EVT: It's impact on Northwestern Ontario – The Alberta Perspective

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Thomas Jeerakathil BSc, MD, MSc, FRCP(C)
Professor
Division of Neurology
University of Alberta
Northern Stroke Lead CV/S SCN, AHS
Co-PI Stroke Ambulance Project

Disclosures

- Bayer – 2 honoraria for 2 advisory board meetings on anticoagulants
- Grant funding from CIHR, HSFC, AHS, Alberta Health, SCN, University of Alberta Hospital Foundation

Mitigating potential bias

- The topic of this talk is unrelated to any disclosures

Objectives

- Recognize in-field stroke scales for identification of patients likely to benefit from endovascular therapy
- Describe how the Telestroke system can facilitate access to endovascular care
- Describe the current and future state of endovascular treatment in Northwestern Ontario

Steve

- 69 year old male business owner with high blood pressure
- Awoke feeling ‘unwell’ with no focal symptoms
- Wife called EMS
- EMS arrival - unable to speak
- Suddenly weak on the right side
- Right hemianopsia
- Remote, rural Alberta

LVO is a major cause of overall death and disability from stroke.

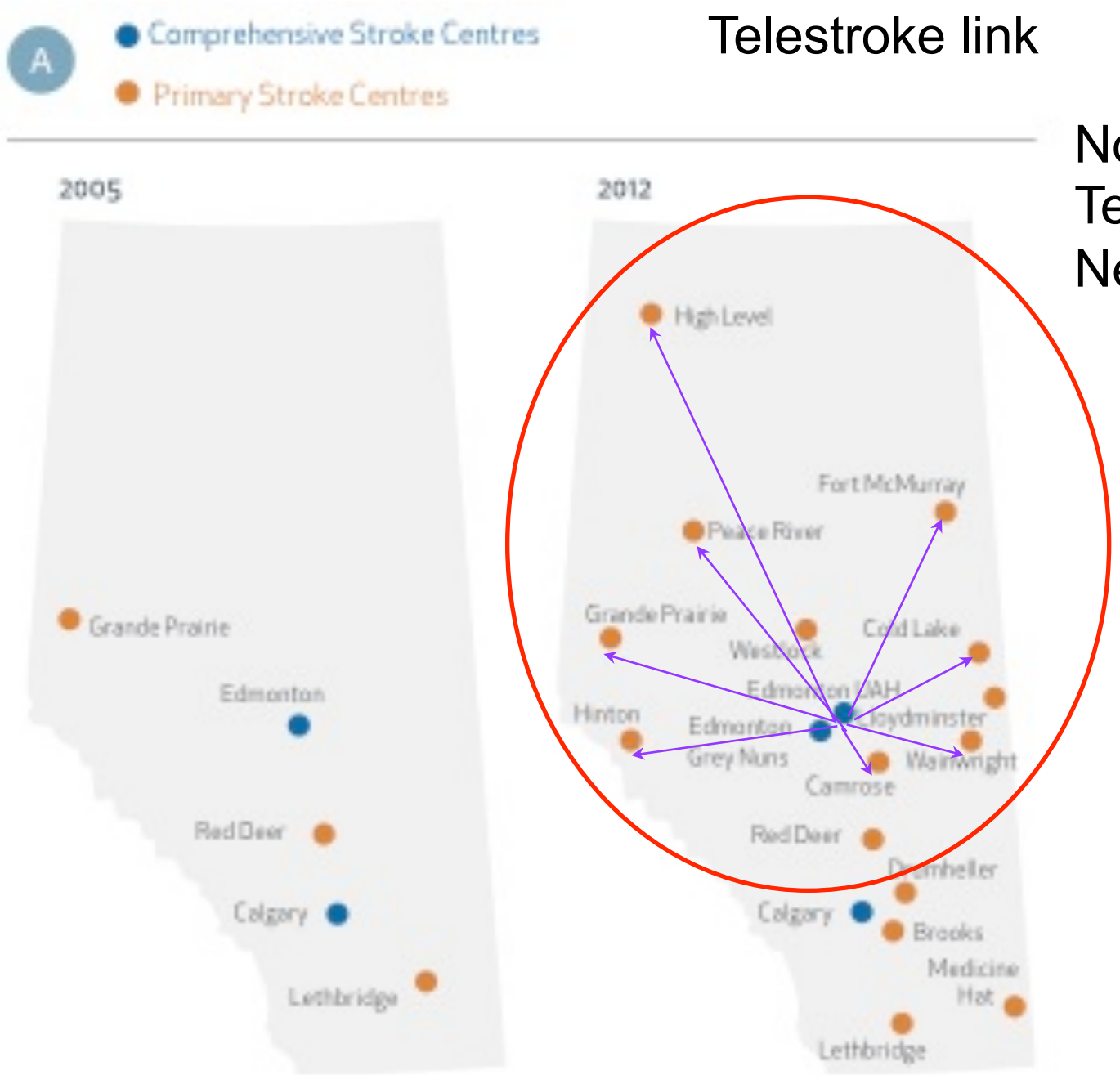
TABLE 2 | Rates and outcomes of large-vessel occlusion (LVO) and non-LVO acute cerebral ischemia.

	Smith et al. (11)	van Seeters et al. (13)	Pooled model-adjusted estimates
Study sample size	643	824	1,467
LVO, *n* (%)	328 (51.0%)	219 (26.5%)	38.7% (CI: 21.8–55.7%)
Dependence and death (modified Rankin Scale 3–6)			
Among all patients	280/643 (43.5%)	292/824 (35.4%)	39.4% (CI: 33.7–45.0%)
Among LVO	212/328 (64.6%)	138/219 (63.0%)	64.0% (CI: 60.0–68.0%)
Among non-LVO	68/315 (21.6%)	154/605 (25.5%)	24.0% (CI: 21.3–26.8%)
Odds ratio (OR), LVO vs. non-LVO	3.98 (2.86–5.54)	4.99 (3.59–6.94)	4.46 (CI: 3.53–5.63)
Fraction due to LVO	212/280 (75.7%)	138/292 (47.3%)	61.6% (CI: 41.8–81.3%)
Mortality			
Among all patients	90/643 (14.0%)	N/A	14.0% (CI: 11.4–16.9%)
Among LVO	86/328 (26.2%)	N/A	26.2% (CI: 21.5–31.3%)
Among non-LVO	4/315 (1.3%)	N/A	1.3% (CI: 0.3–3.2%)
OR, LVO vs. non-LVO	4.09 (2.5–6.68)	N/A	4.09 (2.5–6.68)
Fraction due to LVO	86/90 (95.6%)	N/A	95.6% (CI: 89.0–98.8%)

N/A: not available.

Malhotra et al. Front Neurol 8:651. doi: 10.3389/fneur.2017.00651

Telestroke link



Northern Telestroke Network

Technology -Telestroke

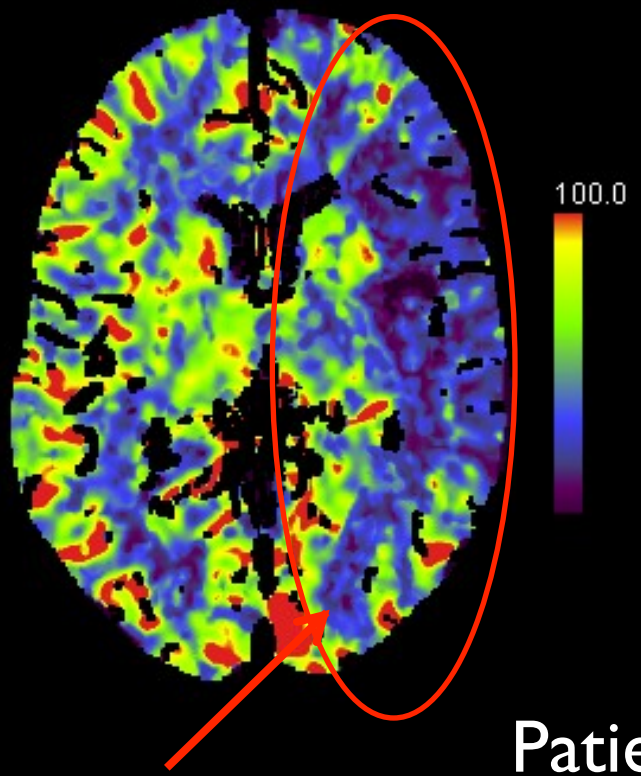
Steve

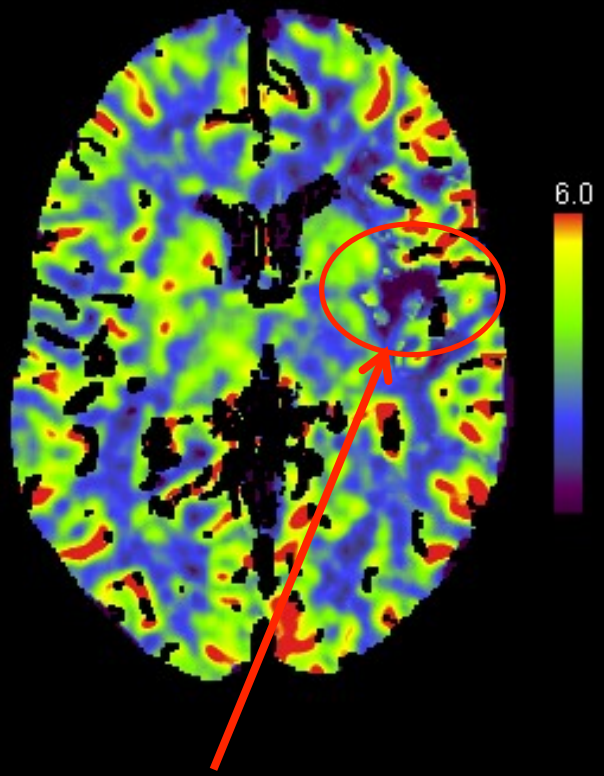
- Transported 2 hours to a primary stroke centre
- Received IV tPA at exactly 4.5 hours from onset
- The Telestroke neurologist initiated transport at the time of thrombolysis
- All transport vehicles tied up or weather limited for the next three hours

Technology: CT Angiogram – LVO – large vessel occlusion

Patient 1

CT Perfusion: blood flow to brain cell microvasculature



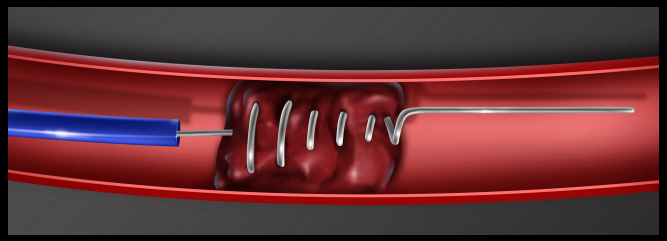


Brain at risk - in purple

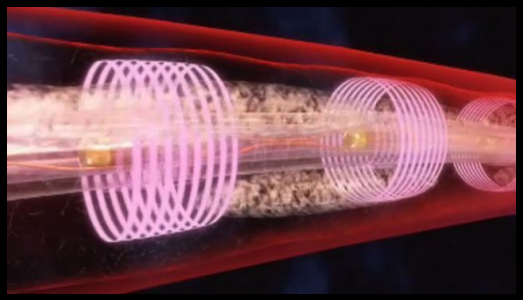
Patient 1 – 10 hours post onset

Brain infarcted

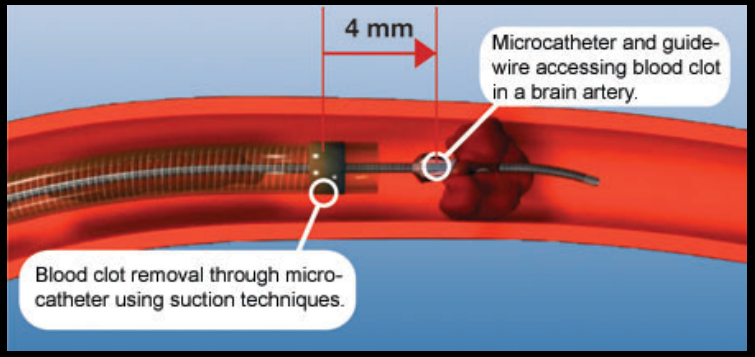
Past devices: no benefits proven vs tPa



Merci catheter

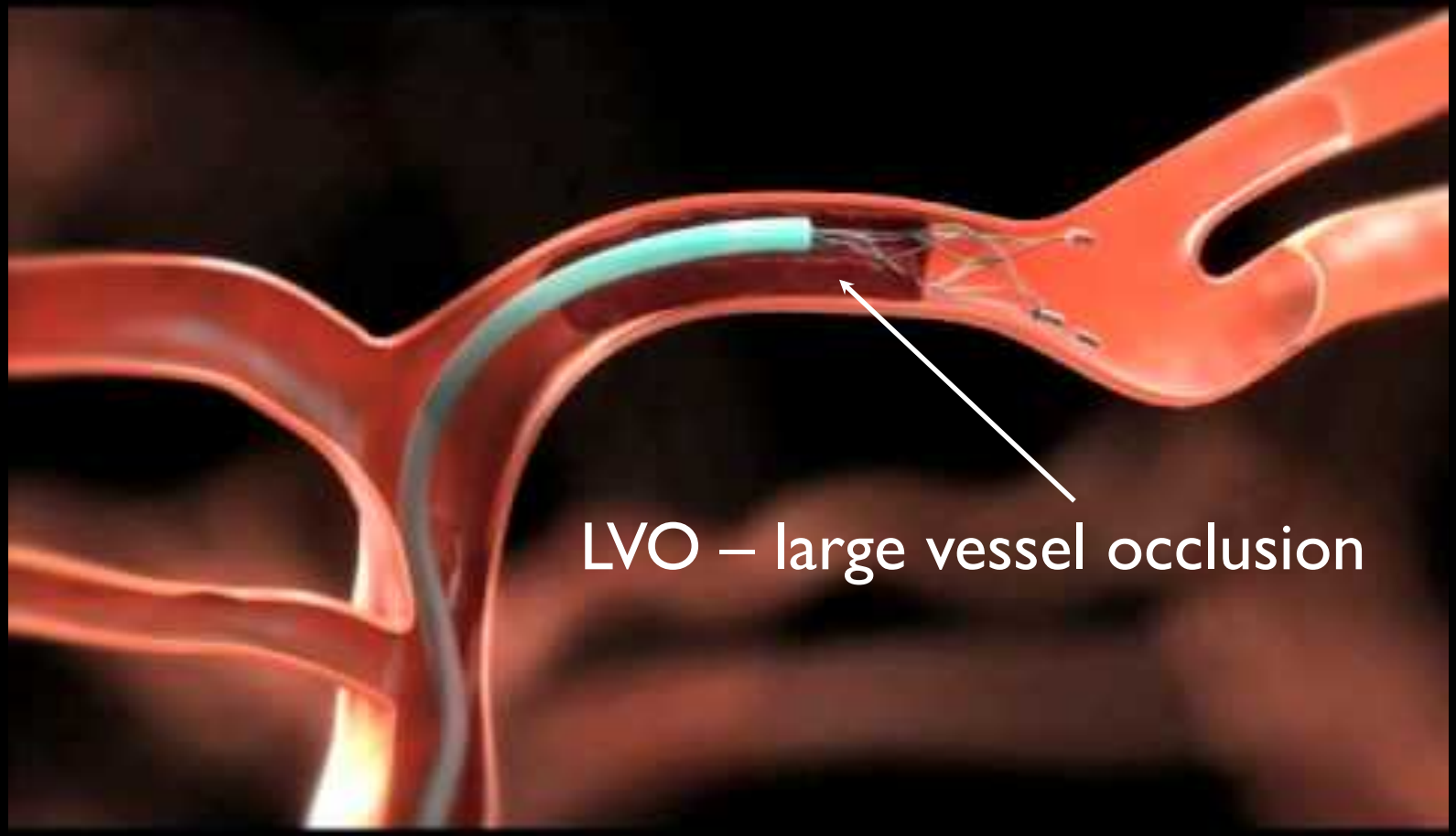


Ekos Ultralyse

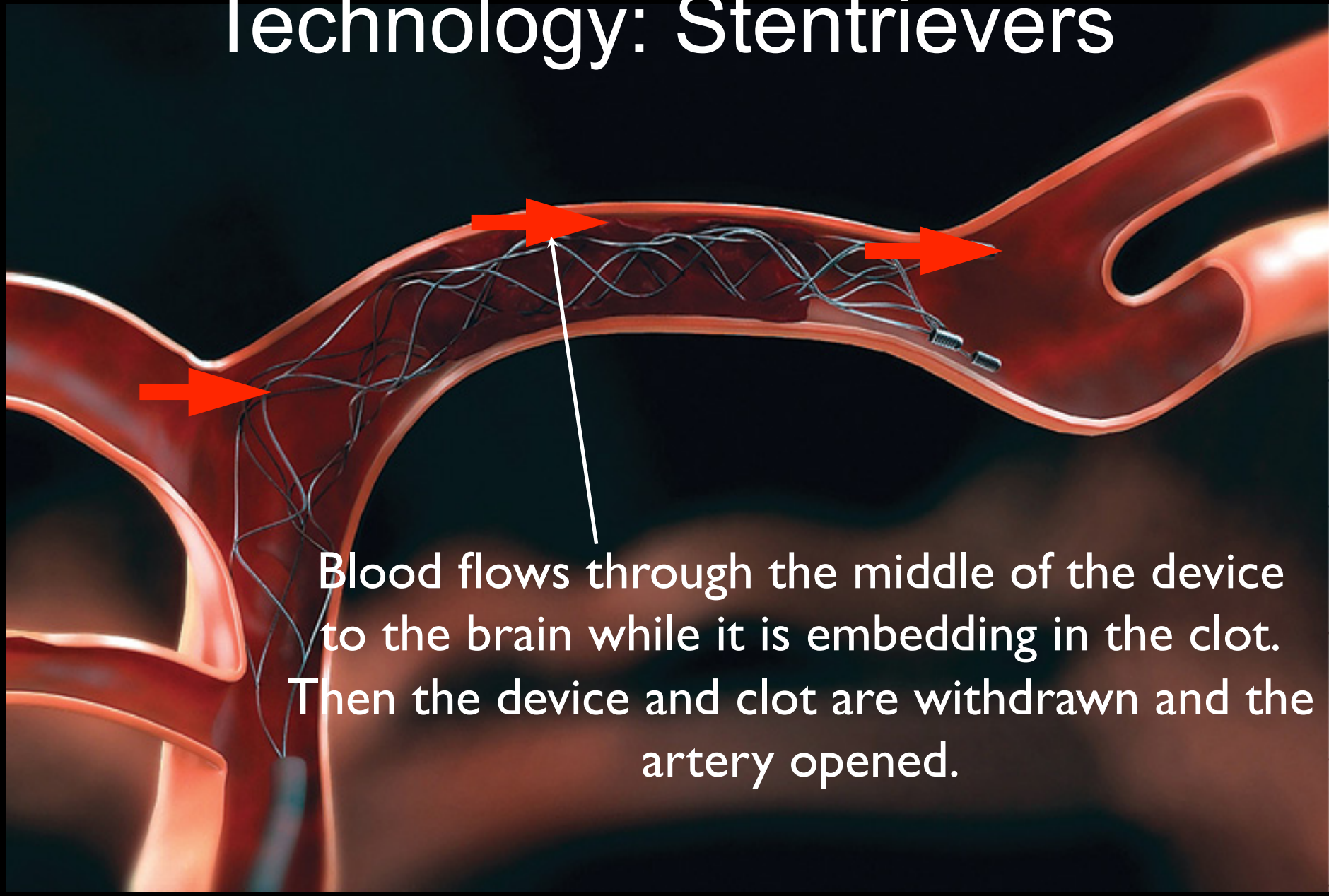


Penumba suction device

Technology: Stent retrievers

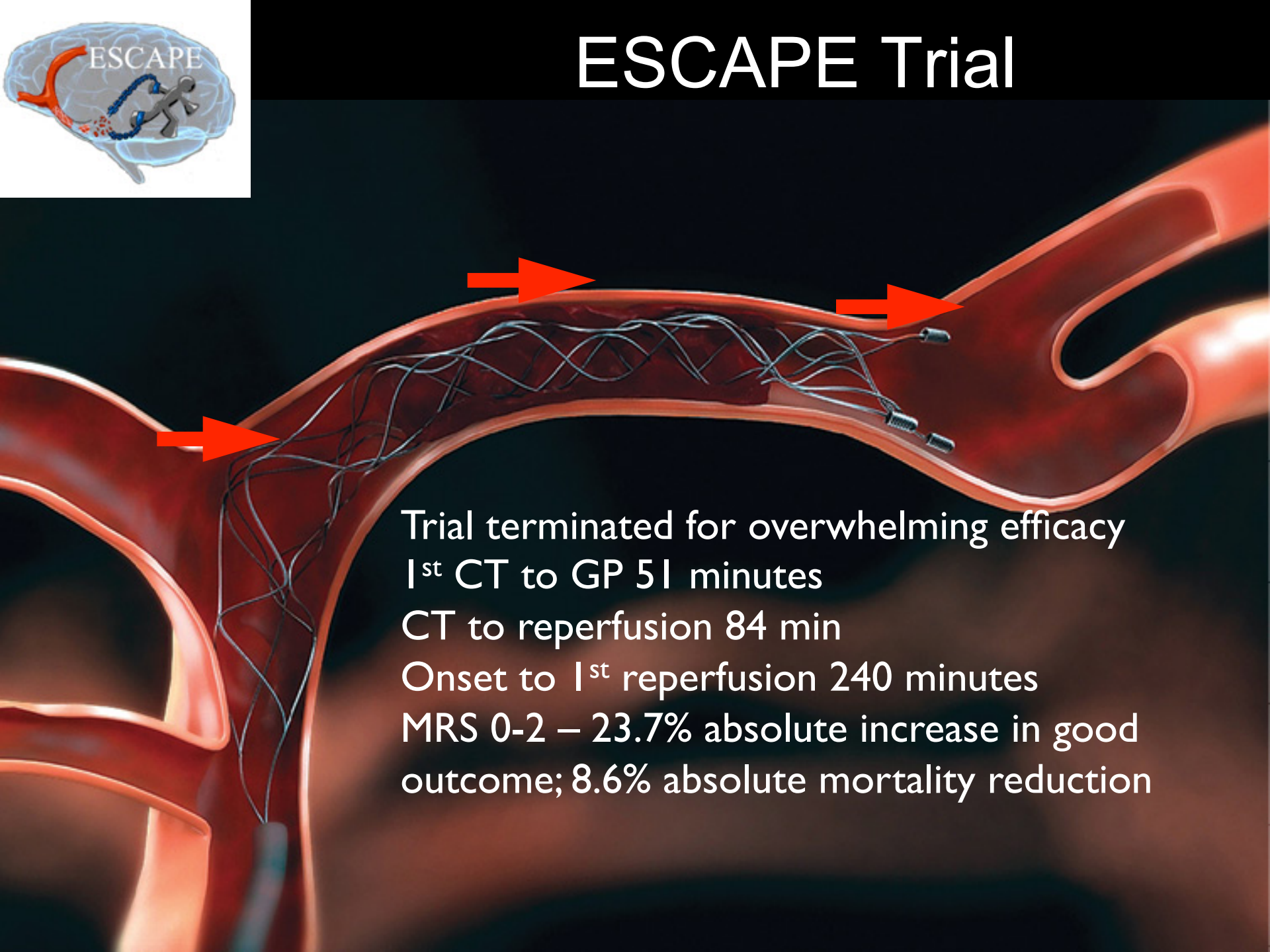


Technology: Stentrievers



Blood flows through the middle of the device to the brain while it is embedding in the clot. Then the device and clot are withdrawn and the artery opened.

ESCAPE Trial



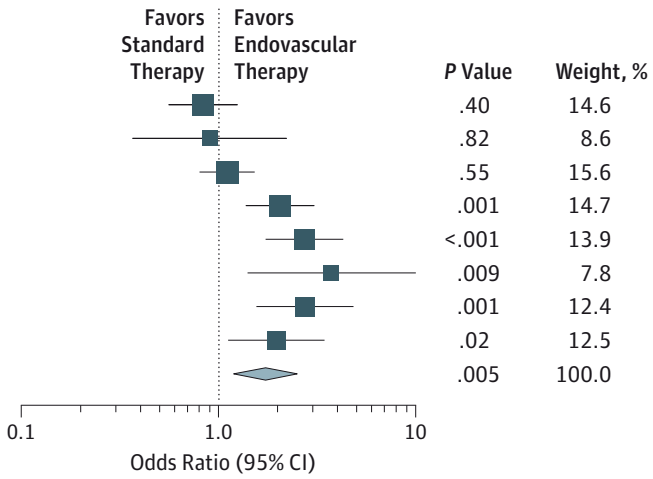
Trial terminated for overwhelming efficacy
1st CT to GP 51 minutes
CT to reperfusion 84 min
Onset to 1st reperfusion 240 minutes
MRS 0-2 – 23.7% absolute increase in good outcome; 8.6% absolute mortality reduction

Figure 3. Secondary Efficacy and Safety Outcomes of Endovascular Therapy vs Standard Therapy

A Functional independence (modified Rankin Scale score 0-2) at 90 d

Source	Endovascular Therapy Events/No.	Standard Therapy Events/No.	Odds Ratio (95% CI)	*P* Value	Weight, %
SYNTHESIS,[26] 2013	76/181	84/181	0.84 (0.55-1.27)	.40	14.6
MR RESCUE,[27] 2013	12/64	11/54	0.90 (0.36-2.25)	.82	8.6
IMS III,[28] 2013	177/415	86/214	1.11 (0.79-1.55)	.55	15.6
MR CLEAN,[29] 2015	76/233	51/267	2.05 (1.36-3.09)	.001	14.7
ESCAPE,[30] 2015	87/164	43/147	2.73 (1.71-4.37)	<.001	13.9
EXTEND-IA,[31] 2015	25/35	14/35	3.75 (1.38-10.17)	.009	7.8
SWIFT-PRIME,[32] 2015	59/98	33/93	2.75 (1.53-4.94)	.001	12.4
REVASCAT,[33] 2015	45/103	29/103	1.98 (1.11-3.53)	.02	12.5
Overall	557/1293	351/1094	1.71 (1.18-2.49)	.005	100.0

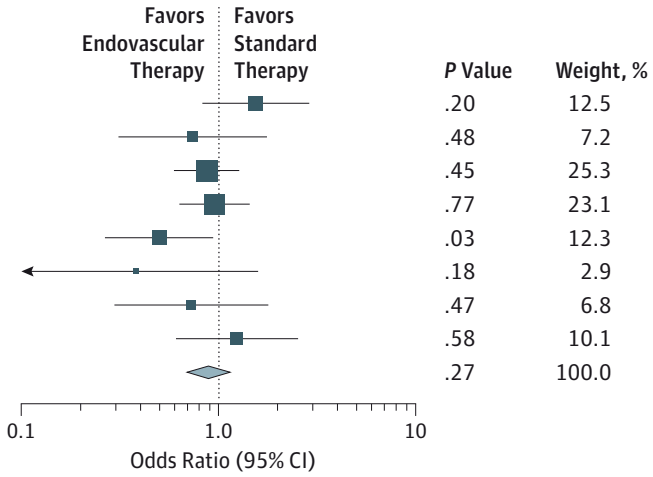
$I^2 = 75.4\%$, $P < .01$



B Mortality at 90 d

Source	Endovascular Therapy Events/No.	Standard Therapy Events/No.	Odds Ratio (95% CI)	*P* Value	Weight, %
SYNTHESIS,[26] 2013	26/181	18/181	1.52 (0.80-2.88)	.20	12.5
MR RESCUE,[27] 2013	12/64	13/54	0.73 (0.30-1.76)	.48	7.2
IMS III,[28] 2013	83/434	48/222	0.86 (0.58-1.28)	.45	25.3
MR CLEAN,[29] 2015	49/233	59/267	0.94 (0.61-1.44)	.77	23.1
ESCAPE,[30] 2015	17/164	28/147	0.49 (0.26-0.94)	.03	12.3
EXTEND-IA,[31] 2015	3/35	7/35	0.38 (0.09-1.59)	.18	2.9
SWIFT-PRIME,[32] 2015	9/98	12/97	0.72 (0.29-1.79)	.47	6.8
REVASCAT,[33] 2015	19/103	16/103	1.23 (0.59-2.55)	.58	10.1
Overall	218/1312	201/1106	0.87 (0.68-1.12)	.27	100.0

$I^2 = 17.7\%$, $P = .29$



Metanalysis 2015 JAMA

Underwent Stentriever therapy as part of an ongoing clinical trial

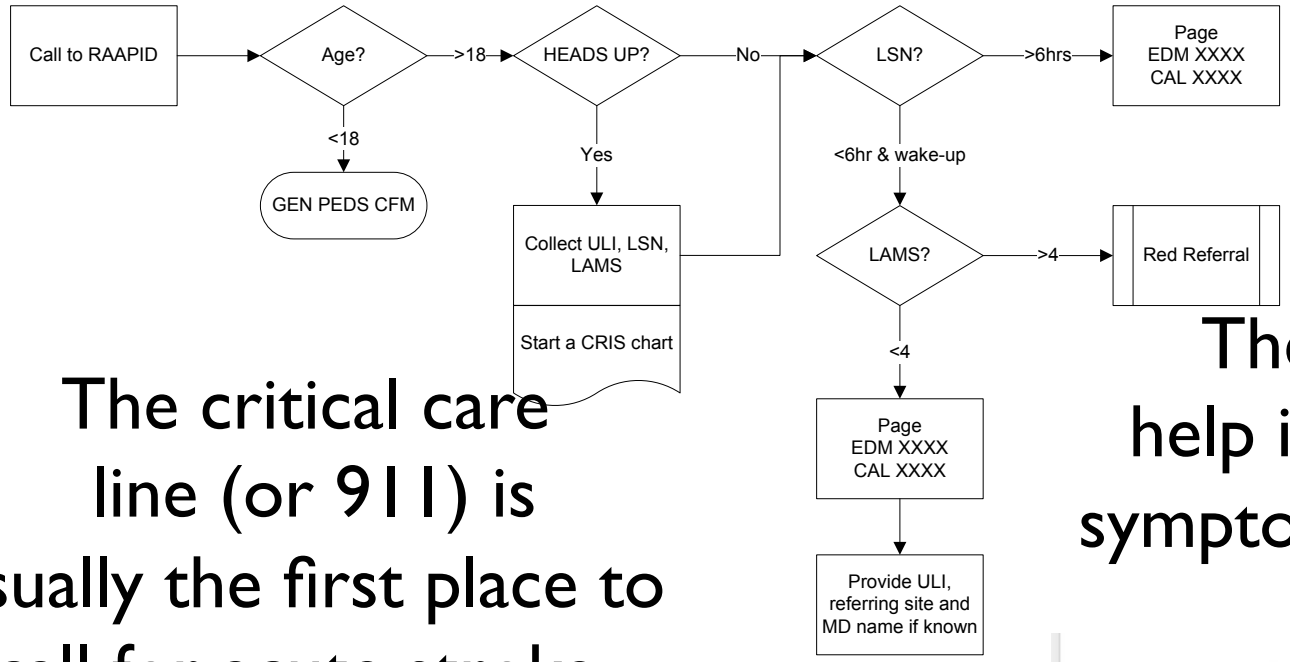
Steve (the first patient)

Access to endovascular therapy

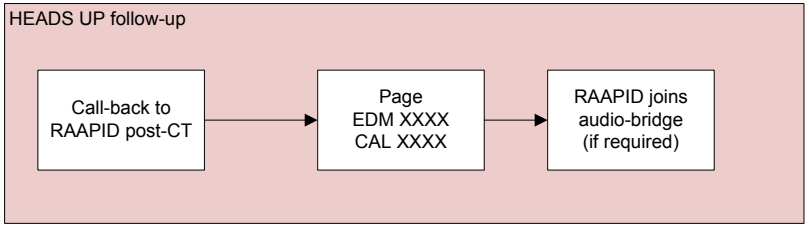
Accessing the acute stroke system -- four scenarios: (for patients presenting within 6 hours of onset or wakeups presenting within 6 hours of waking)

1. The patient presents to a Primary Stroke Centre (PSC)
2. The patient presents to a non-PSC (walk-in or inpatient)
3. The patient is with an EMS crew (ERA Project)
4. The patient presents to a clinic – call 911!

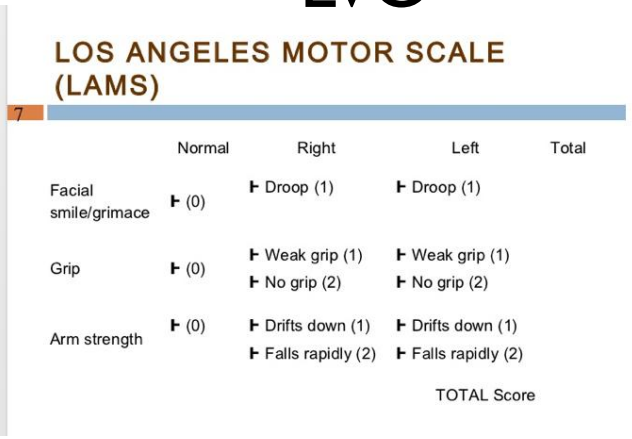
Stroke CFM
Notes: If this is a HEADS UP call, ensure the caller has the pt ULI, LSN (if known)



The critical care line (or 911) is usually the first place to call for acute stroke.



The LAMS can help identify motor symptoms that predict LVO



LAMS Scoring

Item	Score	Description
Face	0	Both sides move normally
	1	One side has a facial droop
Arm	0	Both sides stay up
	1	One side drifts downward
	2	One side falls rapidly
Grip	0	Both sides are strong
	1	One side is weak
	2	One side is absent
Total	0-5	

Other scales

- FAST-ED
- VAN
- FAST VAN
- RACE
- 3-ITEM LVO Algorithm (Zhao, BMJ 2017)
  http://jnnp.bmj.com/content/88/5/e1.26

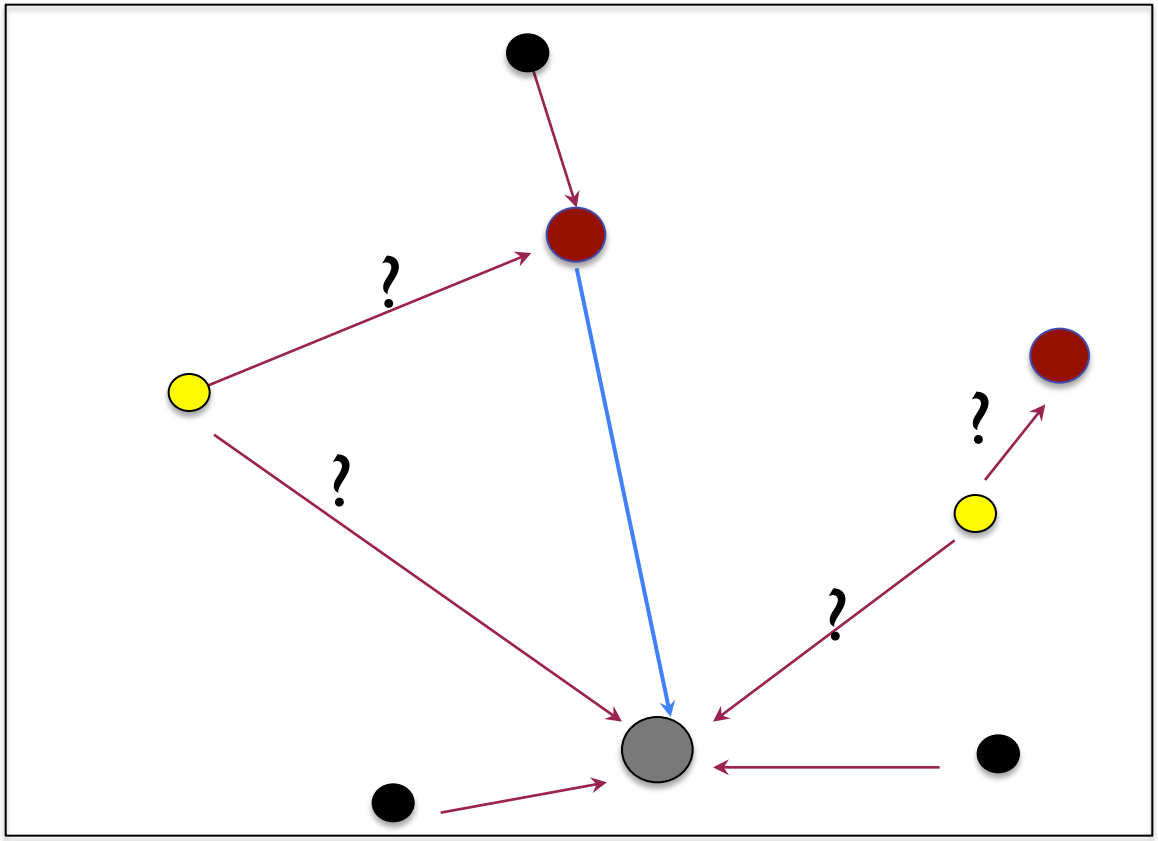
Patient Diversion

What factors determine the destination primary or comp stroke centre?

- Geography/ proximity?
- Time (transport and door to treatment)?
- Quality and volume?
- Discussion between transport physician and the stroke neurologist if possible

PSC

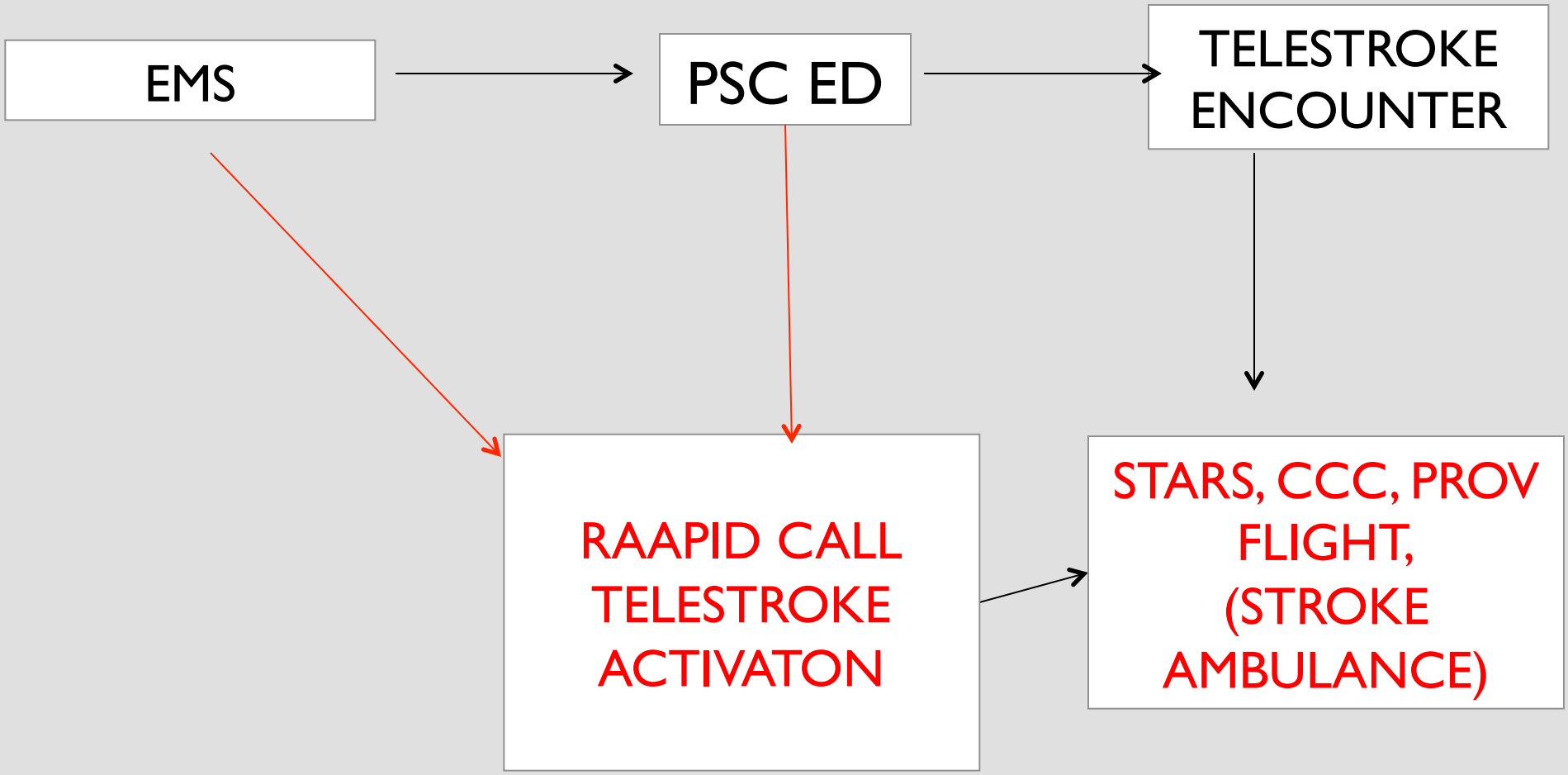
CSC



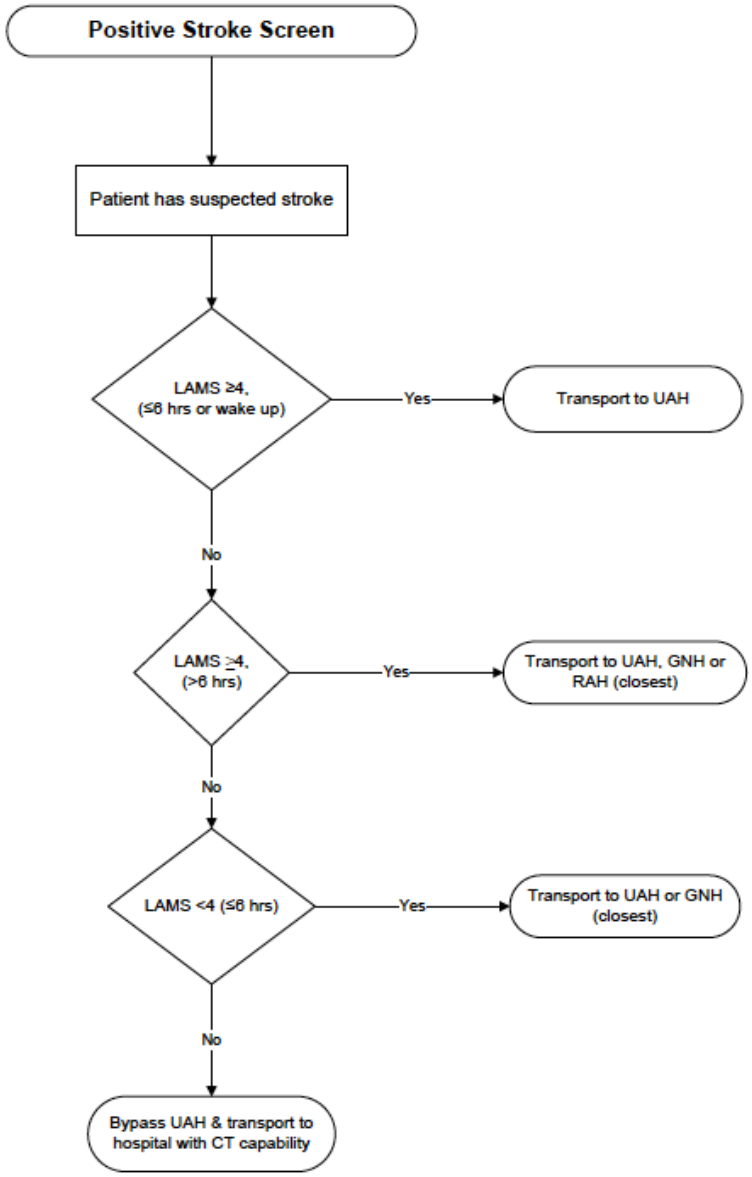
ERA (Endovascular Recanalization Alberta)

- If rural EMS crews encounter a patient who screens positive for stroke and has a LAMS >= 4 and if they are not close to a PSC or CSC this activates the ERA (Endovascular Recanalization Alberta) process
- The crews call RAAPID and the telestroke physician, and often the OLMC physician determine whether diversion to a CSC should occur for more rapid endovascular therapy (OLMC should involve Telestroke in these decisions)
- In the North the Stroke Ambulance may rendezvous with the crew if the Telestroke physician is involved
- In the Edmonton Zone, urban crews need to decide acutely whether to go to the Grey Nuns or UAH (for EVT)

Acute stroke call process



EDMONTON ZONE PREHOSPITAL STROKE ALGORITHM



Gdrive/AHS-CH/CHPillar2/Emergency Services & Acute Care/Algorithms & Protocols/EZ Prehospital Stroke Algorithm.Mar29.2017.vsd

EVT Decision at the PSC

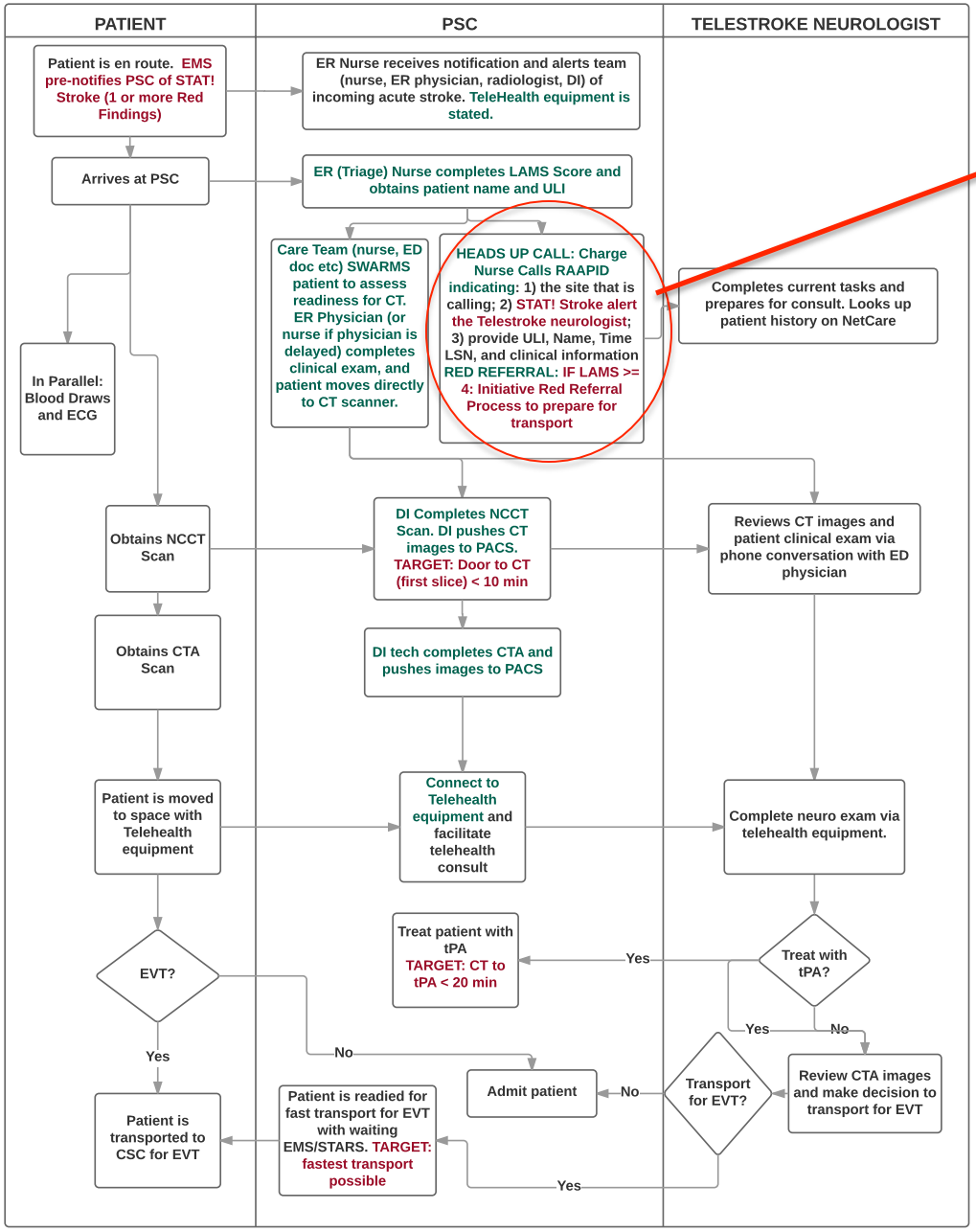
- First decision is to treat with tPA
  - TARGET = DNT < 30 minutes (few are attaining this target)
- Once this is done CTA imaging can be reviewed to assess the patient for rapid transfer to CSC for EVT
- At this point relink through your Critical Care Line with stroke neurology and transport team (EMS dispatch, flight, helicopter, transport physician)
  - If transportation to CSC for EVT, then the TARGET DIDO is < 45 minutes (but also difficult to actually achieve)

How can we reduce DIDO?

- Keep the incoming EMS crew on site if possible to avoid delays in transfer of care
- In return, PSCs should have a fast turnaround
- The expectation of physician assessment within 10-15 minutes (like an MI)
- PSCs - Speed up your CTA process to <5-10 min so that you can do the CTA after the plain CT
- Goal DIDO – 25 min for nonPSC; 45 min for PSC

How can we reduce DIDO?

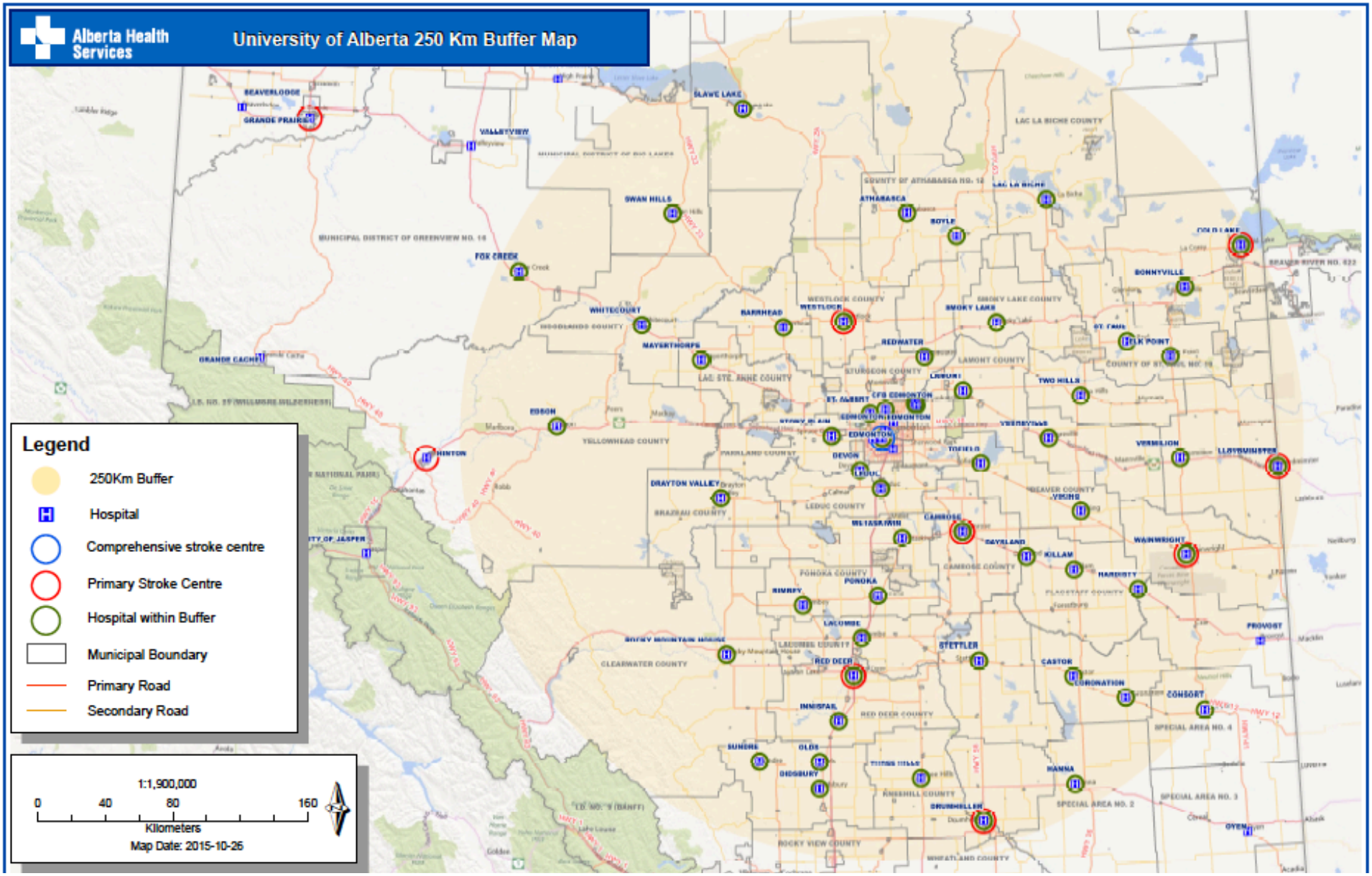
- We are planning to launch the RED REFERRAL process for EVT
- The Red Referral Process when launched could speed DIDO by mobilizing ambulance crews and putting flight vehicles on alert earlier in the telestroke encounter.
- Then there will be a relink after the telestroke encounter to launch or stand down
- (Northwestern Ontario may be ahead in this regard with transport vehicle alert at the point of 911 call)



Planned: Red Referral planned at Heads Up call: for LAMS>= 4;
RAAPID: CCC
Prov Flight STARS Telestroke.
This is before the actual telestroke encounter.
Transport assets placed on alert. Then launched or stand down in about 25 minutes after the telestroke encounter is over.

Non-PSC Northern Alberta – Stroke Ambulance

- If within a 250 km range around Edmonton and during the weekday hours of 8-4 call RAAPID with any acute stroke regardless of LAMS
- The patient may be a candidate for a Stroke Ambulance dispatch which might allow the fastest thrombolysis as well as transport to Edmonton for EVT
  - We have activated phase 2 – (response to in-Zone Edmonton Hospitals)
  - Transport doc should involve telestroke in the field call in this radius during operational hours
  - Phase 3 is transport of EVT candidates

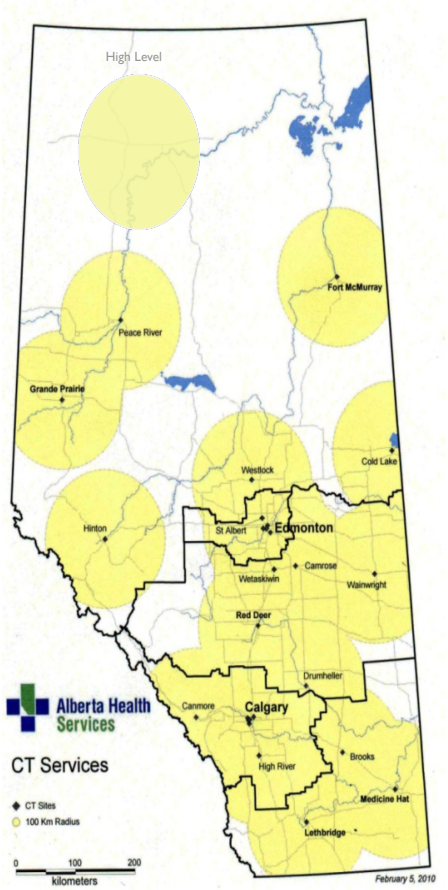

Alberta Health Services
University of Alberta 250 Km Buffer Map
Legend
250Km Buffer
Hospital
Comprehensive stroke centre
Primary Stroke Centre
Hospital within Buffer
Municipal Boundary
Primary Road
Secondary Road
1:1,900,000
0
40
80
160
Kilometers
Map Date: 2015-10-26
GRANDE PRAIRIE
BEAVERLODGE
VALLEYVIEW
SLAVE LAKE
SWAN HILLS
FOX CREEK
WHITECOURT
HINTON
EDSON
GRANDE CACHE
BARRHEAD
MAYERTHORPE
WESTLOCK
REDWATER
ATHABASCA
BOYLE
BONNYVILLE
COLD LAKE
SMOKY LAKE
ST. PAUL
TWO HILLS
VERMILION
LLOYDMINSTER
ST. ALBERT
CFB EDMONTON
EDMONTON
DEVON
LEDUC
DRAYTON VALLEY
CAMROSE
WETASKIWIN
DAYSLAND
KILLAM
WAINWRIGHT
HARDISTY
PONOKA
RIMBEY
LACOMBE
STETTLER
RED DEER
CASTOR
CORONATION
CONSORT
PROVOST
INNISFAIL
SUNDRE
OLDS
DIDSBURY
HANNA
DRUMHELLER
OYEN
YELLOWHEAD COUNTY
LAC STE. ANNE COUNTY
LAC LA BICHE COUNTY
MUNICIPAL DISTRICT OF GREENVIEW NO. 16
WOODLANDS COUNTY
WESTLOCK COUNTY
SMOKY LAKE COUNTY
LAMONT COUNTY
STURGEON COUNTY
PARKLAND COUNTY
BRAZEAU COUNTY
LEDUC COUNTY
BEAVER COUNTY
CAMROSE COUNTY
PONOKA COUNTY
LACOMBE COUNTY
CLEARWATER COUNTY
RED DEER COUNTY
KNEEHILL COUNTY
ROCKY VIEW COUNTY
WHEATLAND COUNTY
SPECIAL AREA NO. 2
SPECIAL AREA NO. 3
SPECIAL AREA NO. 4

Canada's First Stroke Ambulance

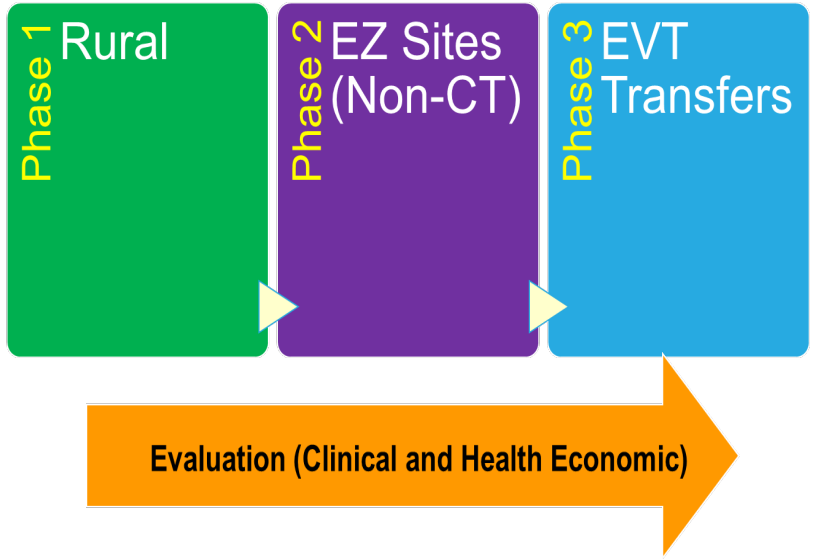
Paramedic

Stroke Ambulance (SA) Edmonton

Ambulan**C**e **H**oused **I**schemic Stroke tr**E**atment with intra**VE**nous Thrombolysis (ACHIEVE)



Stroke Ambulance Project



Stroke Ambulance – Phase III

Implemented January 22, 2018
Expand Stroke Ambulance services to Edmonton Zone hospitals, for patients who require urgent transport to the University of Alberta Hospital (UAH) for a possible large vessel occlusion and urgent endovascular therapy.
This could apply to both ED patients and inpatient stroke

If you suspect your patient has a large vessel occlusion, please call RAAPID North at 1-800-282-9911 for an acute consult with the Telestroke Neurologist.

Transport Management Considerations in Stroke

- Transport physician should contact Telestroke (Stroke Neurologist) with decisions on movement to nearest hospital, PSC or CSC (comprehensive stroke centre)
- Minimize scene time to the absolute minimum for transport considerations and safety
- Avoid giving asa chew and swallow as unproven hyperacutely in acute stroke, patients could have dysphagia, and it could be a hemorrhage
- Although controversy, elevate head of bead to 20 degrees in severe stroke to reduce aspiration

WHAT'S NEW IN 2017/18 ON THE EVT FRONT?

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

Randomized open trial with blinded endpoints

206 patients randomized to standard care vs EVT with stent retrievers

Highly selected perfusion imaging criteria

Terminated after an interim analysis

DOI: 10.1056/NEJMoa1706442

In highly selected patients, NNT 3 for good outcome

Table 2. Efficacy Outcomes.*

Outcome	Thrombectomy Group (N=107)	Control Group (N=99)	Absolute Difference (95% CI)†	Adjusted Difference (95% Credible Interval)‡	Posterior Probability of Superiority
Primary end points					
Score on utility-weighted modified Rankin scale at 90 days§	5.5±3.8	3.4±3.1	2.1 (1.2–3.1)	2.0 (1.1–3.0)	>0.999
Functional independence at 90 days — no. (%)¶	52 (49)	13 (13)	36 (24–47)	33 (21–44)	>0.999
				Risk Ratio (95% CI)	**P Value**
Secondary end points					
Early response — no. (%)‖	51 (48)	19 (19)	29 (16–41)	3 (2–4)	<0.001**
Recanalization at 24 hr — no. (%)††	82 (77)	39 (39)	40 (27–52)	2 (2–4)	<0.001**
Change from baseline in infarct volume at 24 hr — ml††					0.003‡‡
Median	1	13			
Interquartile range	0–28	0–42			
Infarct volume at 24 hour — ml††					<0.001‡‡
Median	8	22			
Interquartile range	0–48	8–68			
Grade of 2b or 3 on mTICI scale — no. (%)§§	90 (84)	NA			

DOI: 10.1056/NEJMoa1706442

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

G.W. Albers, M.P. Marks, S. Kemp, S. Christensen, J.P. Tsai, S. Ortega-Gutierrez, R.A. McTaggart, M.T. Torbey, M. Kim-Tenser, T. Leslie-Mazwi, A. Sarraj, S.E. Kasner, S.A. Ansari, S.D. Yeatts, S. Hamilton, M. Mlynash, J.J. Heit, G. Zaharchuk, S. Kim, J. Carrozzella, Y.Y. Palesch, A.M. Demchuk, R. Bammer, P.W. Lavori, J.P. Broderick, and M.G. Lansberg, for the DEFUSE 3 Investigators*

ABSTRACT

6-16 hours
Advanced imaging selection criteria; 28% absolute increase in good outcome
NNT 3

A second late endovascular trial
Terminated for efficacy in interim analysis after 182 pts

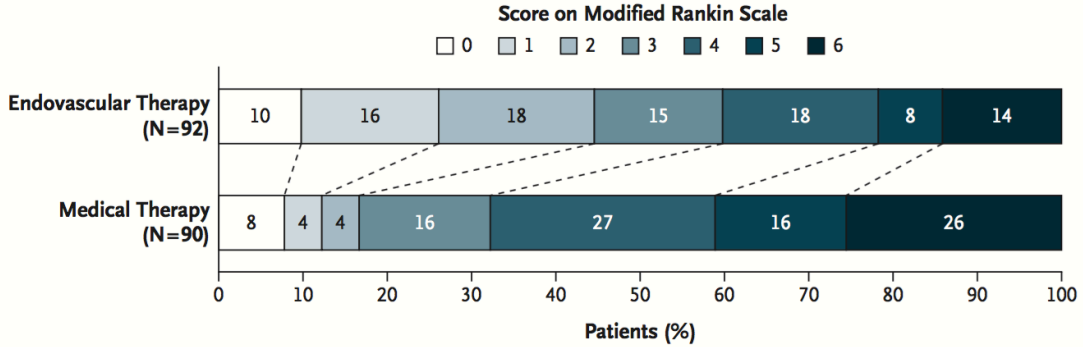


Figure 2. Scores on the Modified Rankin Scale at 90 Days.

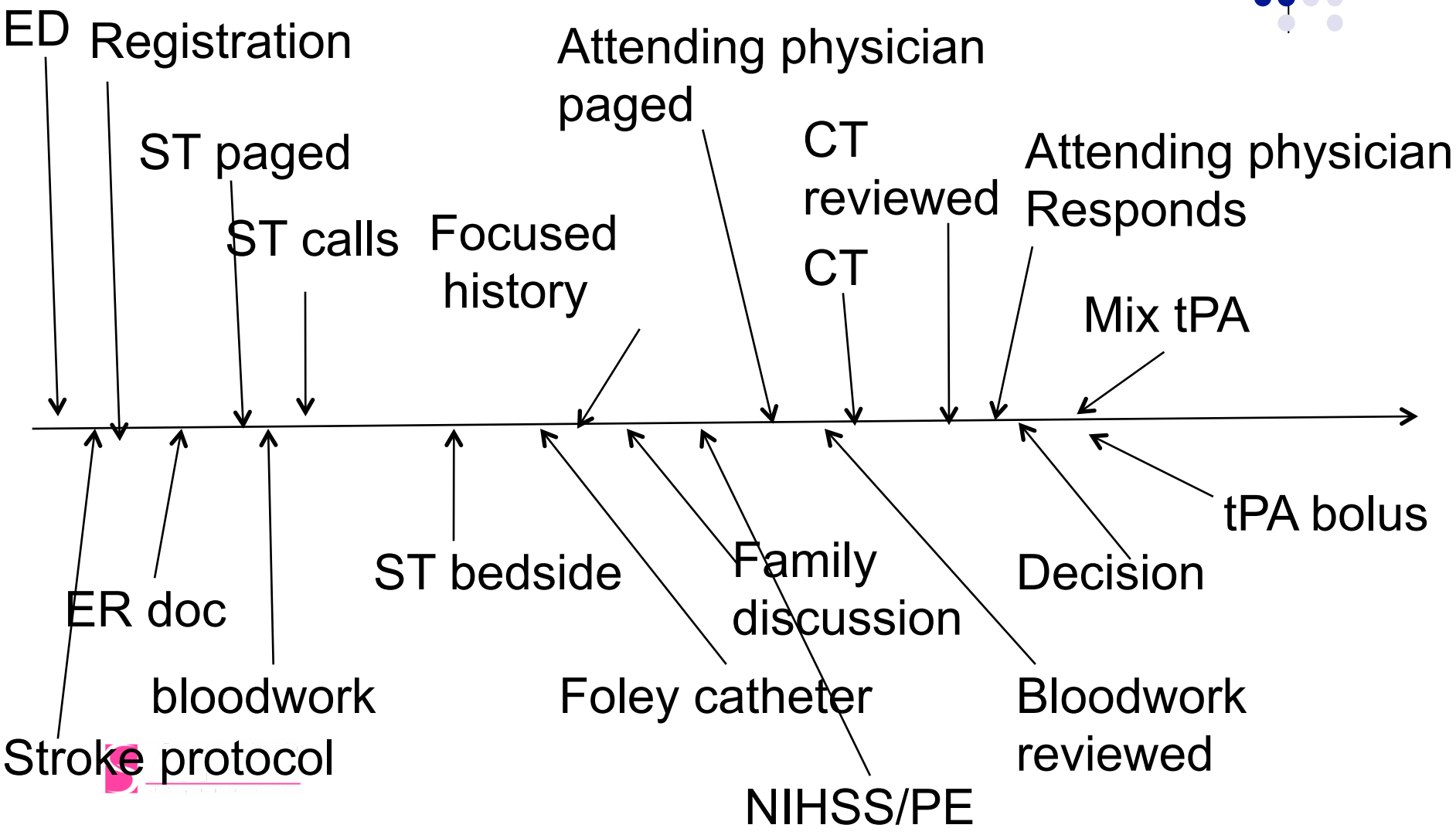
Patients in the endovascular-therapy group received endovascular therapy plus standard medical therapy. Patients in the medical-therapy group received standard medical therapy alone. Scores on the modified Rankin scale range from 0 to 6, with 0 indicating no symptoms, 1 no clinically significant disability, 2 slight disability, 3 moderate disability, 4 moderately severe disability, 5 severe disability, and 6 death. There was a significant difference favoring the endovascular-therapy group over the medical-therapy group in the overall distribution of scores (unadjusted common odds ratio, 2.77; 95% CI, 1.63 to 4.70; P<0.001).

WHAT'S NEW IN 2017/18 ON THE EVT FRONT?

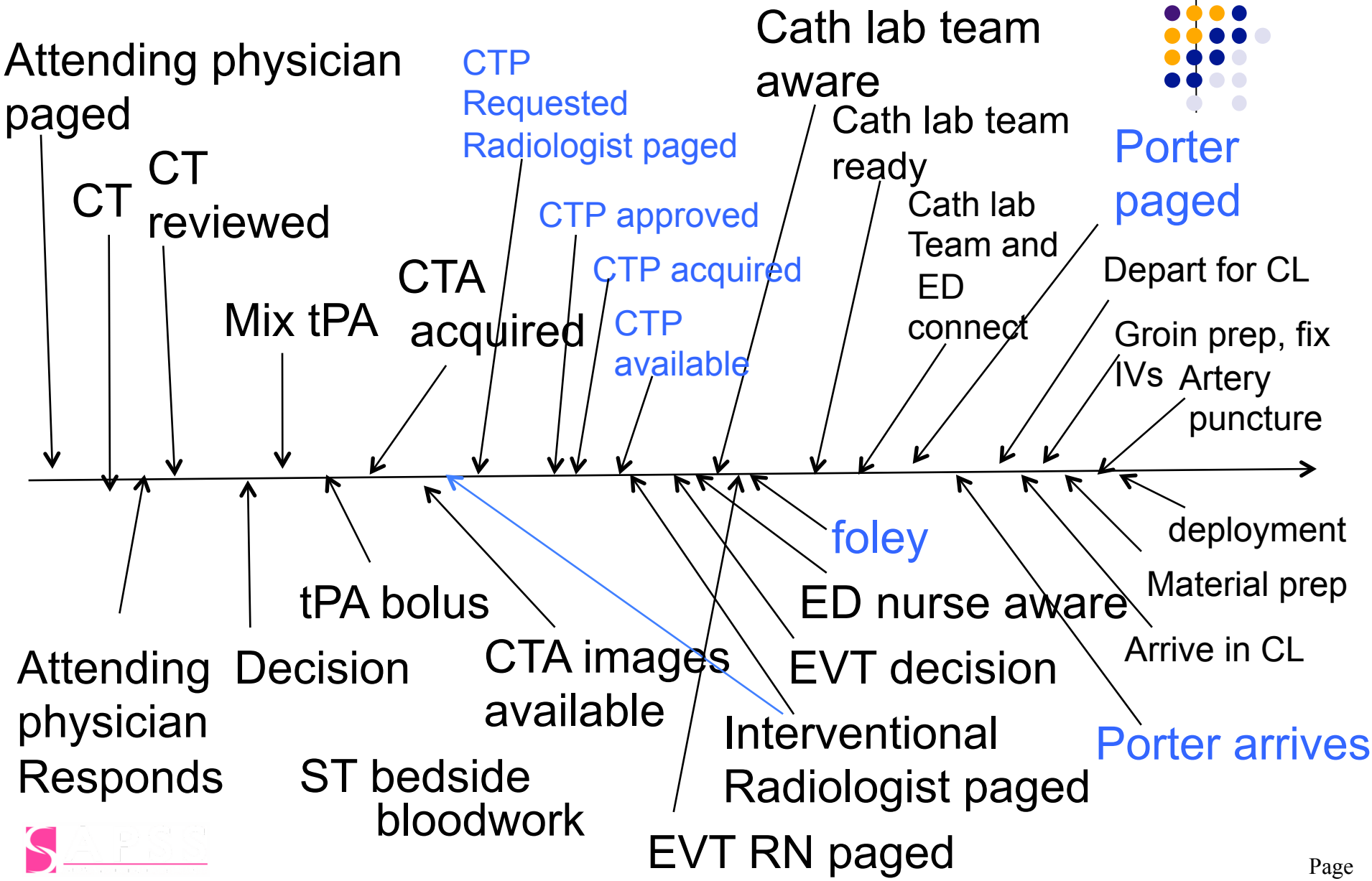
The interventional window has expanded to up to 24 hours for highly selected patients with LVO and advanced imaging evidence of a penumbral pattern. Health systems are currently trying to adapt and figure out their strategy to manage this. For now EVT "could be considered" out to 24 hours in select patients. The STATStroke window for EMS activation has not yet changed in Alberta (but will)

What effect will a 24h StatStroke window have? On EMS? ED? Stroke Physicians?

Timelines in door to tPA use



Timelines in tPA/CT to EVT use



Alberta Health Services

*‘ My message is: get your sh*t together and treat fast.’*

Moyank Goyal

personal communication

Take Home Points

- Stroke remains a highly morbid disease
- Have a systematic approach to acute stroke and seek consultation immediately
- EVT is a highly effective treatment for ischemic stroke and time – limited
- EMS and Air Medical Transport are critical components in brain survival

Thank-you