Endovascular Thrombectomy Outcomes in Large Core on CT Are Strongly Associated with Perfusion Core Volume and Time

Implications from Two Large Cohorts for Future Trials

Amrou Sarraj, M.D

Associate Professor,

Department of Neurology, UT McGovern Medical School, Houston

On Behalf of SELECT and TREVO Investigators

Presenter Disclosure Information

Financial Disclosures:

- Grant support: Stryker Neurovascular (SELECT & SELECT 2)
- Scientific Advisory board: Stryker Neurovascular
- Consultant and Speaker: Stryker Neurovascular
- UT-Memorial Hermann center PI for the TREVO registry
- UT-Memorial Hermann center PI for the DEFUSE 3 trial
- ASSIST registry steering committee

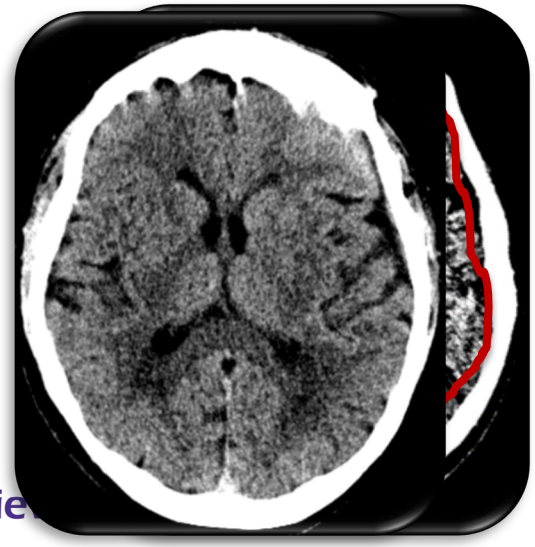
Authors

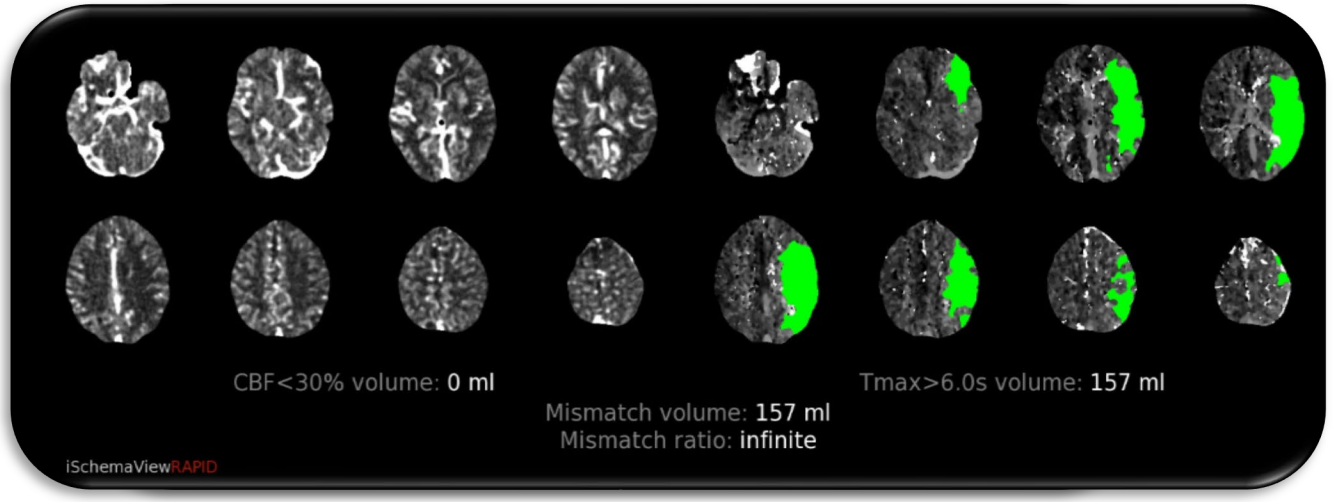
Amrou Sarraj[1], Ameer Hassan[2], Raul Nogueira[3], David Liebeskind[4], Nirav Vora[5], Michael Abraham[6], Sean Savitz[1], James Grotta[1], Clark Sitton[1], Blaise Baxter[7], Peng R Chen[1], Antonin Krajina[8], Chunyan Cai[1], Gary Cutter[9], Deep Pujara[1], Bita Imam[1], Joey English[10], Erol Veznedaroglu[11], Diogo Haussen[3], Maarten Lansberg[12], Rishi Gupta[13], Gregory Albers[12]

[1]UT Health Science Center at Houston, Houston, TX; [2]Univ of Texas - Rio Grande Valley, Harlingen, TX; [3]Emory University, Atlanta, GA; [4]Univ of California Los Angeles, Los Angeles, CA; [5]OhioHeatlh - Riverside Methodist Hosp, Columbus, OH; [6]Univ of Kansas Medical Ctr, Kansas City, KS; [7]Erlanger Hospital, Chattanuga, TN; [8]Charles University, Hradec Kralove, Czech Republic; [9]Univ of Alabama at Birmingham, Birmingham, AL; [10]California Pacific Medical Center, San Francisco, CA; [11]Drexel Neurosciences Institute, Philadelphia, PA; [12]Stanford Univ, Stanford, CA; [13]Wellstar Health System, Marietta, GA

Introduction

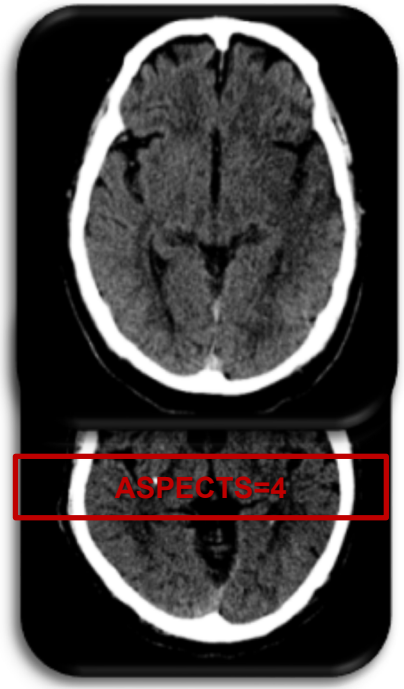
- Endovascular thrombectomy (EVT) efficacy and safety is established in patients with minimal ischemic changes:
  - **ASPECTS ≥ 6**
  - **Small core on perfusion images**
- Patients with significant ischemic changes (large core) were largely excluded from most trials



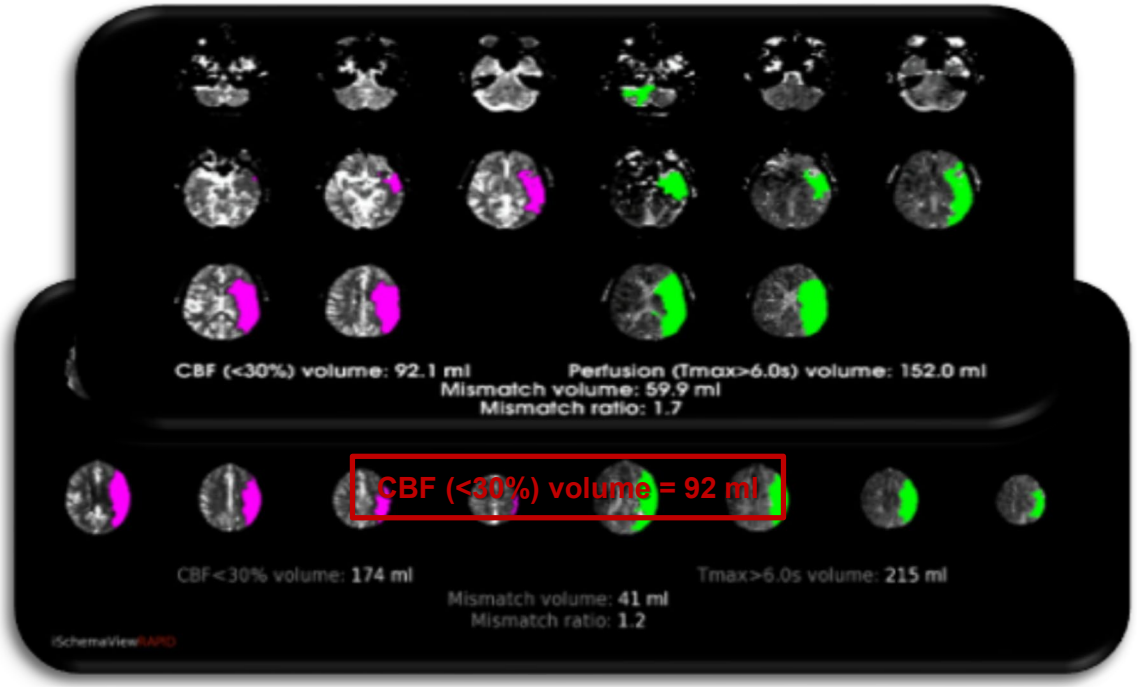


Ischemic Changes on Imaging Modalities

- Large core definition may differ between CT and CTP:
  - CT ASPECTS detects hypodense tissue
  - CTP identifies regions of very low blood flow or volume



ASPECTS=4



CBF (<30%) volume = 174 ml

Trevo® Retriever Registry

SELECT TRIAL

Objective

- Evaluate the variability of EVT outcomes in patients with large core on CT in relation to:
  I. CTP core volume
  II. Time

SELECT TRIAL

- Prospective, cohort multicenter study of imaging selection prior to thrombectomy
- Unified imaging profile (CT, CT angiography, and CTP with mismatch determination using RAPID software) for all patients
- Blinded core lab evaluated all images
- Study arms (non-randomized):
  - EndovascularThrombectomy
  - Medical Management

Trevo® Retriever Registry

- A post-marketing registry
- Imaging obtained at the discretion of the investigators
- Blinded core lab evaluated all images
- Study arms:
  - EndovascularThrombectomy

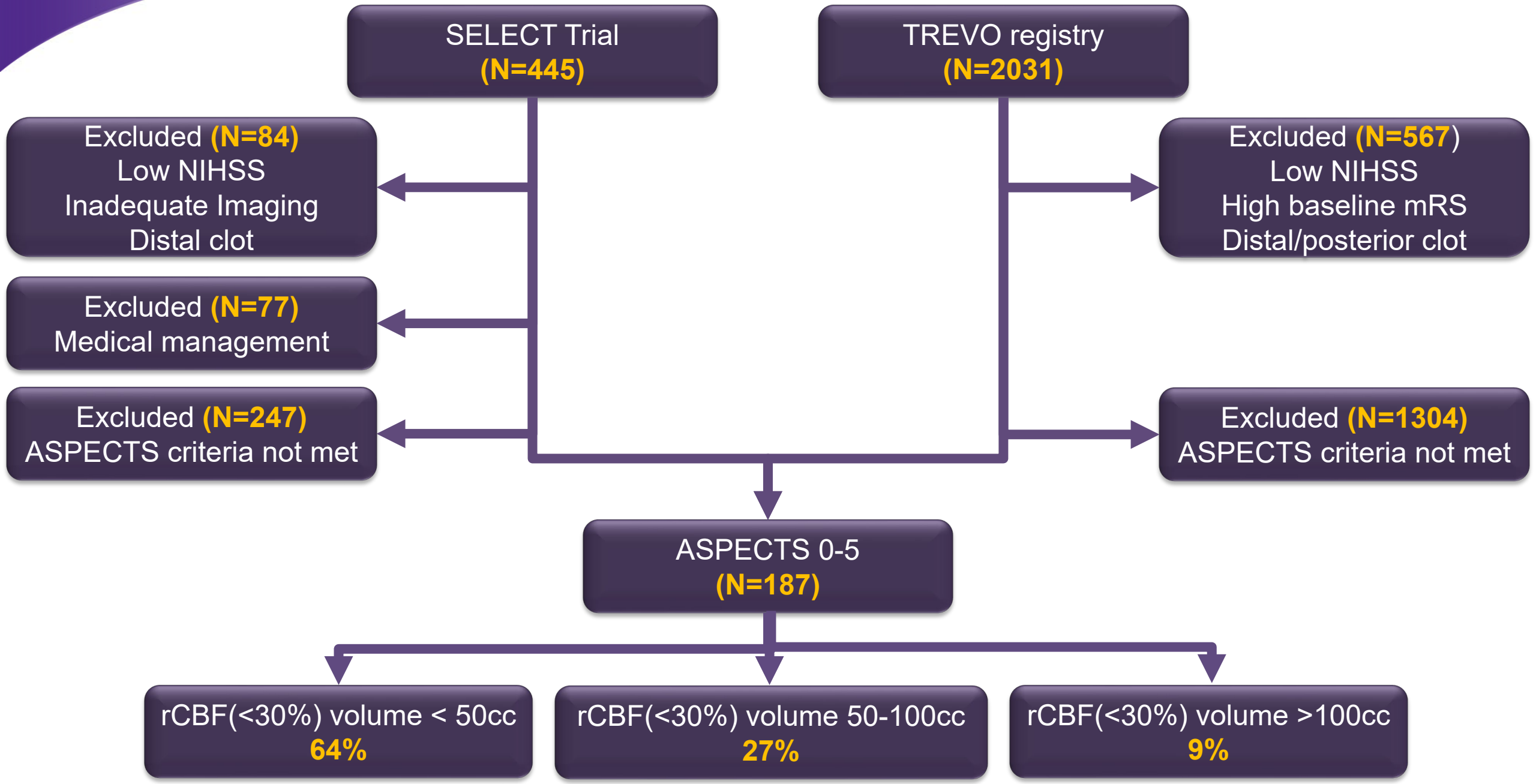
Methods

- ***Inclusion criteria:***
  - Anterior Circulation LVO (ICA, MCA-M1/M2)
  - Large core on ***CT ASPECTS 0-5***
  - NIHSS at presentation ≥ 6
  - LKW to procedure time 0-24 hours
  - Baseline mRS 0-1

Methods

- ***Primary Outcome:***
  - 90 days modified Rankin scores (mRS) of 0-2
- ***Safety Outcomes:***
  - Symptomatic intracerebral hemorrhage (sICH)
  - Neurological worsening (decline of ≥4 NIHSS points at 24hr)
  - Mortality at 90 days

- The analyses were performed on SELECT
- Validation on the combined cohort of SELECT and TREVO

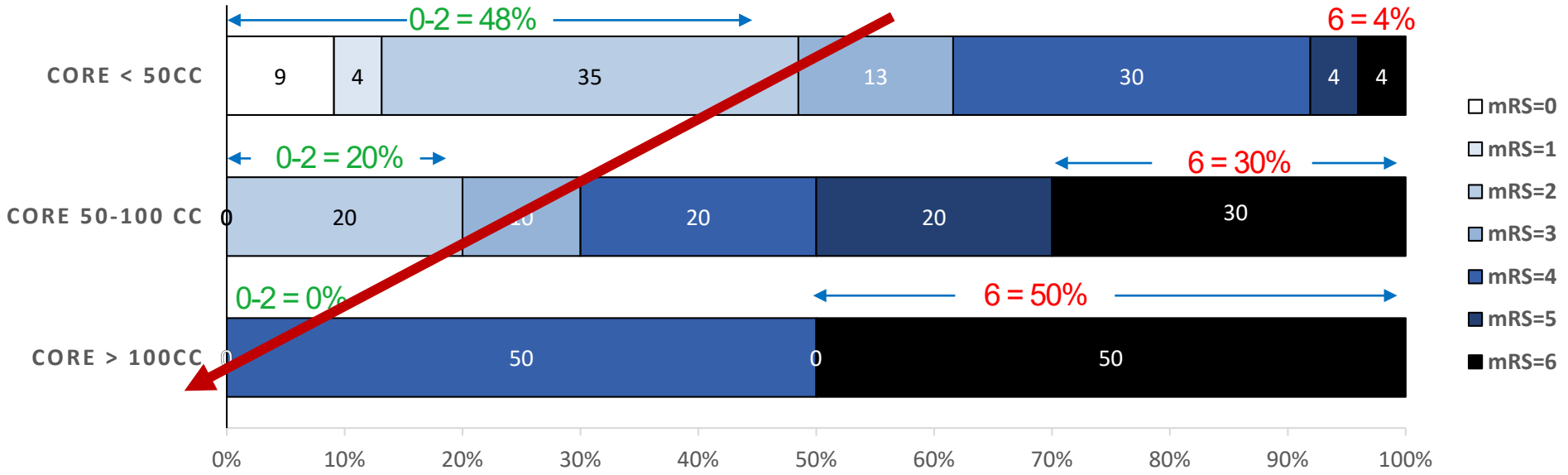

SELECT Trial
(N=445)
TREVO registry
(N=2031)
Excluded (N=84)
Low NIHSS
Inadequate Imaging
Distal clot
Excluded (N=567)
Low NIHSS
High baseline mRS
Distal/posterior clot
Excluded (N=77)
Medical management
Excluded (N=247)
ASPECTS criteria not met
Excluded (N=1304)
ASPECTS criteria not met
ASPECTS 0-5
(N=187)
rCBF(<30%) volume < 50cc
64%
rCBF(<30%) volume 50-100cc
27%
rCBF(<30%) volume >100cc
9%

Baseline Characteristics

	TREVO	SELECT	P-value
Age (years)	64.14(17.66)	63.68 (14.77)	0.89
Hypertension	66%	78%	0.18
Diabetes	31%	38%	0.46
Coronary artery disease	19%	8%	0.24
Baseline NIHSS	17.8(5.4)	18.8 (5.0)	0.36
IV Lytics Administered	47%	70%	0.02
Clot location			
ICA	25%	30%	0.23
M1	58%	65%	
M2	17%	5%	
Transfer Status	53%	51%	0.86
Time from LSN to procedure (min)	6.52(4.60)	5.15(2.70)	0.10
ASPECTS score	4.4 (0.7)	4.4(0.8)	1.0

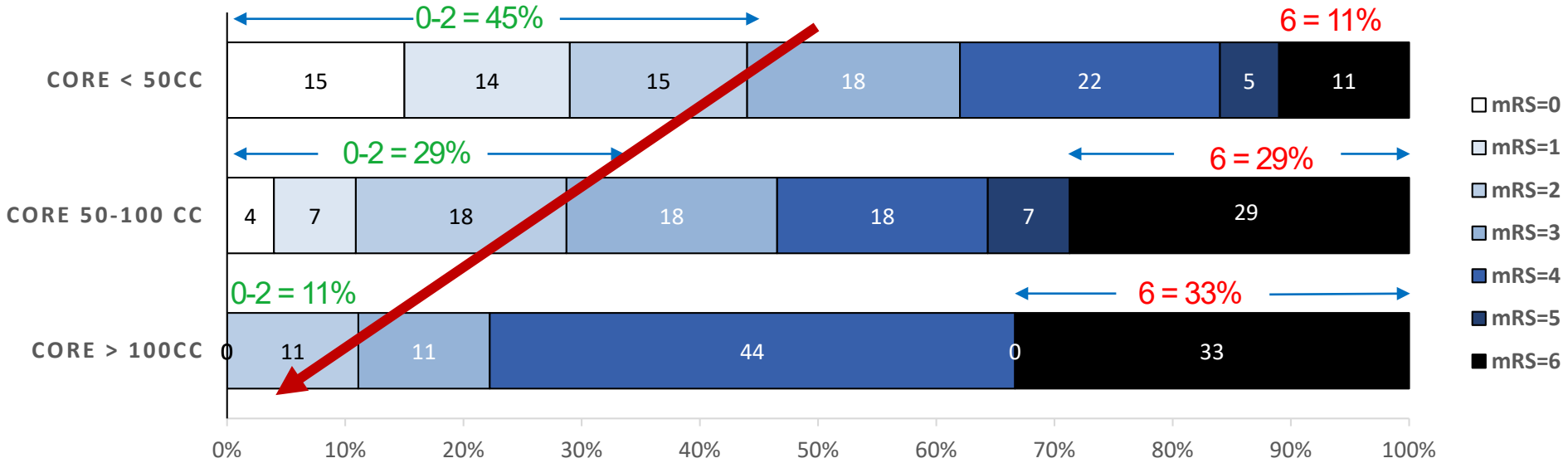
SELECT Clinical Outcomes

Good outcomes: 48% vs 20% vs 0%, p for trend=0.031
Symptomatic ICH: 4% vs 0% vs 75%, p for trend=0.002
Neurological Worsening: 4% vs 22% vs 100%, p for trend<0.001
Mortality: 4% vs 30% vs 50%, p for trend=0.009

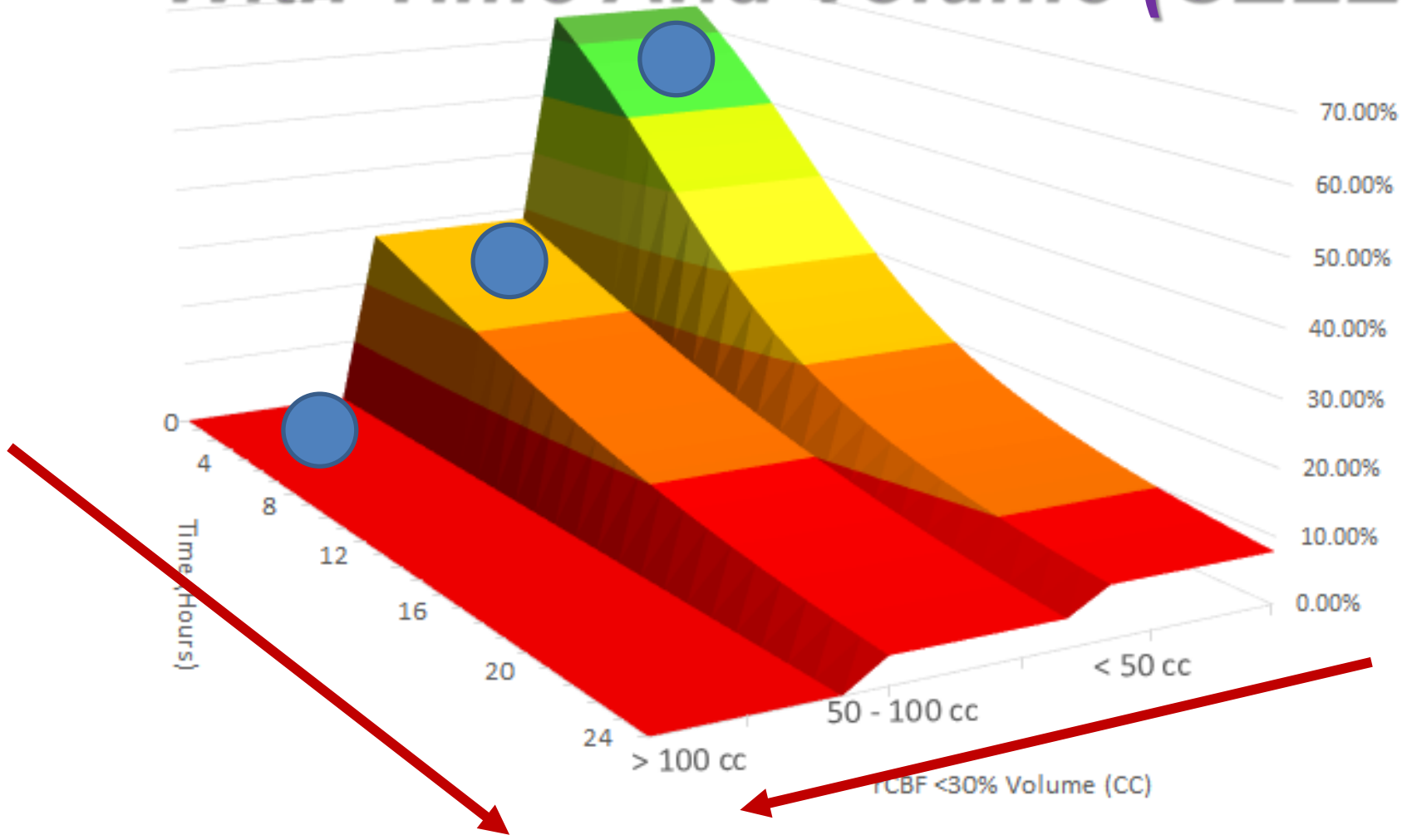


SELECT + TREVO Clinical Outcomes

Good outcomes: 45% vs 29% vs 11%, p for trend=0.018
Symptomatic ICH: 2% vs 7% vs 33%, p for trend=0.002
Neurological Worsening: 3% vs 18% vs 56%, p for trend<0.001
Mortality: 11% vs 29% vs 33%, p for trend=0.019



Probability Of Good Outcomes With Time And Volume (SELECT)



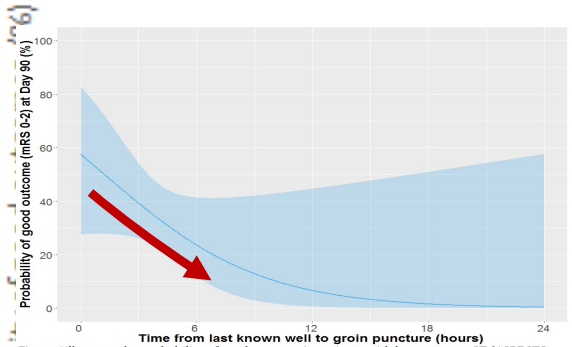
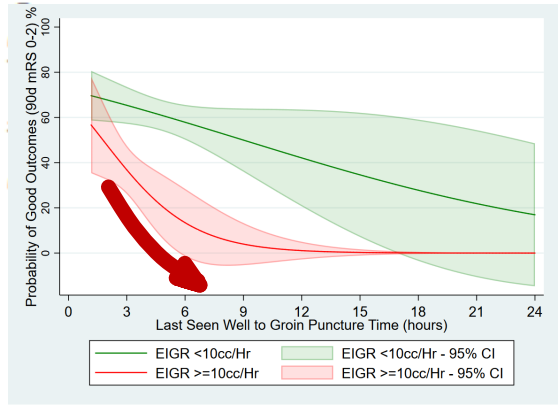
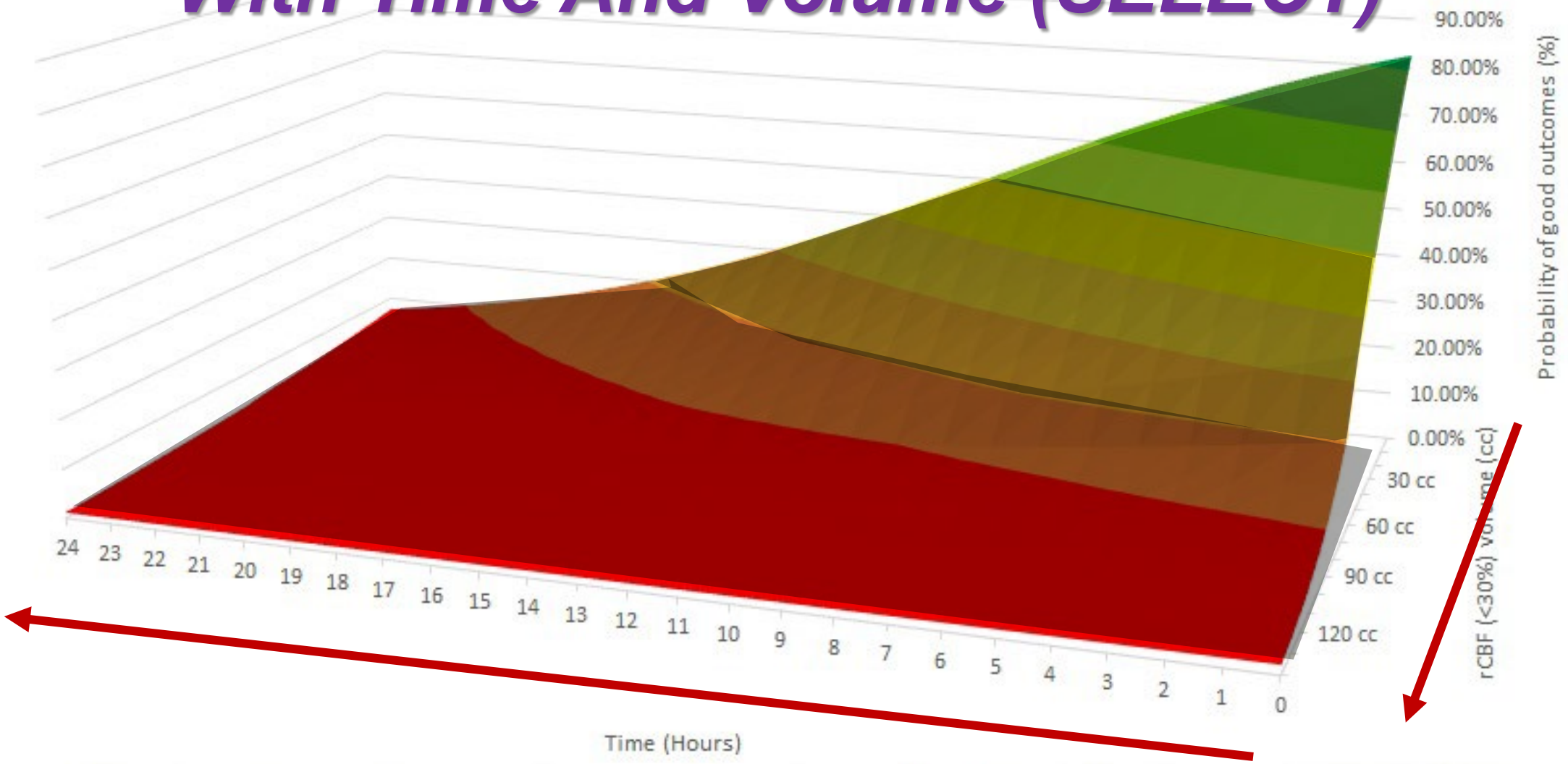


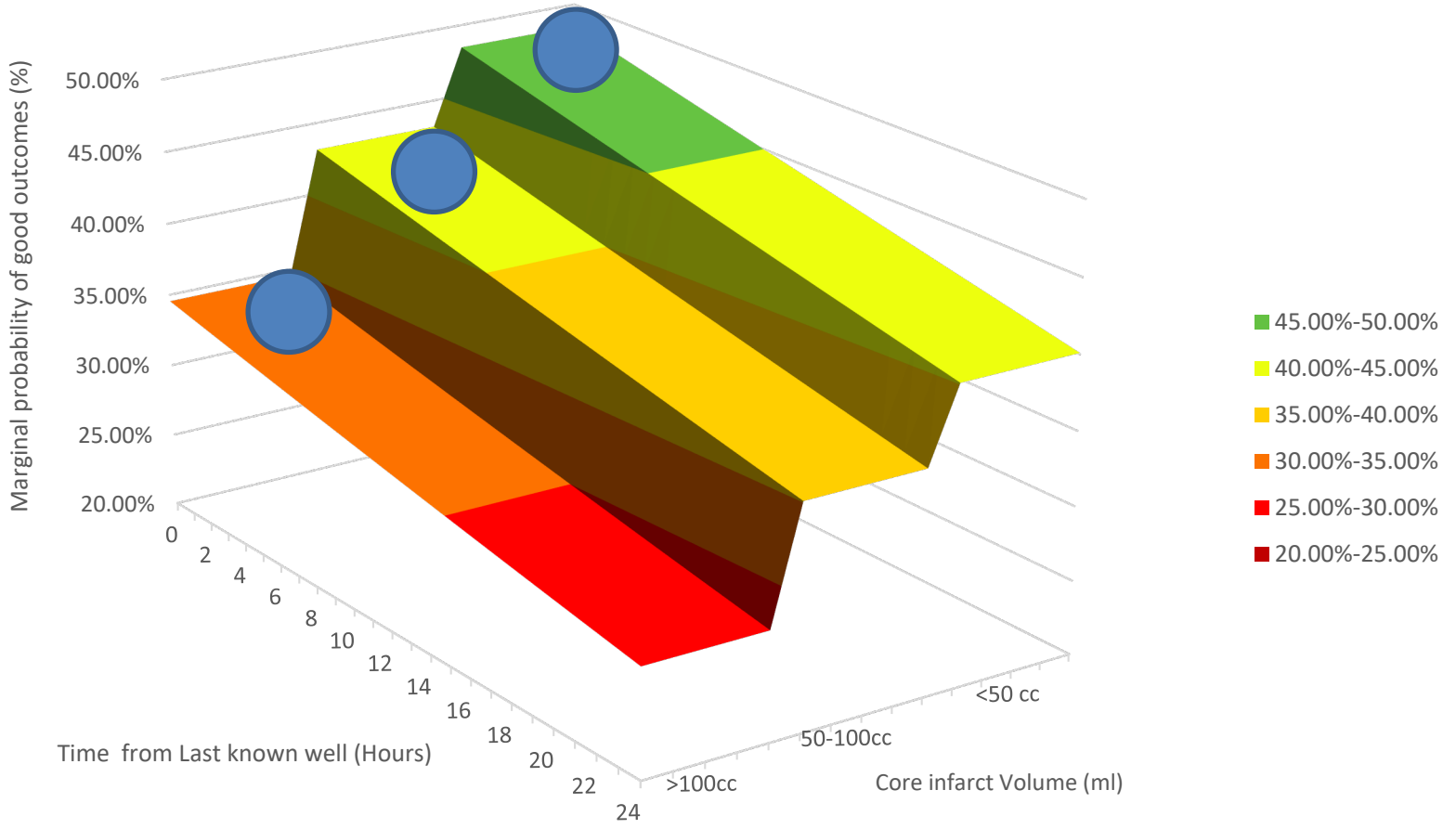
Figure 1illustrate the probability of good outcome in patients with large core on CT (ASPECTS <6) and /or CTP (rCBF <30%) > 50cc with endovascular thrombectomy in relation to time



Probability Of Good Outcomes With Time And Volume (SELECT)



Probability Of Good Outcomes With Time And Volume (SELECT & TREVO)



Limitations

- No medical management controls
- No benefit conclusions can be made
- Unified imaging profile in SELECT
- Imaging selection by site investigators' discretion in TREVO

Conclusion

- In patients with large core on CT, as the volumes increased and time to reperfusion progressed:
  I. The rates of functional independence declined
  II. Mortality and symptomatic hemorrhage rates increased

- Low rates of good outcomes with thrombectomy beyond 100 cc
  – May still be better than medical management thus RCTs are needed

- This data can help inform the design of future large core RCTs

SELECT 2

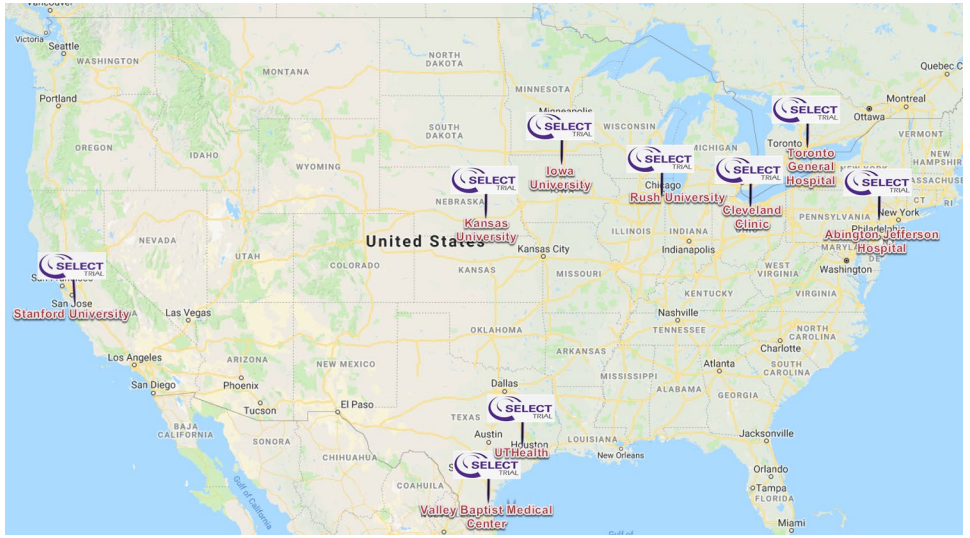
- Randomized, controlled trial assessing:

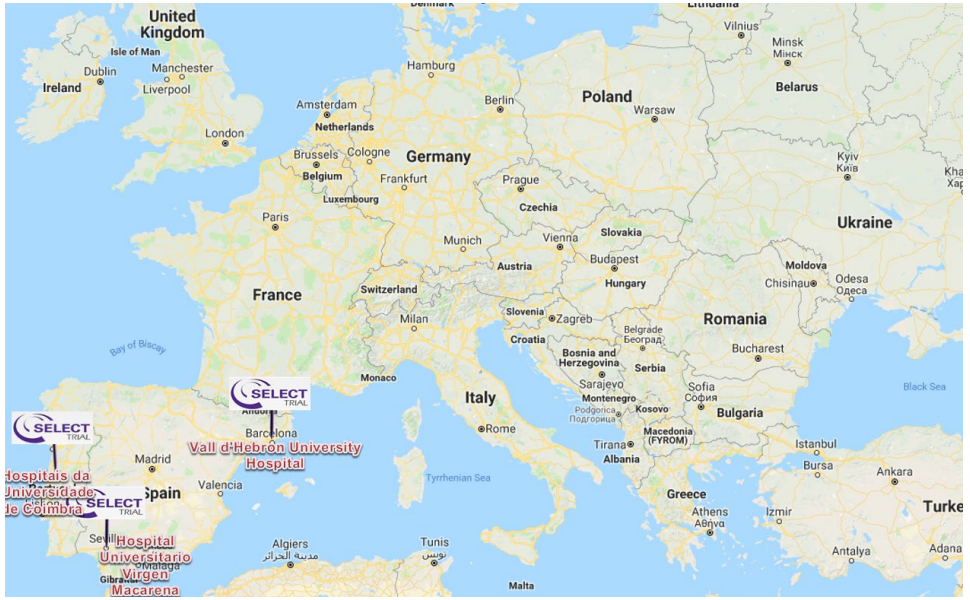
I. Thrombectomy efficacy and safety in patients with unfavorable profiles on CT and perfusion images

II. Correlation between imaging and thrombectomy outcomes

- 20 sites
  - US
  - International

- Large core
  - **ASPECTS 3-5**
  - **rCBF (<30%) volume 50-100cc**
- Enrollment goal: up to 460 patients





Evolution of Evidence and Population

MR CLEAN
ESCAPE
REVASCAT
SWIFT PRIME
EXTEND-IA

→

DAWN
DEFUSE 3

→

?

Small Core - Early window (0-6 hours)

Small Core - late window (>6-24 hours)

Large Core

2015

2018

?

2021

Thank You

- Patients and their families
- Investigators, coordinators and steering committee
- Statistical team
- Stryker Neurovascular