytic therapy as an emerging application.

Although the efficiency of the therapy with i.v. tPa within 3 hours after onset of symptoms has been proven in selected patients with CT, now these criteria are determined by MRI, as the data we gather are fast and accurate in the first hours.

Material and methods

Study was realised in Clinic of Neuroradiology at University Clinical Centre Mannheim-Germany during our three month continuous professional education in Germany, where we studied for thrombolytic treatment in strokes.

We studied 21 patients hospitalized in Clinic of Neuroradiology at University Clinical Centre

in Mannheim-Germany. They all undergo brain MRI evaluation for stroke. MRI 1.5T Siemens Symphony was used for brain scan with appropriate head coil. We applied these sequences: T1, T2, FLAIR, DWI/PWI, ADC, TOF3D, Hemo (T2*).

Results

In our study from all patients (n=21), DWI abnormalities were found in 90.5% (n=19) and in 9.5% (n=2) DWI abnormalities were absent (Table1).

DWI/PWI mismatch was found in 71.4% (n=15) and 28.6% (n=6) had no DWI/PWI mismatch (Table 1).

On Hemo sequence hemosiderine deposits were found in 19% (n=4), while in 81% (n=17) we detected absence of hemosiderine deposits (Table 1).

Table 1. Different MRI sequences and application of i.v./i.a. tPA thrombolysis

Application of i.v. of i.a. tPA thrombolysis	**MRI – Sequences**								
	DWI			**DWI/PWI mismatch**			**Hemo**		
	Negative	**Positive**	**Total**	**Negative**	**Positive**	**Total**	**Negative**	**Positive**	**Total**
No	0	9	**9**	6	3	**9**	5	4	**9**
Yes	2	10	**12**	0	12	**12**	12	0	**12**
Total	**2**	**19**	**21**	**6***	**15**	**21**	**17**	**4***	**21**
(%)	**9.5**	**90.5**	**100**	**28.6**	**71.4**	**100**	**81**	**19**	**100**

- one of the patient with Hemo positive (T2 positive) findings for hemosiderine did not had DWI/PWI mismatch also.

In our study from all patients (n=21), i.v. or i.a tPA was applied in 57% (n=12), while 43% (n=9) were not suitable for treatment (Fig.1). Thrombolysis was not administered in 4 patients with presence of hemosiderine in HEMO seq. and in other 5 patients because of delays in time.

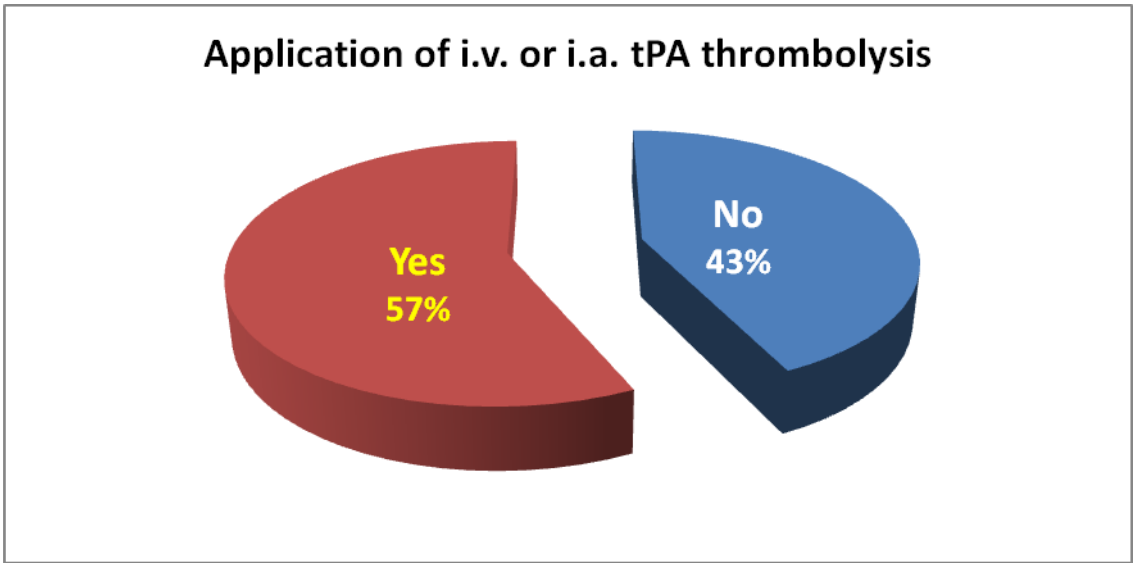

Fig.1.Application of i.v./i.a. thrombolysis

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On Angio MRI we found stenoses of main brain arteries on 71.4% (n=15), while in 28.6% (n=6) were with no evident stenoses. Anatomic locations of stenosis are shown in Table 2.

Table 2. Anatomic locations of stenosis

Angio - MRI		**Application of i.v. or i.a. tPA thrombolysis**			
		No	**Yes**	**Total**	**%**
Basilar artery		1	1	**2**	4.8
ACI sin.		-	1	**1**	4.8
ACM dex.		2	2	**4**	19
ACM sin.		1	-	**1**	4.8
ACP dex.		1	2	**3**	14.3
ACP sin.		2	2	**4**	19
Stenosis not present		2	4	**6**	28.6
Total	**N**	**9**	**12**	**21**	**100**
	%	**42.9**	**57.1**	**100**	**-**

Depending on DWI, DWI/PWI and Hemo findings from all cases with stenoses (n=15), 9 of them (60%) were suitable for tPA treatment and 6 were not treatable (40%) (Fig. 2). In cases with no evident stenosis (n=6), 4 cases (66.7%) were treatable with tPA and in 2 cases (33.3%) tPA treatment was not applied (Table 3).

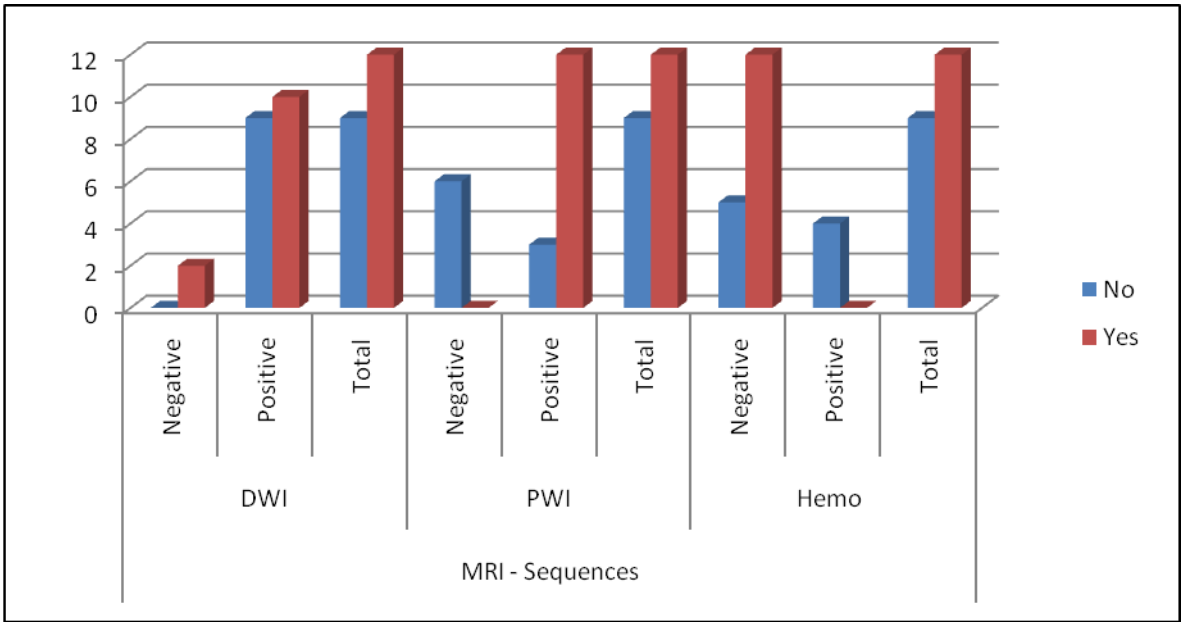

Fig.2.Distribution of negative and positive findings depending on MRI sequences

Table 3. Angio-MRI application of tPA

Angio-MRI		Application of i.v. or i.a. tPA thrombolysis			
		Yes	No	Total	%
stenoses presence		8	7	15	71.4
stenoses not present		4	2	6	28.6
Total	N	12	9	21	100.0
	%	57.1	42.9	100.0	-

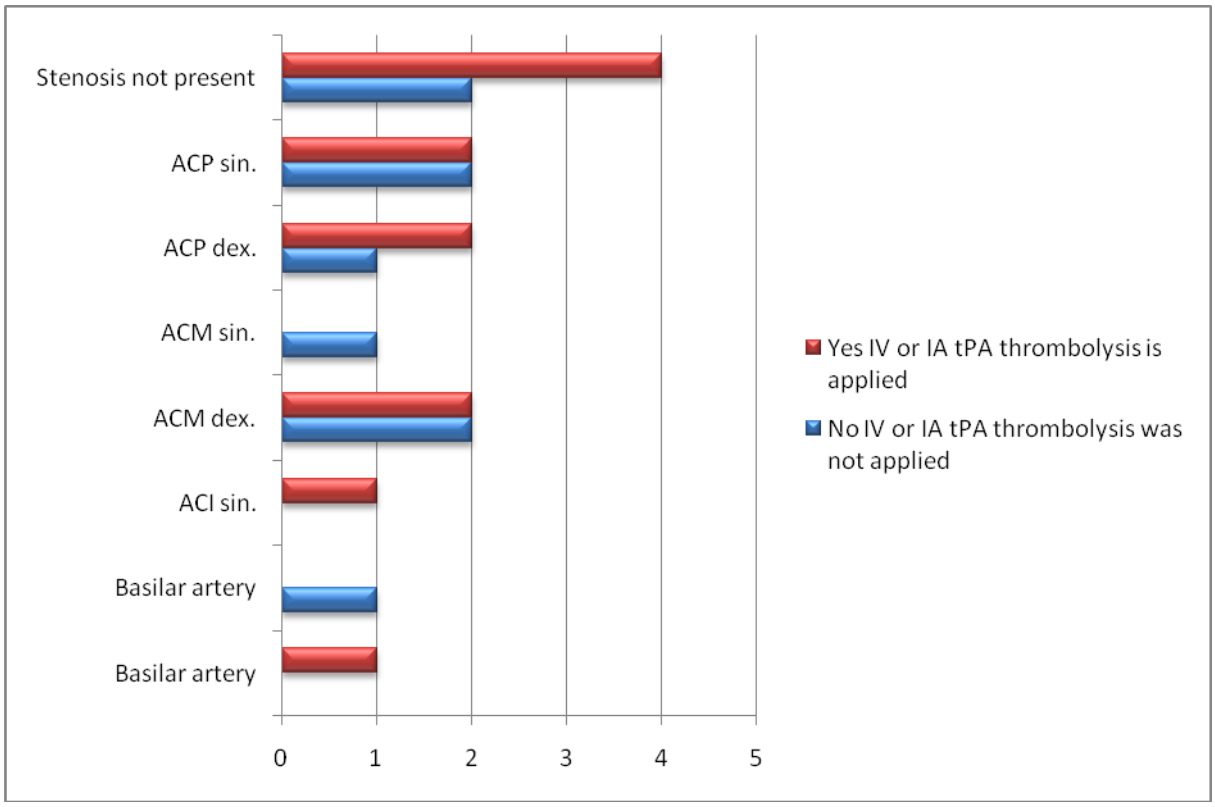

Fig.3.Thrombolysis application depending on anatomic locations of stenosis

Discussion

From 21 examined patients, 19 of them resulted with DWI abnormalities. DWI/PWI mismatch provides information for recoverable areas of brain tissue infarcts and possibilities of application tPA [6]. DWI/PWI mismatch area depends from time on stroke symptoms onset and time of MRI [7]. In our cases DWI/PWI mismatch was seen in 15 from 19 cases with DWI abnormalities. In 5 other cases tPA was not applied because of time delays (< 6 hour) for examination and absence of DWI/PWI mismatch. Hemo (T2*) in 4 cases revealed presence of hemosiderine, which indicates the presence bleeding that is considered contraindication for application of tPA. In one case except the presence of hemosiderine, the absence of DWI/PWI mismatch was seen also. On Angio MRI we found stenoses of main brain arteries on 71.4% (n=15), while in 28.6 (n=6) were with no evident stenoses. In cases with stenosis, in 12 cases recanalisation was found after 1 to 2 days. In our study we found mismatch in15 of 21 (71.4%) comparing with Jansen et al. who found mismatch in 21 of 35

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(60%) acute stroke patients [8]. Chelsea at al. found hemosiderine deposits in 5 of 41 (12.2%) while in our study we found 4 of 21 (19%) cases [1].

Conclusion

MRI criteria for thrombolytic therapy are being applied in some cerebral vascular centres. In our study DWI/PWI mismatch and Hemo (T2*) were applied as MRI criteria for choosing suitable patients for tPA treatment. MRA can only refine the selection of candidates for thrombolysis. The conclusion comes that the PWI-DWI mismatch presents the brain tissue at risk, therefore thrombolysis should be applied, even though occlusion is not seen in the MRA

In Kosovo, the application of thrombolytic therapy has not started yet.

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