11ᵉ conférence SSVQ – Montreal
The importance of collateral circulation in cases of thrombectomy

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Conflict of interest

- None

Case presentation

Case presentation

- 49 yo man, right hand dominant
- PMHx:
  - HTN
  - Previous transiant ischemic attack
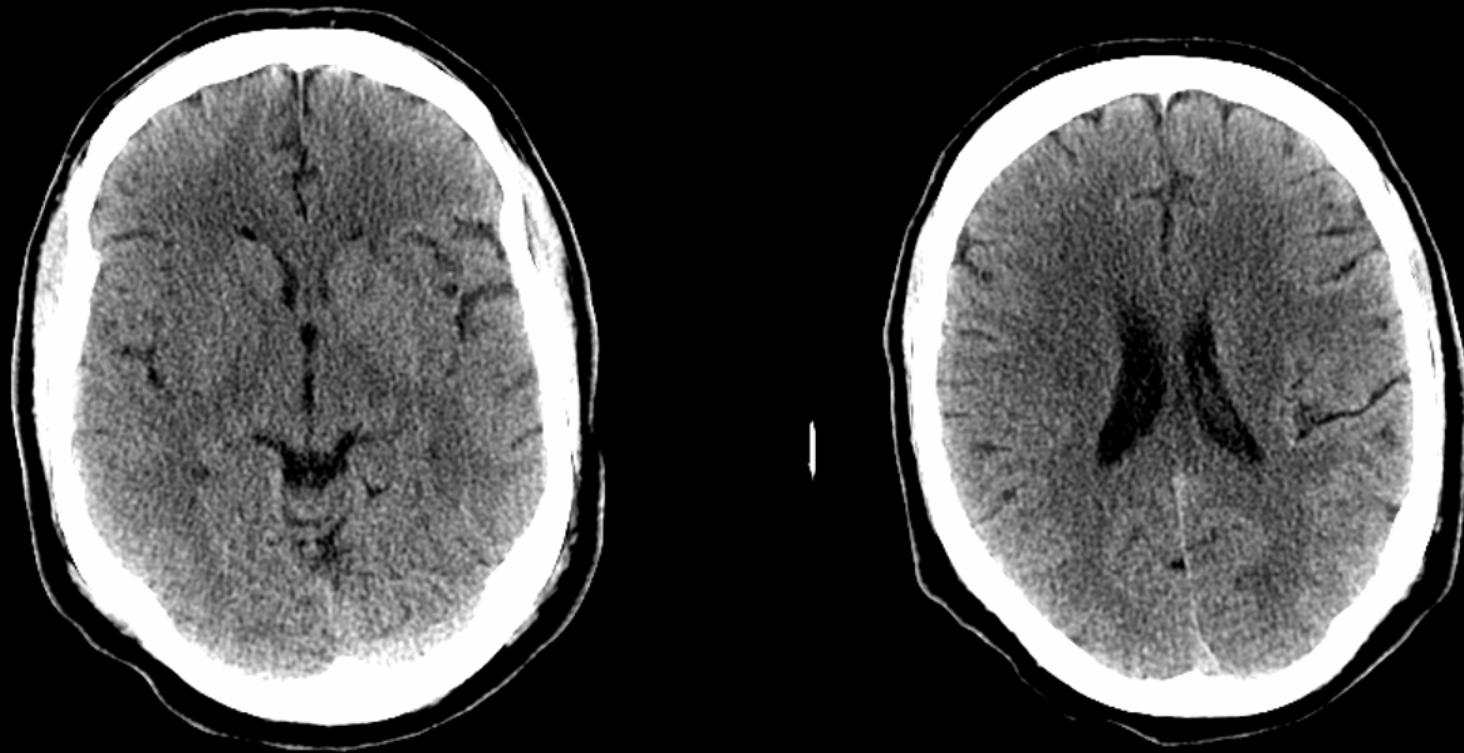- MEDS: ASA

Clinical presentation

- HPI:
  - Presented to the ER after collapsing while at in line at the airport

- On examination:
  - Right gaze deviation
  - Dense left hemiparesis
  - NIHSS of about 20

- Clinical suspicion of Acute Right MCA stroke
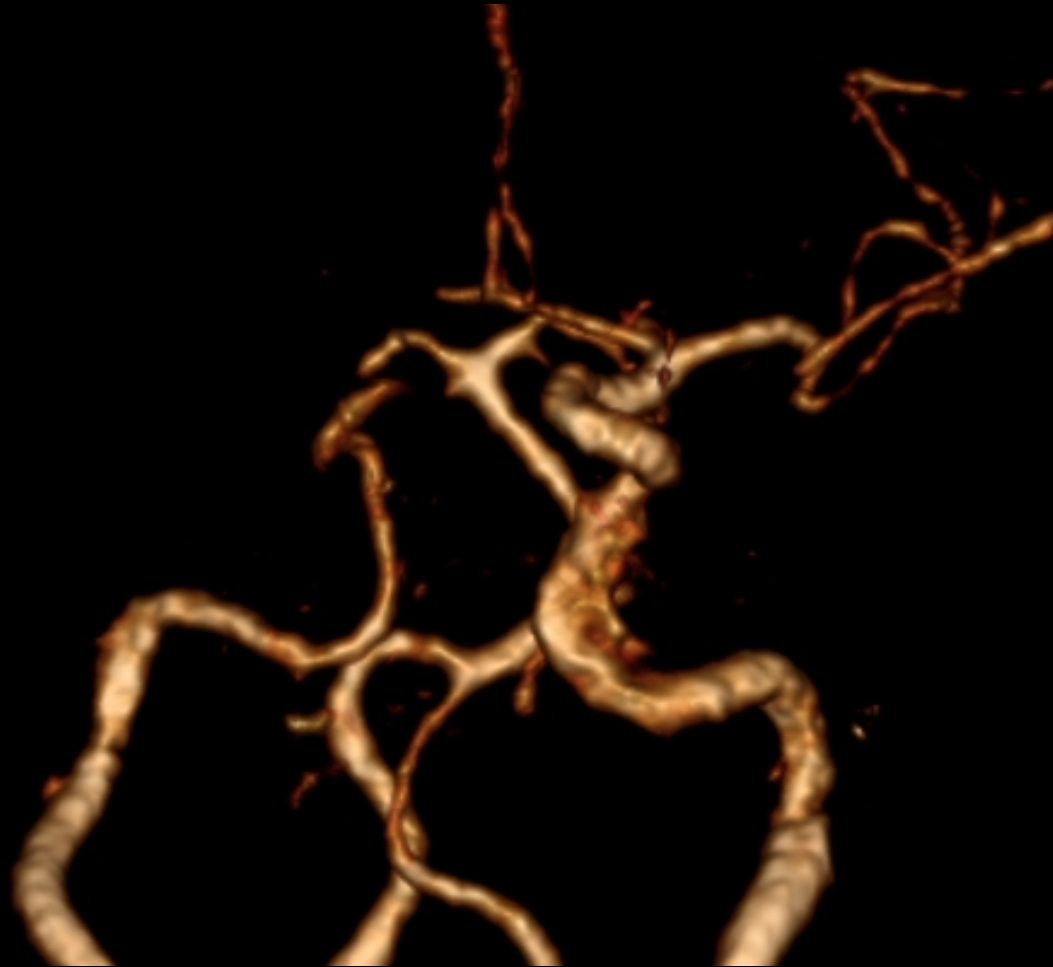
Initial CT head

ASPECT SCORE 8

Management

- Patient received intra-venous tPA at 3h10 minutes
- Adequate BP control during the pre and post tPA
- The CTA performed 2 hours post tPA followed by Angiogram
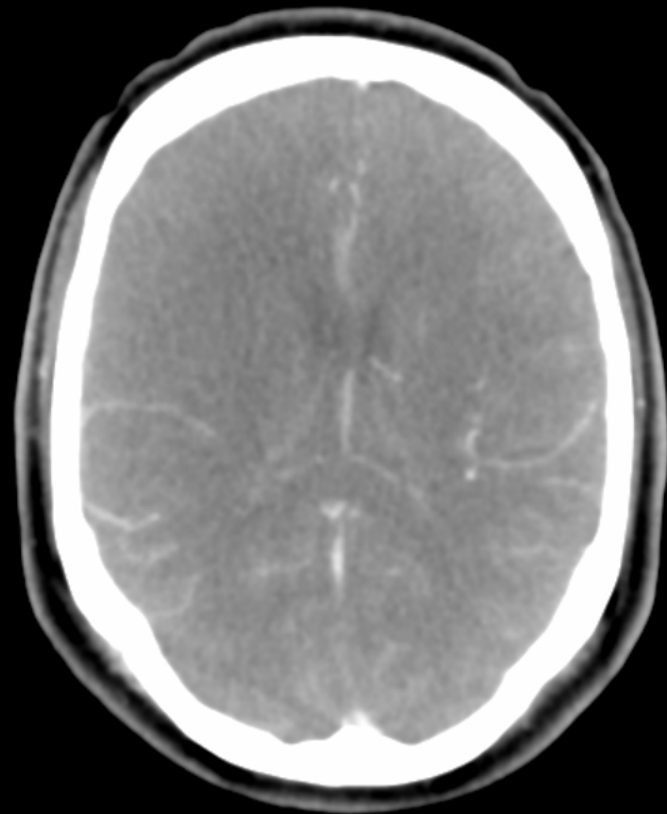
3D reconstructed image from CTA

R   L

CTA findings

- TOTAL occlusion of the Right internal carotid and the terminus and proximal right MCA

- No collateral flow present

Clinical decision

- At this point, decision was made with consent from family member that the large very proximal lesion would not be open by tPA alone

- Angiography is performed

Angiogram – A P view

Angiogram finding

- Recanalization obtained with TREVO

- At time 5:20 hours after onset of symptoms

- Patient was admitted to the ICU and rapidly developped altered mental status and lethargy

- Urgent CT head was performed

Follow-up CT head

Patient out-come

- Day 1: Decompressive craniectomy
- Diagnosis of Atrial fibrillation
- Required:
  - Percutaneous junostomy
  - Tracheostomy
- Remained densely plegic on the left with fluctuating level of counciousness
- Was discharged to rehab at day 80 of admission with mRS of 4

Lessons learned from the case

1. Aim for more rapid reperfusion in cases where thrombectomy is performed
2. Be more carefull about performing mechanical thrombectomy in patient with very poor collateral flow

Collateral circulation

Collateral circulation

- Collateral circulation is known to vary across individuals in any population

- Significant effect on baseline variables including the time course of ischemic injury, stroke severity, imaging findings, and therapeutic opportunities.

Collateral circulation

- 2 main type of collateral circulation
  - Circle of Willis
  - *Leptomeningeal*
- Role of collateral circulation highlighted in the 4 RTC on endovascular treatement
  - IMSIII, MR RESCUE, SWIFT and TREVO2

Basic on collateral flow

LEPTOMENINGEAL COLLATERAL GRADING SYSTEM

- 0: absent
- 1: less than contralareral side
- 2: equal to contralateral side,
- 3: greater than contralateral side
- 4: exuberant.
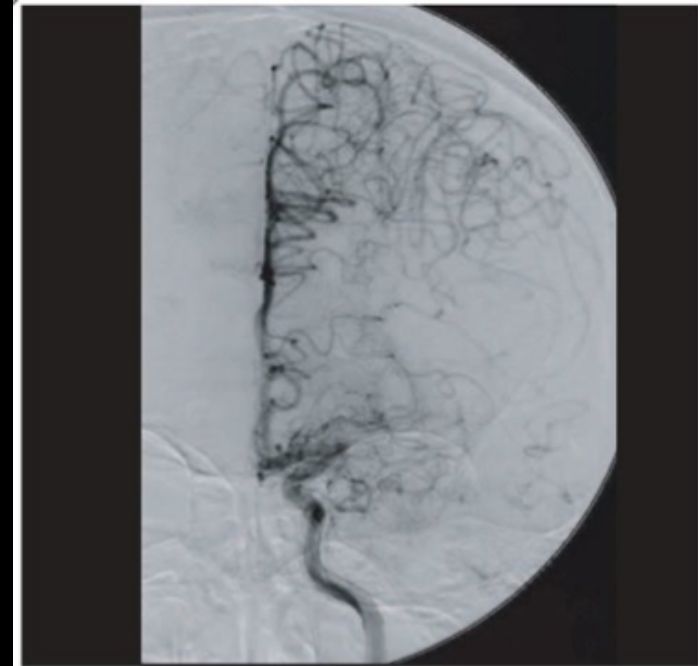
EXEMPLE OF ACA TO MCA COLLATERAL

Figure 1. Angiography of leptomeningeal collaterals. Angiographic demonstration of anterior cerebral artery leptomeningeal collaterals in acute occlusion of the left middle cerebral artery. From the Comprehensive Stroke Center, University of Pennsylvania, PA, USA (2003).

Why are collaterals good?

Collateral circulation

- New evidence that Influence recanalization and reperfusion and risk of developping an hemorrhagic transformation, and subsequently outcomes after stroke

Collateral – What have we learn from IMS-III

Table 2. Angiographic and Clinical Outcomes Based on Collateral Grade

Outcomes	Collateral Grade, no. (%)					Fisher P Value	Cochran–Armitage Trend P Value
	0 (n=19)	1 (n=53)	2 (n=108)	3 (n=88)	4 (n=8)		
Recanalization (AOL ≥2)	10 (53)	34 (64)	85 (79)	77 (88)	7 (88)	0.0016	<0.0001
Reperfusion (mTICI ≥2)*	8 (44)	27 (54)	79 (75)	75 (86)	7 (88)	<0.0001	<0.0001
Symptomatic ICH <30 h of intravenous t-PA	2 (11)	3 (6)	6 (6)	6 (7)	0 (0)	0.8918	0.6346
Clinical outcome mRS ≤2 at 3 mo	4 (21)	13 (25)	37 (34)	46 (52)	4 (50)	0.0039	0.0002
Death from all causes <3 mo	5 (26)	14 (26)	21 (19)	11 (13)	0 (0)	0.1402	0.0118

AOL indicates arterial occlusive lesion; ICH, intracerebral hemorrhage; mRS, modified Rankin Scale; mTICI, modified Thrombolysis in Cerebral Infarction; and t-PA, tissue plasminogen activator.

*Eleven subjects with missing mTICI score due to clot location (basilar, vertebral, or posterior cerebral artery).

Liebeskind, D. S., et al. (2014). "Collaterals at angiography and outcomes in the Interventional Management of Stroke (IMS) III trial." Stroke 45(3): 759-764.

Collateral – What have we learn from SWIFT study

Patient characteristic	Collateral grade 0-1	Collateral grade 2	Collateral grade 3	Collateral grade 4
NIHSS at Day 7 or DC mean	22.4 (13)	16.1 (28)	5.2 (29)	5.5 (2)
mRS 0-2	14.3% (2)	20.0 % (5)	59.3% (16)	50.0% (1)
TICI success (2b-3)	53.8% (7)	84.0% (21)	82.8% (24)	50.0% (1)
Revarsculization without ICH	42.9% (6)	53.6% (15)	75.9% (22)	50.0% (1)
NOT included: ASPECT Score: collateral score greatly relate to ASPECT score				

ESCAPE

- Current trial ESCAPE will look at patients with good collateral for endovascular treatment
- EXCLUSION CRITERIA:

On a single phase, multiphase or dynamic CTA: no or minimal collaterals in a region greater than 50% of the MCA territory when compared to pial filling on the contralateral side (multiphase/dynamic CTA preferred)
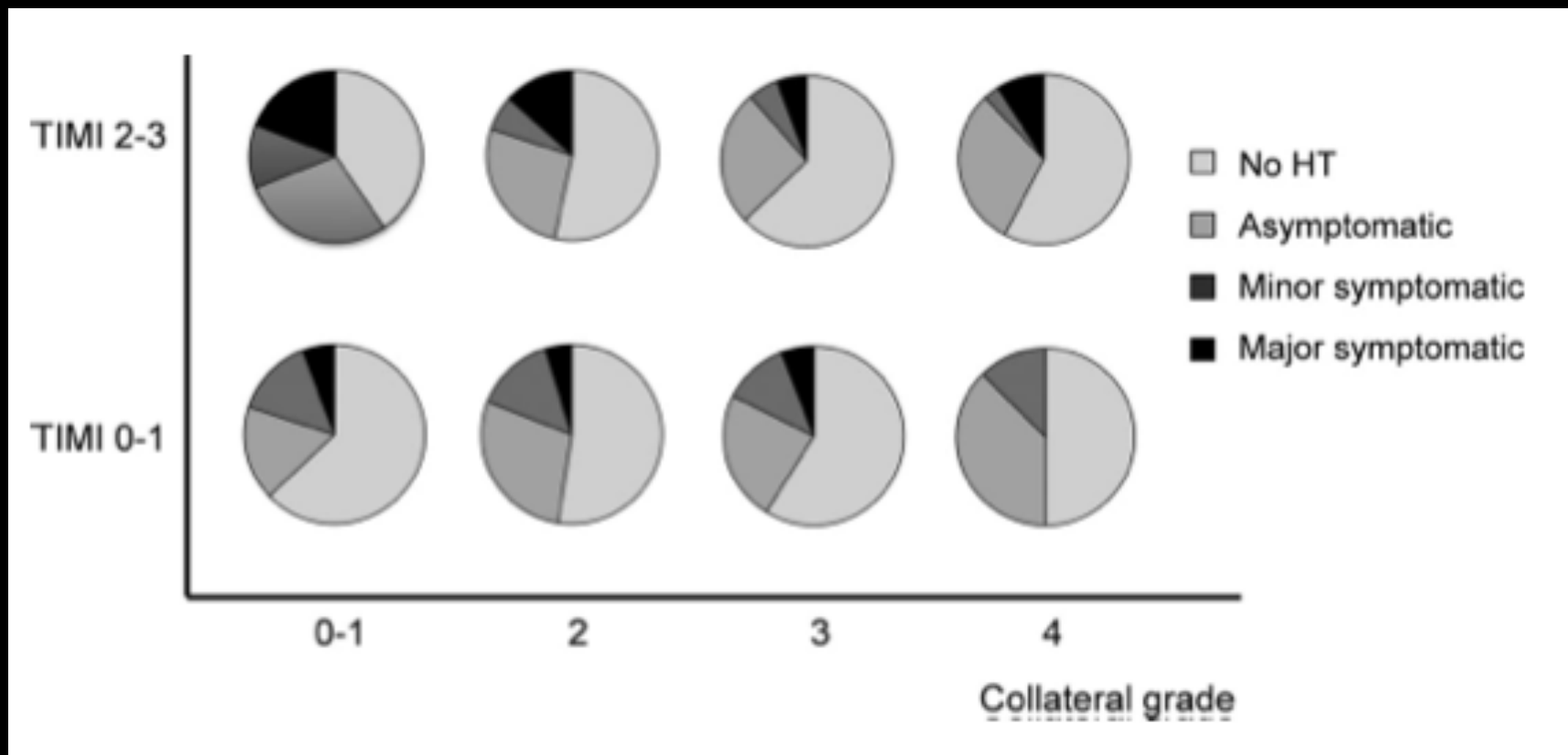
Predictors of bad collateral flow

- Predictor of bad collateral flow
  - Not related to age or sex!
  - Elevated baseline blood glucose
  - Elevated baseline systolic blood pressure

- Multivariate/partial predictor
  - Smoking history
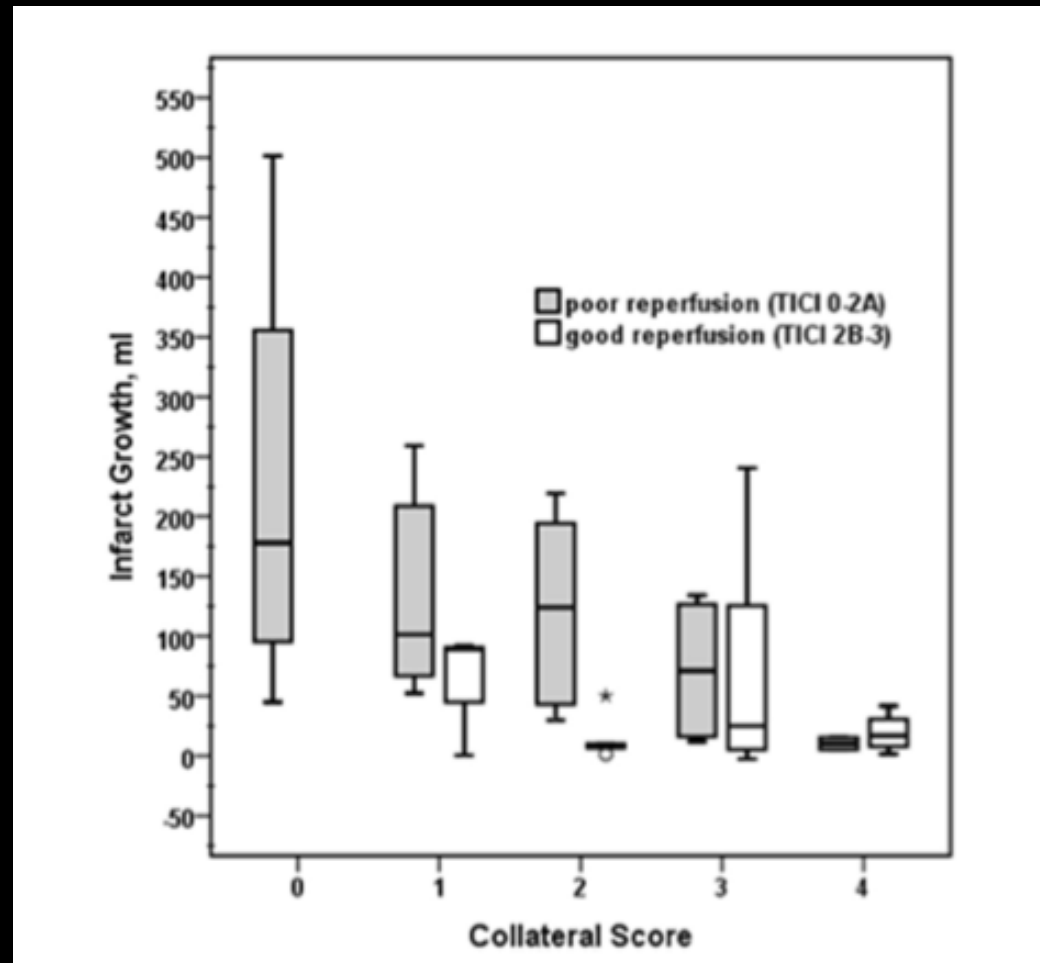
And patients with bad collateral?

What about patient with bad collaterals? – Increase risk of hemorrhage

Bang, O. Y., et al. (2011). "Collateral flow averts hemorrhagic transformation after endovascular therapy for acute ischemic stroke." Stroke 42(8): 2235-2239.

What about patient with bad collaterals – infarct growth

Marks, M. P., et al. (2014). "Effect of collateral blood flow on patients undergoing endovascular therapy for acute ischemic stroke." Stroke 45(4): 1035-1039.

In practice

- Patients with bad collaterals should also be considered for endovascular techniques as recanalization might be benefical though with prudence
  - Increased risk of ICH
  - Increased risk of infarct growth

Thank you!
Questions?