

Imaging Selection in Endovascular Stroke Trials

SWIFT PRIME

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Disclosures:

Covidien/Medtronic, SWIFT PRIME Imaging
Core Lab and Steering Committee

iSchemaView, equity and consulting

Baseline Imaging

Modality	Required or Optional	No. obtained (%)
CT/MR non-contrast	Required	194 (99%)
CT/MR perfusion	Optional	173/196 (88%)
CT/MR angiography	Required	187 (95%)

	CT	MR
CT/MR perfusion imaging performed	139 (71%)	34 (17%)

	CT	MR
Qualifying imaging modality*	155 (82%)	35 (18%)

*Qualifying imaging modality is defined as following:

- CT/MR perfusion if subject was enrolled under protocol Rev D or prior
- CT/MR angiography if subject was enrolled under Rev F

Time to Treatment

	Minutes, median (IQR)
Total scan time for Multimodal CT, min	8 (4 - 21)
“Imaging start to qualifying image”	
CTP post-processing time, min	3.9 (2.2 - 5.4)
Total scan time for Multimodal MR, min	12 (7 - 15)
“imaging start to qualifying image”	
PWI/DWI post-processing time, min	2 (1.5 - 2.7)
“Door-to-Groin” time, min	
for entire cohort	90 (69 - 120)
for patients selected based on NCCT/CTA/CTP	90 (69 - 116.5)
for patients selected based on MRI	94 (73 - 127)
for patients selected based on NCCT/CTA	84 (55 - 102)

Selection Criteria

Criteria for	Description
Vessel Occlusion	Intracranial ICA, M1 or carotid terminus
Core	<ul style="list-style-type: none">• RAPID assessed ischemic core ≤ 50 cc• ASPECTS ≥ 6 on non-contrast CT or DWI MR
Mismatch	Target Mismatch (TMM) by RAPID <ul style="list-style-type: none">• Mismatch volume ≥ 15cc• Mismatch ratio > 1.8• $T_{max} > 10$s lesion ≤ 100 cc

Baseline Imaging Characteristics

Characteristic	Medical Treatment (n=98)	Endovascular Treatment (n=98)
Site of vessel occlusion – no. (%)		
ICA	15/95 (16)	17/93 (18)
MCA-M1	72/94 (77)	62/93 (67)
MCA-M2	6/94 (6)	13/93 (14)
Ischemic core volume - ml		
Mean (SD)	10.7 ± 10.7	11.0 ± 16.0
Median (IQR)	9.0	6.5
ASPECTS		
Mean (SD)	8.4 ± 1.4	8.4 ± 1.5
Median (IQR)	9.0	9.0
Perfusion volume (Tmax>6s) ml		
Mean (SD)	125.6 ± 63.1	115.5 ± 61.1
Median (IQR)	133.0	124.5

Biases and Limitations

- Imaging selection criteria: Target mismatch (TMM) changed during study – perfusion imaging became optional after Rev F; majority of pts continued to have perfusion imaging performed (88% had perfusion imaging)
- Limited sample size in the “No TMM” group:
 - 141 pts = Target Mismatch (TMM) profile
 - 25 pts = No Target Mismatch profile

Subgroup Analysis

According to Baseline Imaging Characteristics

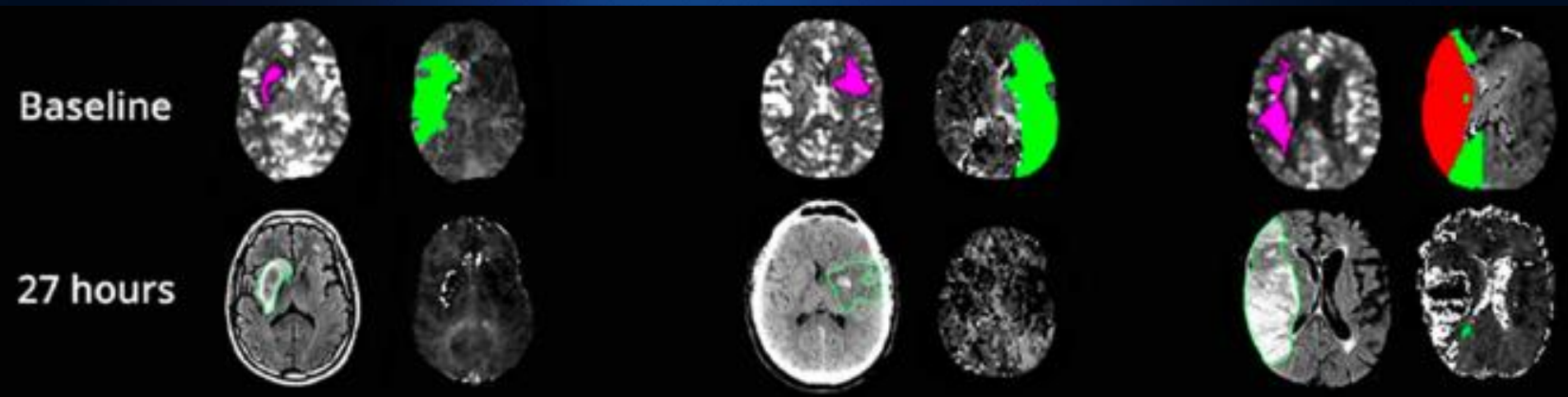
Example Criteria	Medical Tx		Endovascular Tx		P-value
	mRS 0-2	Total	mRS 0-2	Total	
Mismatch Status	n	N	n	N	
TMM	24	68	46	73	0.006
No TMM	3	10	7	14	0.421
No mismatch evaluation	5	18	6	11	0.240
ASPECTS					
8-10	24	58	42	62	0.006
6-7	4	17	8	20	0.319
0-5	0	2	1	2	

Ischemic core and hypoperfusion
volumes predict infarct size

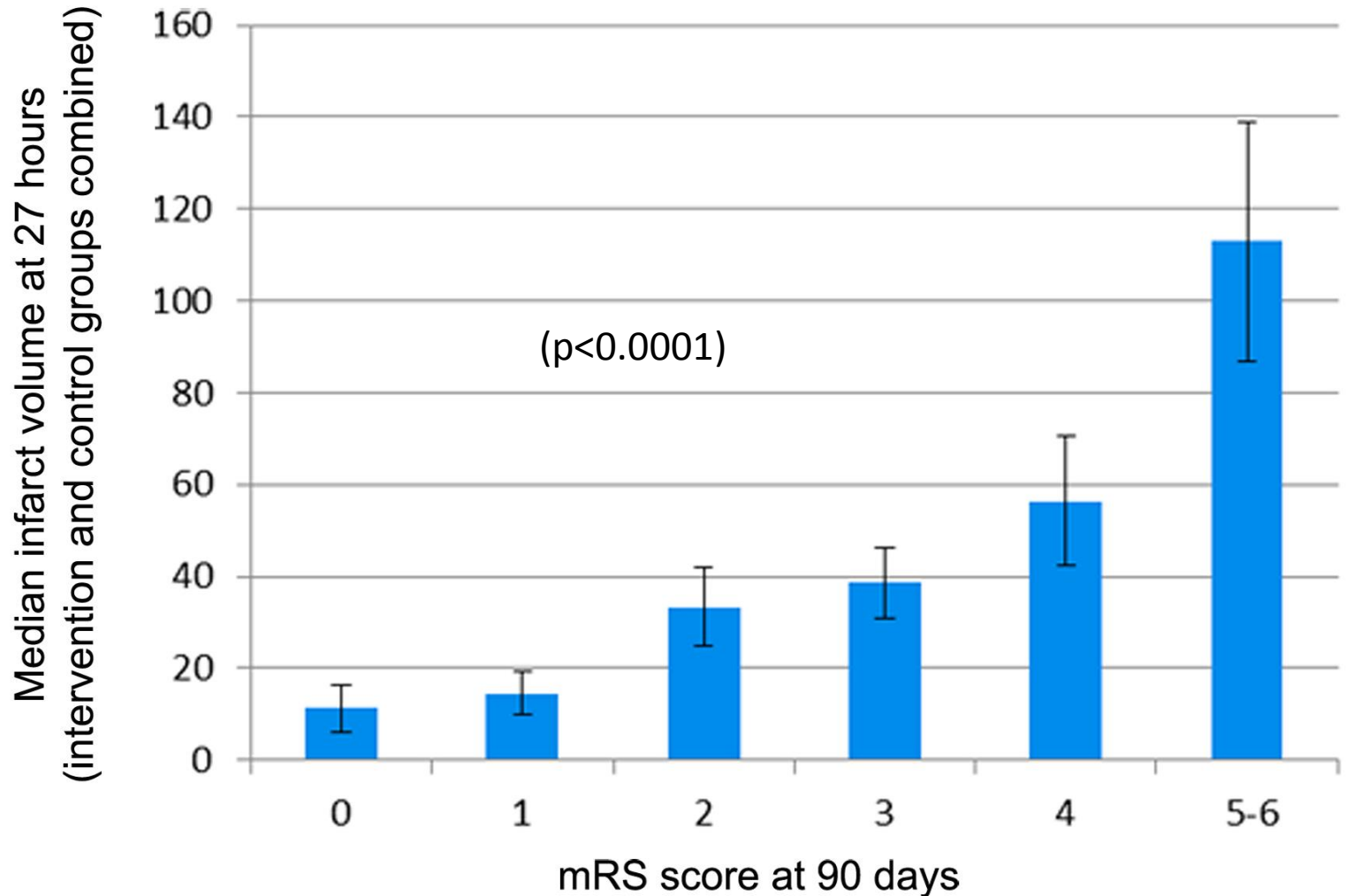
Annals of Neurology, in press

Relationships between imaging
assessments and outcomes

Stroke, August 2015

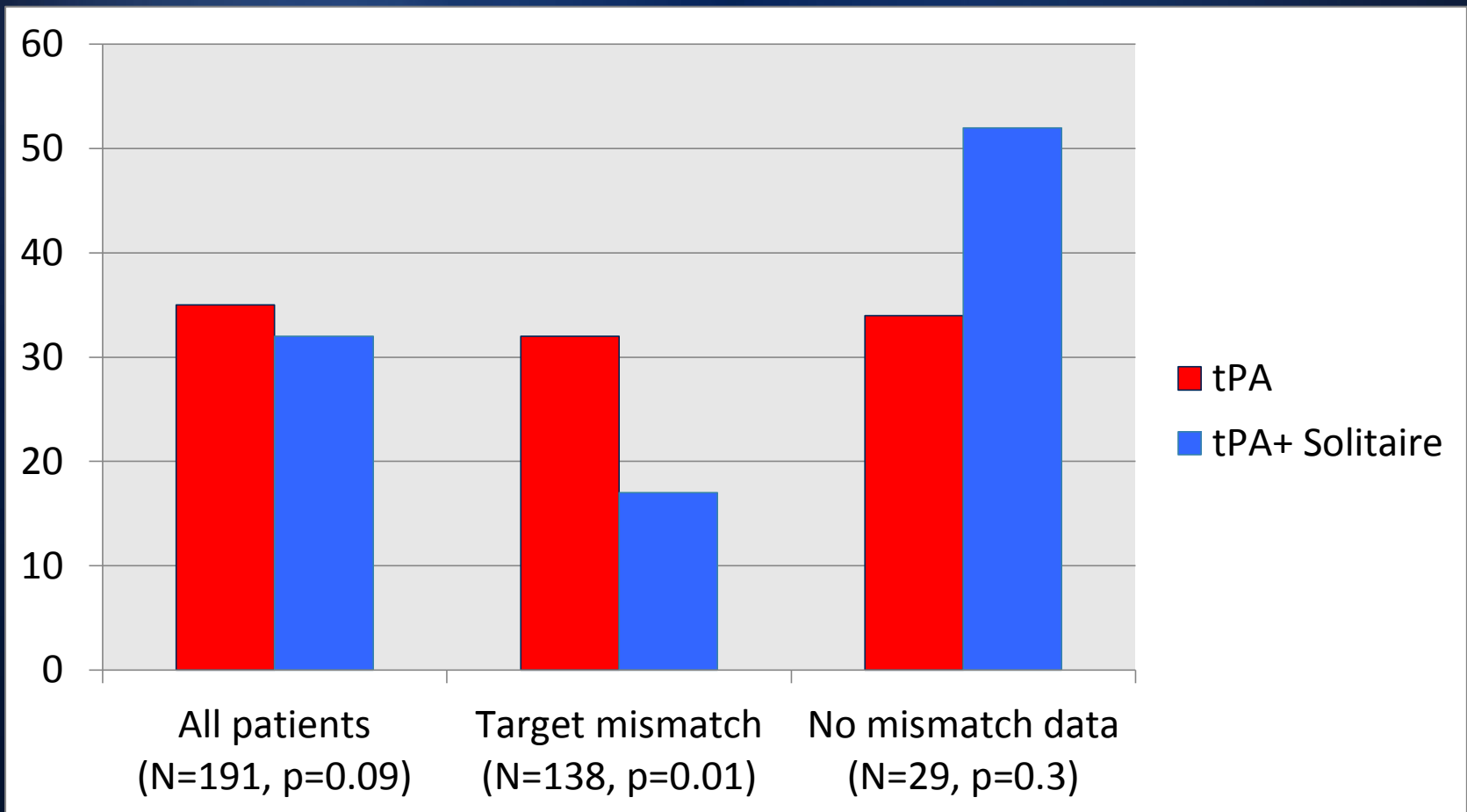


Infarct volume (both treatment groups) strongly correlates with clinical outcome

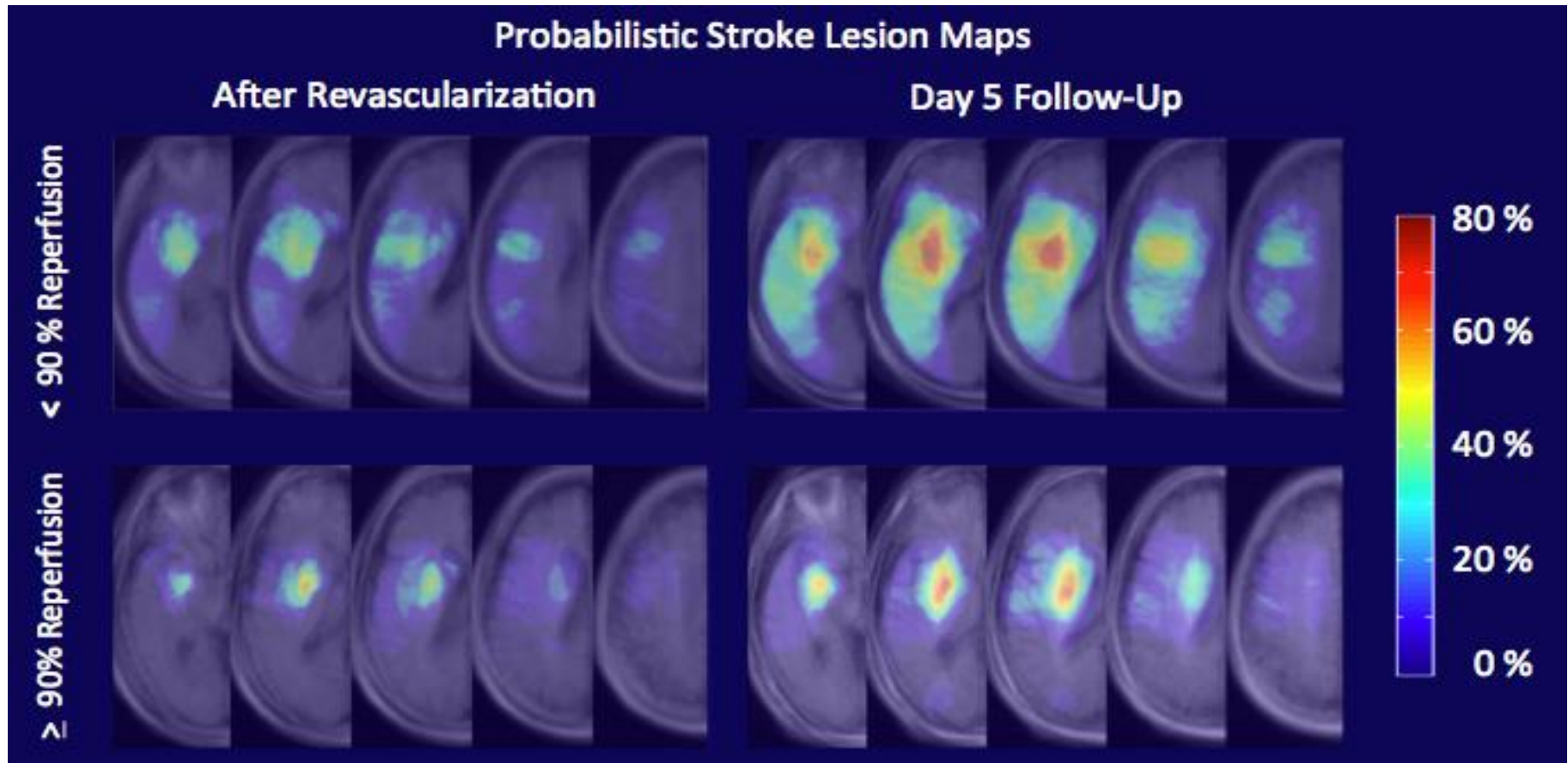


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24 hour infarct volume (median) ml

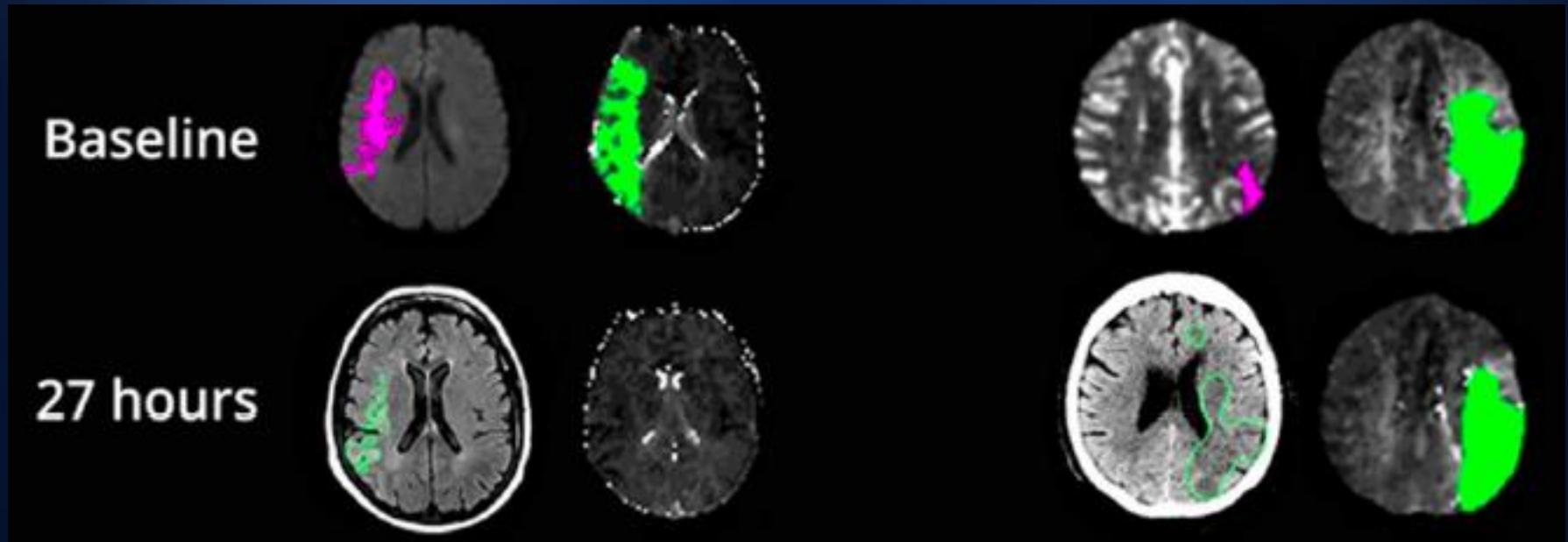


DEFUSE 2: Infarct growth and reperfusion



Does baseline core predict infarct volume if reperfusion occurs?

Does baseline hypoperfusion predict infarct if no reperfusion?



24 ml baseline core; 20 ml infarct

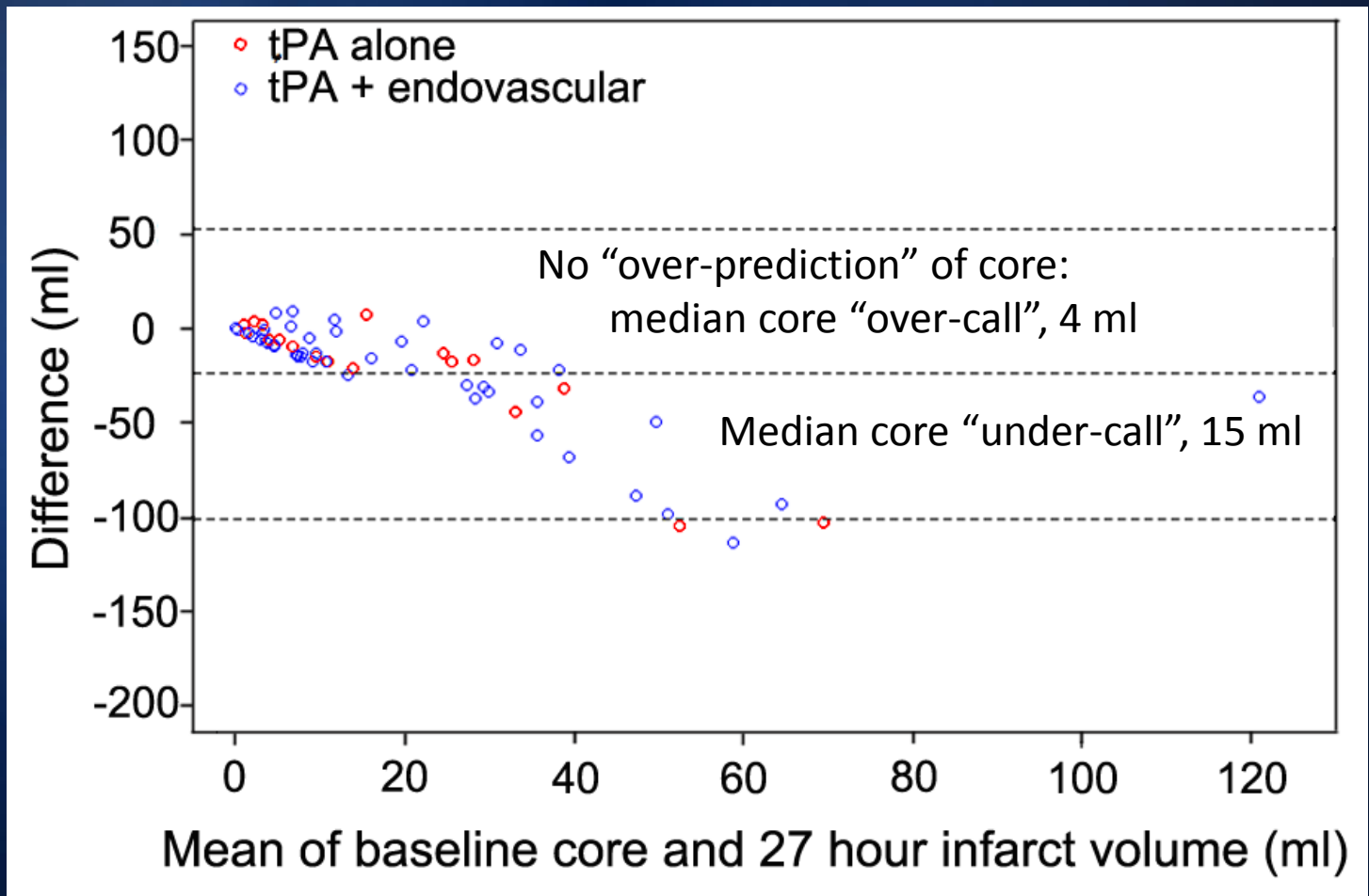
64 ml baseline Tmax > 6s; 60 ml infarct

Results: Baseline ischemic core volume predicts 27 hr infarct volume in patients who reperfuse

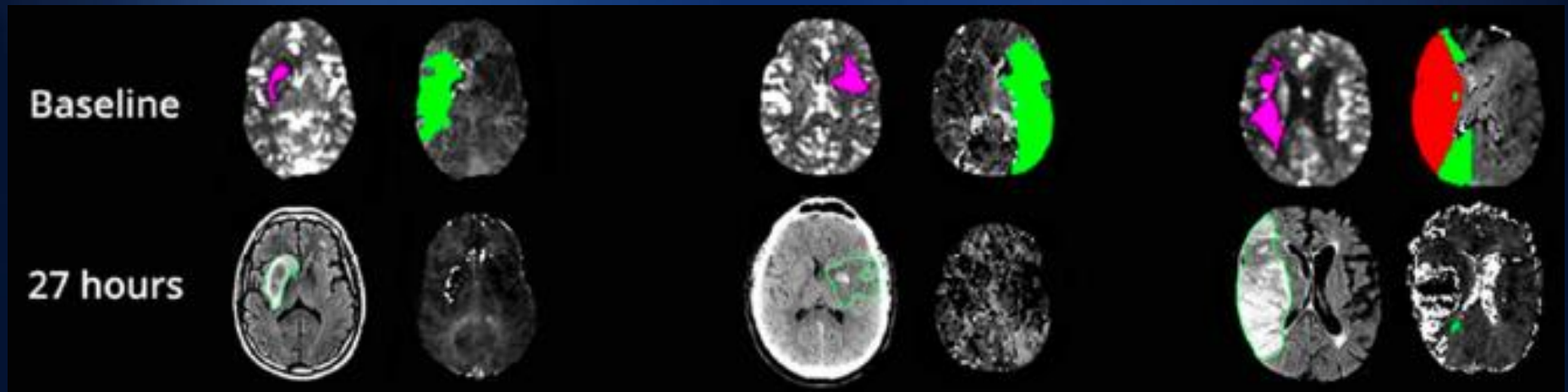
R=.6, P<0.0001

>90% Reperfusion Achieved	Median baseline core (ml)	Median 27 hr infarct (ml)	Median absolute difference (ml)
All patients (N= 70)	3	16	13
CT perfusion (N= 56)	3	15	10
Target mismatch (N=63)	2	15	9
Malignant (N=6)	22	83	38
No hemorrhagic infarct (N=47)	2	9	8
Hemorrhagic infarct (N=23)	11	49	32

Bland-Altman plot



When does early ischemic core “under-predict” the 27 hr infarct?



Hemorrhagic transformation

14 ml predicted; 45 ml actual

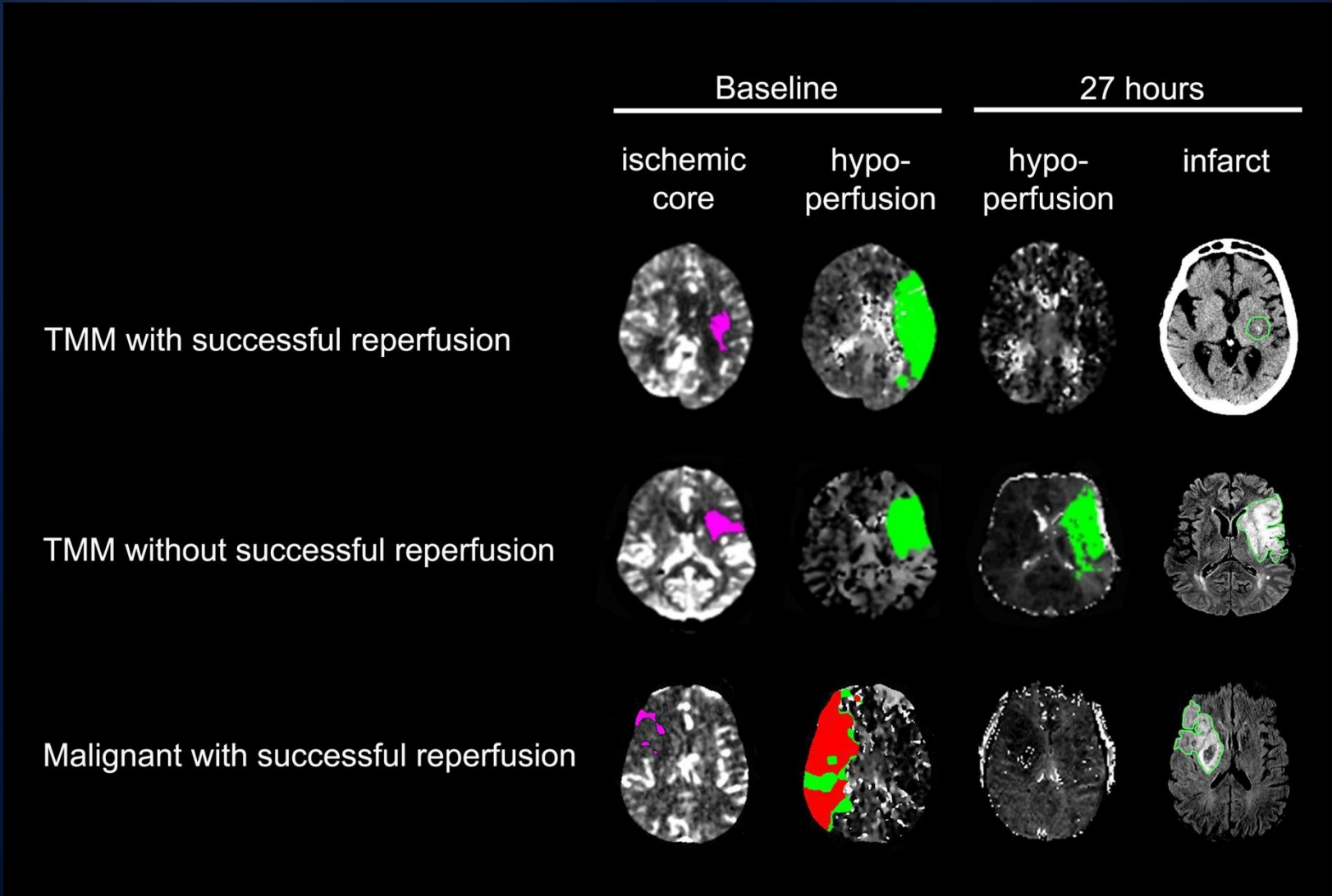
Small ICH with edema

10 ml predicted; 47 ml actual

Malignant profile

24 ml predicted; 269 ml
ml

Predicting Infarct volume: Mismatch Profiles



Target mismatch patients: the union of baseline core and 27 hr hypoperfusion volume predict infarct volume

$R=.7, P<0.0001$

Target Mismatch Profile	Median absolute difference (ml)
All patients (N= 100)	13
CT perfusion (N= 76)	11