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Outcomes of Thrombectomy Within 6 Hours In Patients Not Meeting CT Perfusion DEFUSE-3 Criteria

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Introduction

The utility of CT perfusion (CTP) to select patients with ischemic stroke presenting within 6 hours from last known normal (LKN) for thrombectomy is unclear. Interpretation of CTP done in the early time window is less clear. Applying the same criteria used for selection of appropriate patients in the extended time window may result in exclusion of patients who may benefit from intervention in the early time window.

Methods

Chart review of patients treated at our comprehensive stroke center between September 2017 and July 2018 for the purpose of quality improvement.

Patient Selection:
- LNK <6 hours
- Underwent thrombectomy for ICA or M1 occlusion
- Did not meet DEFUSE-3 CTP criteria. (DEFUSE-3 Criteria: CBF< 30% less than 70 ml, Tmax > 6 greater than 15 ml, and mismatch ratio >1.8)

Data Collected:
- Demographics
- NIH Stroke Scale (NIHSS)
- LKN to thrombectomy time
- TICI score
- CTP measures (CBF < 30% (core), Tmax > 6 seconds (penumbra), mismatch ml, mismatch ratio)
- Final infarct volume on MRI (MRIfv)
- Estimated discharged modified Rankin Scale (mRS)
- MRIfv/ penumbra ratio (MRIfv/P)
- We arbitrarily defined a "useful procedure" as one where MRIfv/P <0.35 (i.e. where final infarct volume was substantially less than penumbral tissue at risk)

Results
- 14 patients included
- Age: 67 (59-77) [median (IQR)]
- NIHSS: 26 (23-29)
- Core: 87.5 ml (72-113 ml)
- Mismatch Ratio: 1.75 (1.5-2.5)
- Patients with mRS < 3 : 1 (7%)
- Patients with mRS = 3: 2 (14%)

Patient	Sex	Age	Race	Initial NIHSS score	CBF <30% (mL)	Tmax > 6s (mL)	Mismatch ratio	Time to puncture (minutes)	TICI Score	MRI final infarct size (ml)	Estimated mRS at discharge
1	**M**	**59**	**White**	**9**	**80**	**224**	**2.8**	**112**	**2B**	**4**	**0**
2	M	43	White	15	110	170	1.5	225	3	269	5
3	F	73	Asian	32	72	171	2.4	210	1	99	5
4	**M**	**85**	**White**	**28**	**81**	**170**	**2.1**	**127**	**3**	**40**	**4**
5	F	64	White	29	113	206	1.8	252	0	140	4
6	M	53	White	27	40	55	1.4	343	0	84	3
7	**F**	**54**	**Asian**	**28**	**72**	**229**	**3.2**	**184**	**3**	**38**	**3**
8	**M**	**76**	**White**	**25**	**123**	**202**	**1.6**	**94**	**3**	**49**	**4**
9	F	78	White	30	179	298	1.7	95	1	258	6
10	M	63	White	30	110	190	1.7	140	3	52	4
11	M	70	Asian	24	77	101	1.3	174	3	87	4
12	M	77	AI/AN	24	308	374	1.2	122	2B	391	5
13	**M**	**62**	**Black**	**23**	**70**	**188**	**2.7**	**207**	**2B**	**25**	**6**
14	**F**	**85**	**Black**	**20**	**94**	**235**	**2.5**	**246**	**2A**	**80**	**4**

Table 1: Data collected for each of the patients in the series. Bolded items denote cases with MRIfv/P <0.35.

	CBF >30% (mL)	Tmax>6s (mL)	Mismatch (mL)	Mismatch ratio	MRI final infarct size (mL)	Penumbra minus MRIfv
Tmax>6s (mL)	0.581 0.0293	1				
Mismatch (mL)	-0.0903 0.7588	0.6095 0.0207	1			
Mismatch ratio	-0.4024 0.1537	0.2599 0.3695	0.9021 0	1		
MRI final infarct size (mL)	0.522 0.0555	0.088 0.7648	-0.4769 0.0846	-0.6931 0.006	1	
Penumbra minus MRIfv	-0.2445 0.3996	0.352 0.2171	0.789 0.0008	0.8515 0.0001	-0.8549 0.0001	1
MRIfv/P	0.2996 0.2981	-0.1694 0.5626	-0.6659 0.0093	-0.7965 0.0007	0.9121 0	-0.9516 0

Table 2: Spearman correlations. The top value in each pair is Spearman's rho and the bottom value is the p value for the correlation.

Spearman's rho = -0.80
p < 0.001

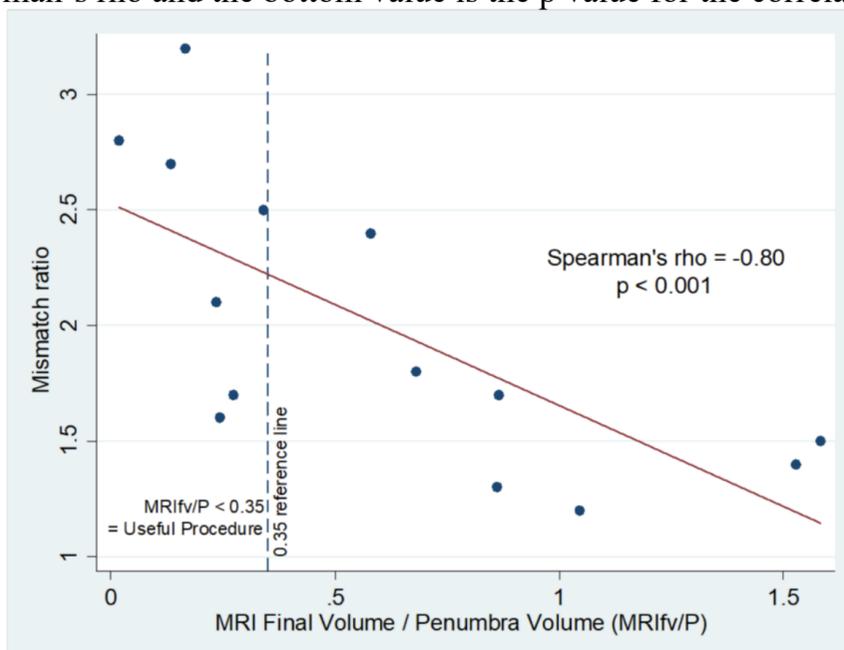MRIfv/P < 0.35 = Useful Procedure

Figure 1: Mismatch ratio vs MRIfv/P

Discussion

Using MRIfv/P < 0.35 as a marker of a useful procedure, 50% of patients may have benefited with the largest core being 123 ml and lowest mismatch ratio being 1.6. The majority of these patients were disabled at discharge despite salvaged penumbra, but may have had functional improvement over the following months. Further refinement of CTP criteria is necessary before patients presenting < 6 hours from LKN can be excluded from thrombectomy using DEFUSE-3, extended time window, criteria.

Sources

1. Borst et al. Value of Computed Tomographic Perfusion-Based Patient Selection for Intra-arterial Acute Ischemic Stroke Treatment. (2015) *Stroke* 46:3375-3382
2. Albers, G. W. *et al*. Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging. (2018) *NEJM* 378(8): 708–718.