

Stroke in a Young Adult

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Disclosures

- No commercial interests
- No conflicts of interest

Objectives

- Review an unusual and complicated case of infarction in a young adult
- Discuss the incidence of stroke in young adults
- Discuss the causes of stroke in young adults

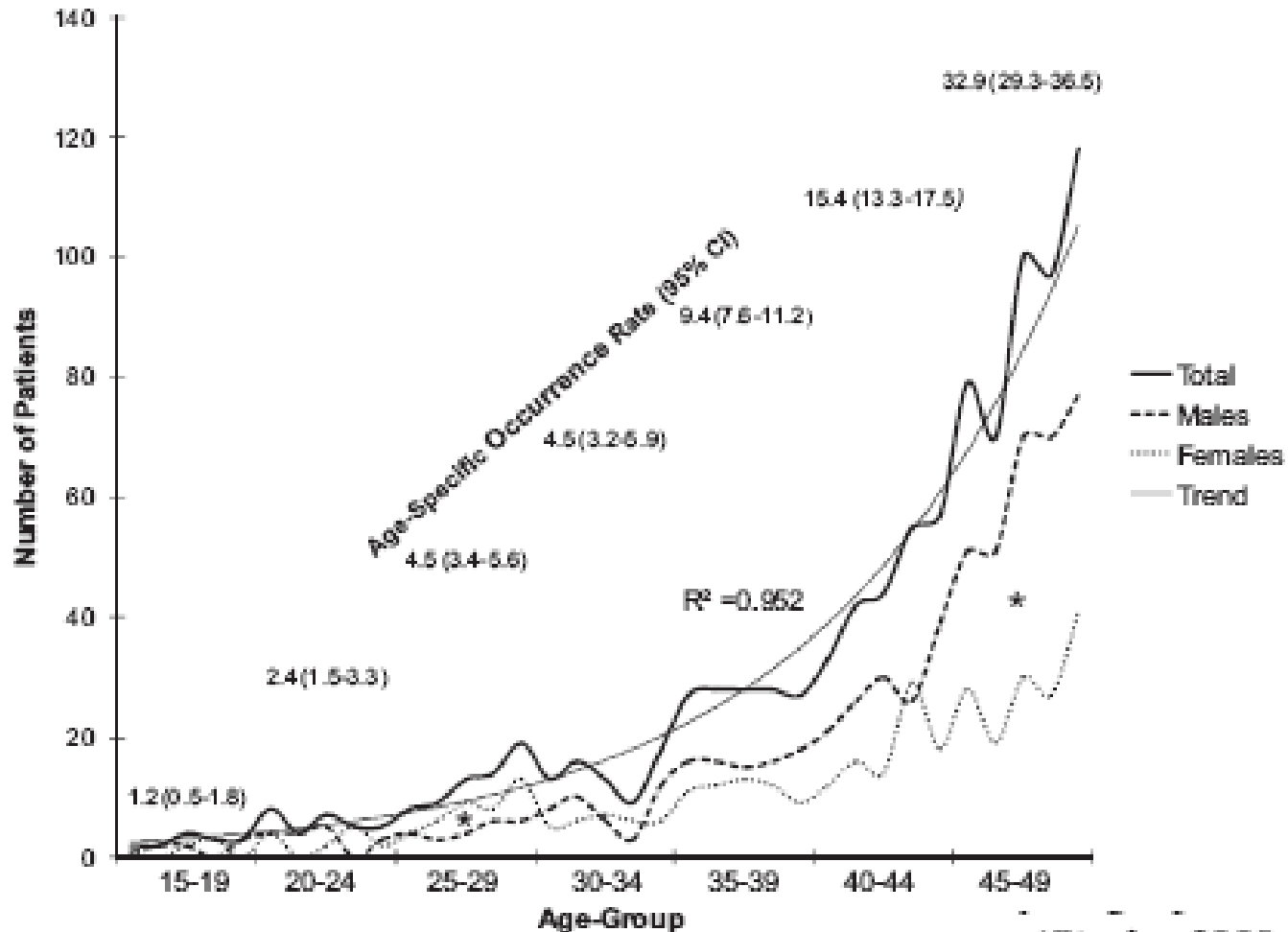
Case: Question 2

- What causes stroke in young adults?
 - Some stroke etiologies are more common in younger patients
 - Stroke can present in odd ways in younger patients
 - Some stroke risk factors in younger patients are a little different

How common is stroke in young people?

What is “young” anyway?

Stroke incidence increases with age



(Stroke. 2009;40:1195-1203.)

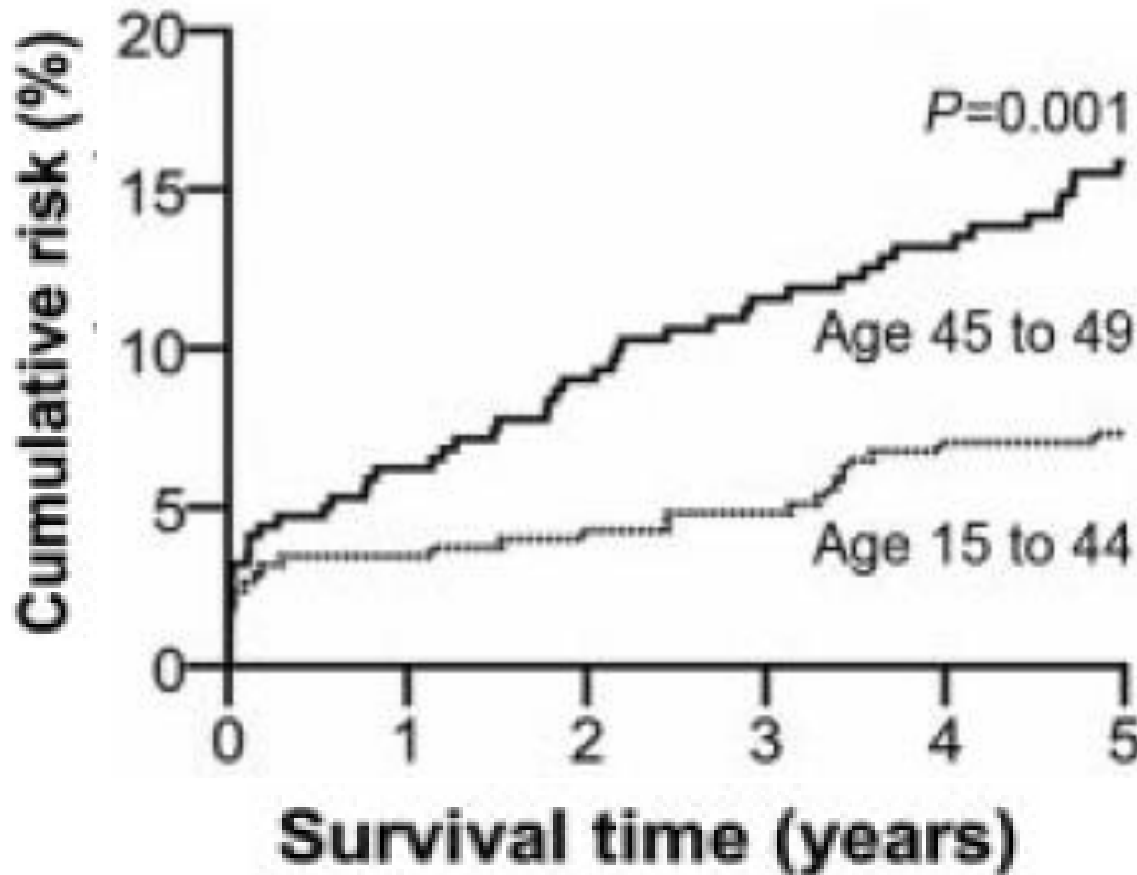
Isn't 45 supposed to be young?

- There are 50,000 strokes per year in Canada
 - ~ 142 strokes per 100,000 people in Canada
- Does young mean...
 - Age 19 or less? 6.7 strokes per 100,000 people
 - Includes neonatal stroke
 - Age 20 to 24? 2.4 strokes per 100,000 people
 - Age 30 to 34? 4.5 strokes per 100,000 people
 - Age 40 to 44? 15.4 strokes per 100,000 people
 - Age 45 to 49? 32.9 strokes per 100,000 people

Stroke vs Other common diseases

| Disease | Annual Incidence per 100,000 |
|--|--|
| Migraine | 400 (women) |
| Breast cancer in women age 40 to 49 | ~125 |
| Trauma in people 18-49 years old (Calgary, 1999-2002) | ~ 60 |
| Stroke in whites between 20 to 45 years old (in Greater Cincinnati/northern Kentucky, 2005) | 25 (with an increasing trend) |
| Multiple sclerosis (in Saskatoon, 2001) | 11 (women), 4.7 (men) |

Stroke mortality in young adults can be high



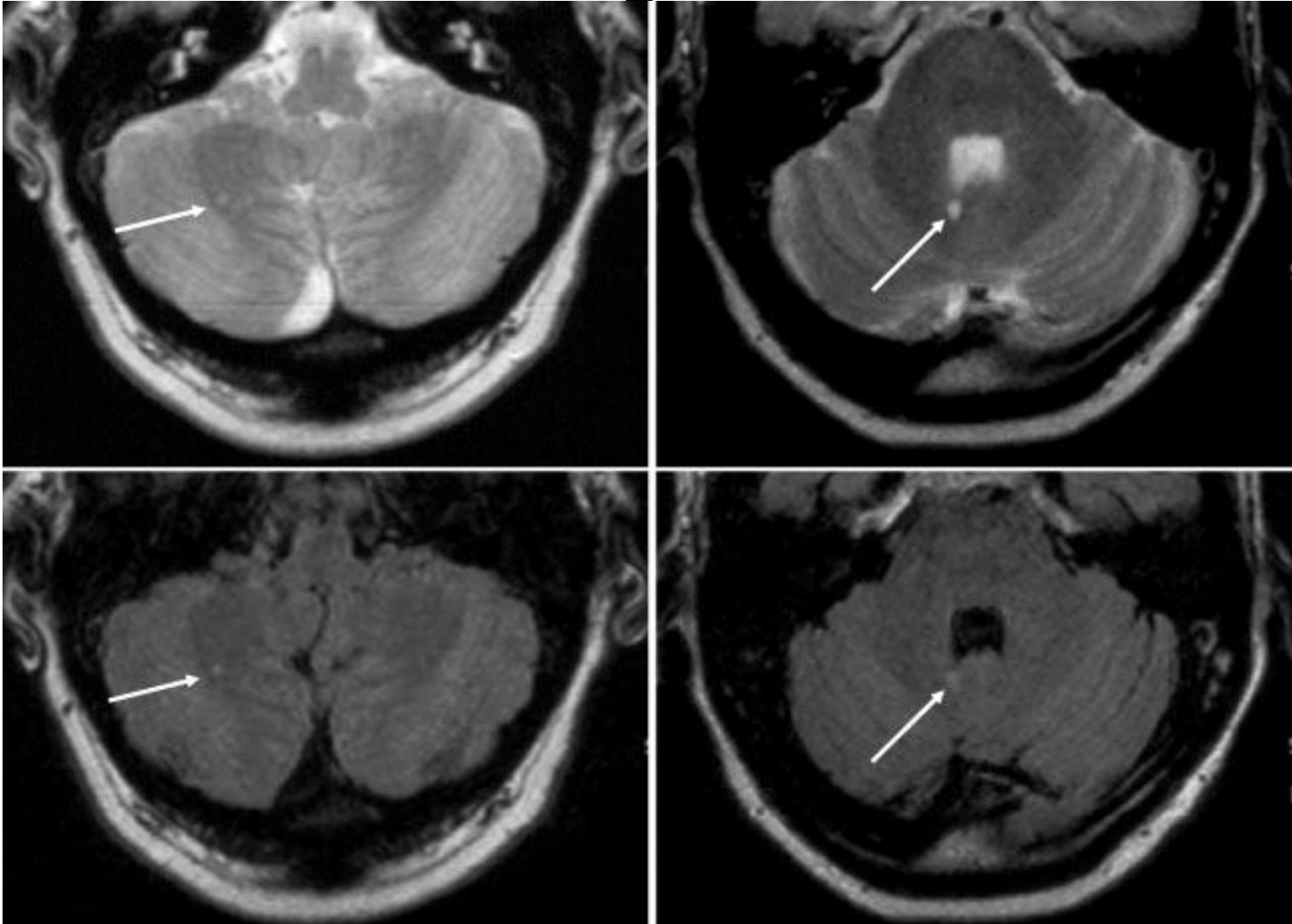
This is about the same 5-year survival for breast cancer in women over age 45 and a little better than the 5-year survival rate for Grade II astrocytoma.

(*Stroke*. 2009;40:2698-2703.)

Migraine and Infarcts?

- A number of references on this subject can be found including:
 - Neuroradiology 2007, 49(5): 419-426
 - Cephalalgia 2008, 28(1): 83-86
 - Stroke 2006, 37: 1109-1112
 - JAMA 2004, 291: 427-434

T2 and FLAIR cerebellar lesions in migraine

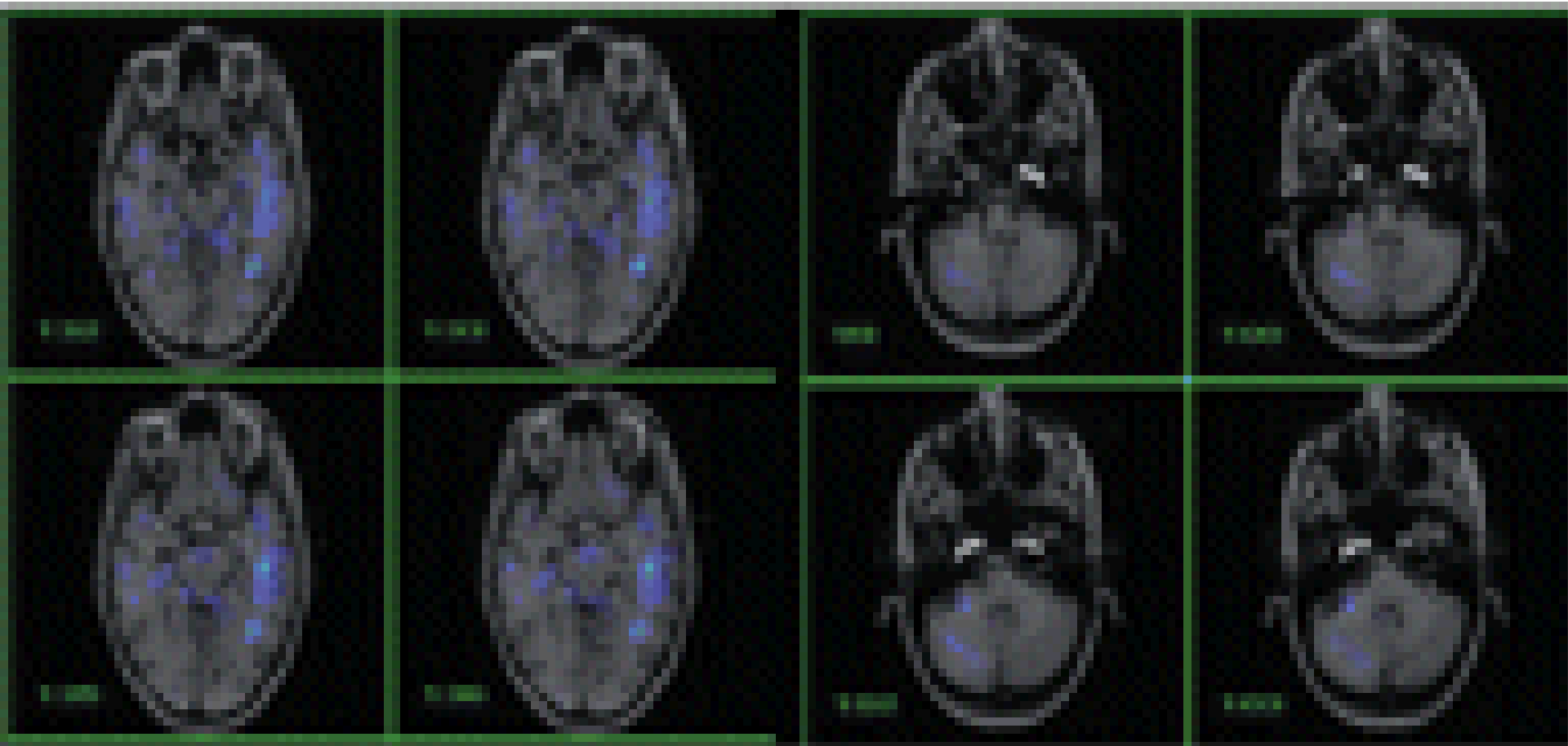


Stroke 2006;37;1109-1112

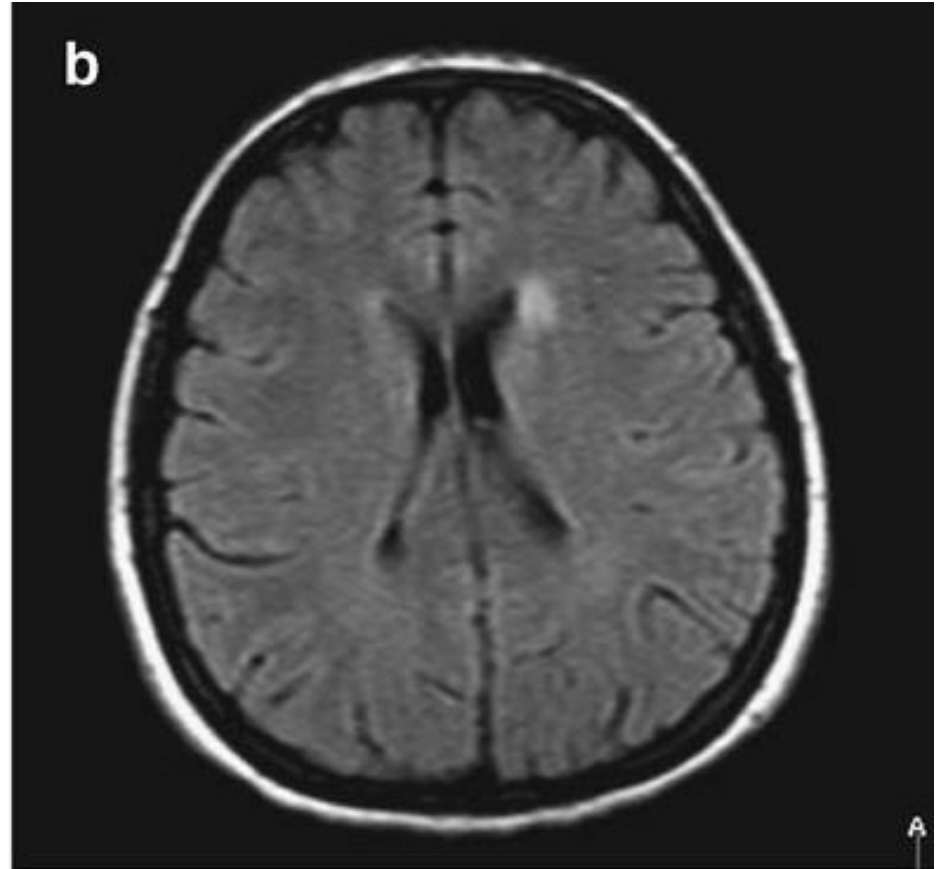
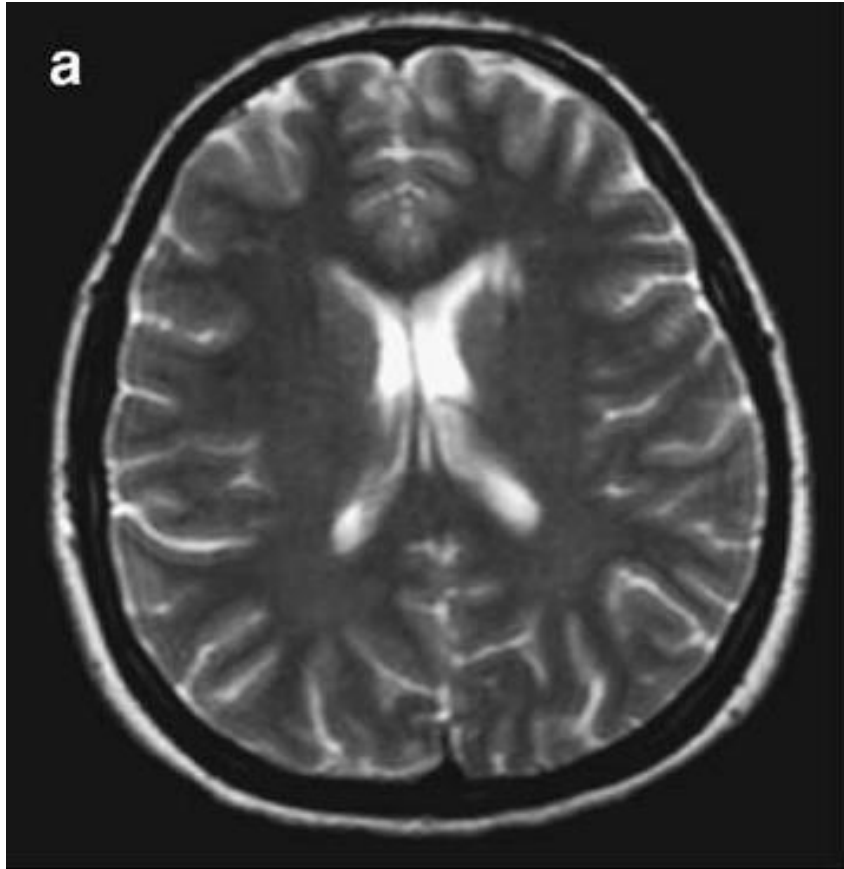
Migraine and cerebellar infarcts

- In one Dutch study, migraineurs had a higher prevalence of cerebellar infarcts compared to non-migraineurs (5.4% vs 0.7%)
 - Infarcts ranged in size from 2 to 21 mm diameter
 - *JAMA. 2004;291:427-434*

Crossed cerebellar diaschisis and cerebellar hypoperfusion during a migraine attack



Migraine and Deep White Matter Lesions



Neuroradiology (2007) 49:419–426

Migraine and UBOs

- UBO = **U**nidentified **B**right **O**bject
- Are these lesions due to ischemia?
 - No one really knows
- Various studies have reported a prevalence of deep white matter lesions in migraineurs ranging from 6% to 46%

What causes stroke in young people?

Stroke has many diverse etiologies in young patients

- The five classic stroke etiological categories are:
 - Large artery atherosclerotic disease
 - Small vessel ischemic disease
 - Cardioembolism
 - Other (uncommon) conditions
 - Undetermined cause

“Other” may be uncommon in older patients, but not so for younger patients

- Vasculitis
- Migraine
- Dissection (traumatic or non-traumatic)
- Hypercoagulable state
- Fibromuscular dysplasia
- CADASIL
- MELAS

Other and Undetermined stroke subtypes are more common in younger patients

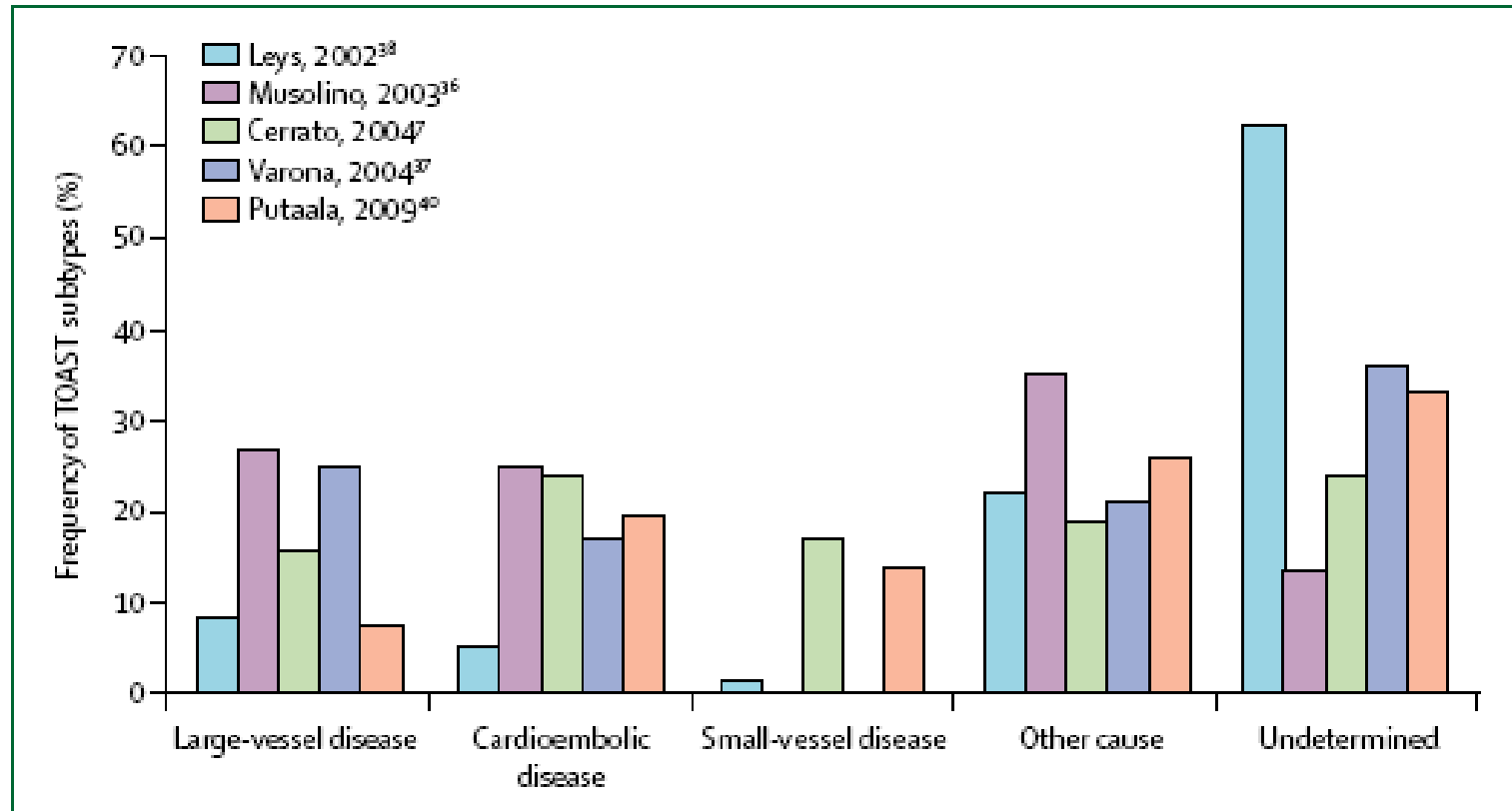
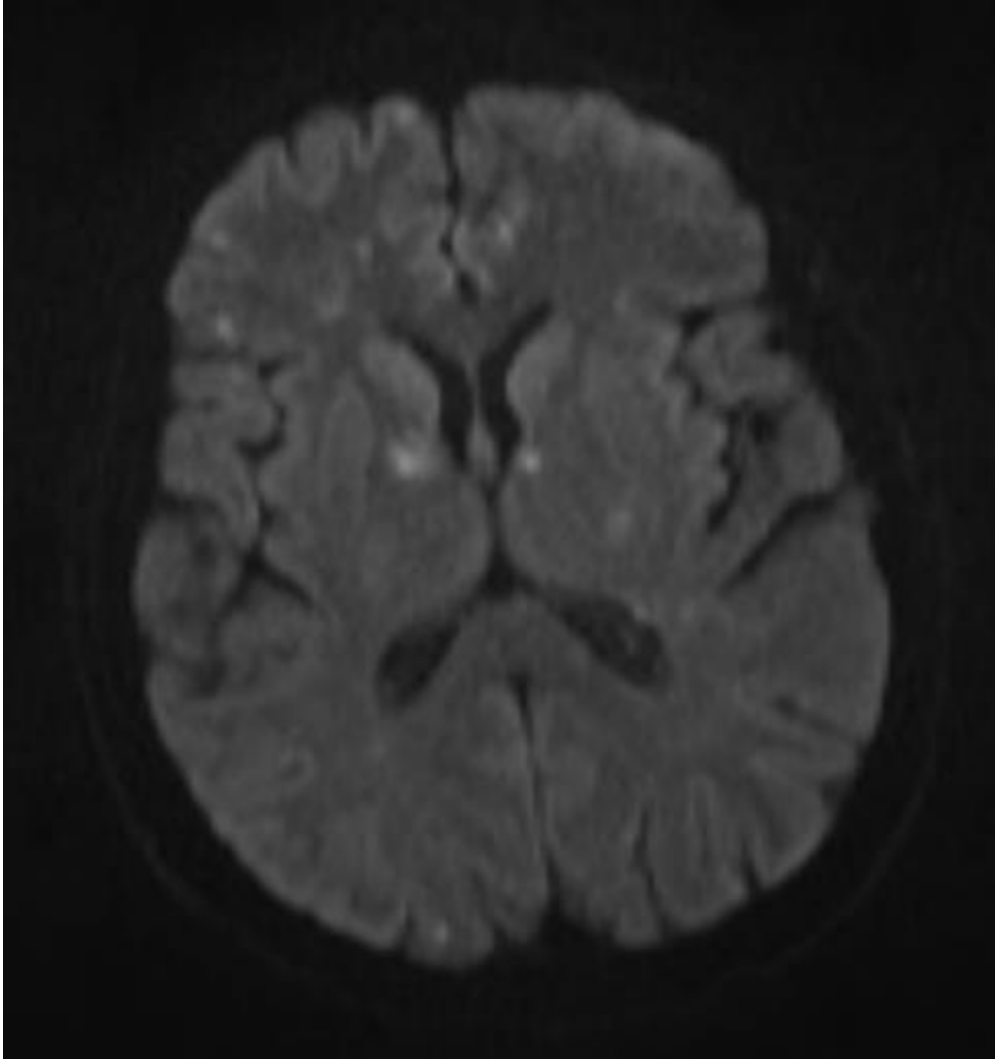


Figure 2: Frequency of TOAST causal subtypes in studies of young adults with stroke

The low percentage of cardioembolic stroke and the high percentage of undetermined subtype in the study by Leys and colleagues³⁸ is related to the non-inclusion of patent foramen ovale and intra-atrial septal aneurysm as a cardioembolic source unless an intracardiac thrombus or a paradoxical embolism was proven.

Some examples of the “Other”
category in younger stroke patients

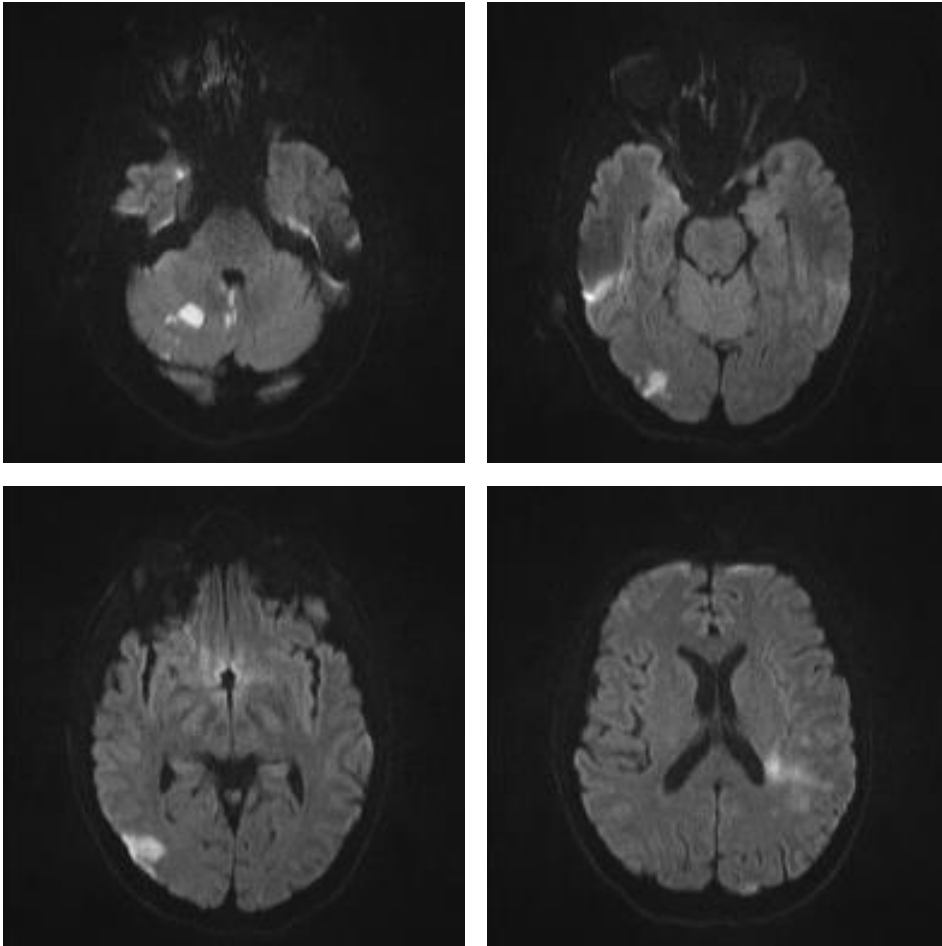
Retinocochleocerebral vasculopathy in a 54 yo F with multiple infarcts, encephalopathy, hearing and vision loss



- **AKA Susac's syndrome**
- A microangiopathic disease usually seen in women between 20 to 40 years of age

Trousseau's syndrome

in a 45 yo M with multiple infarcts, DVT, PE
and adenocarcinoma



- Hypercoagulable state in cancer
- First described by Armand Trousseau (1860s)
 - He later recognized the syndrome in himself and was subsequently diagnosed with gastric cancer

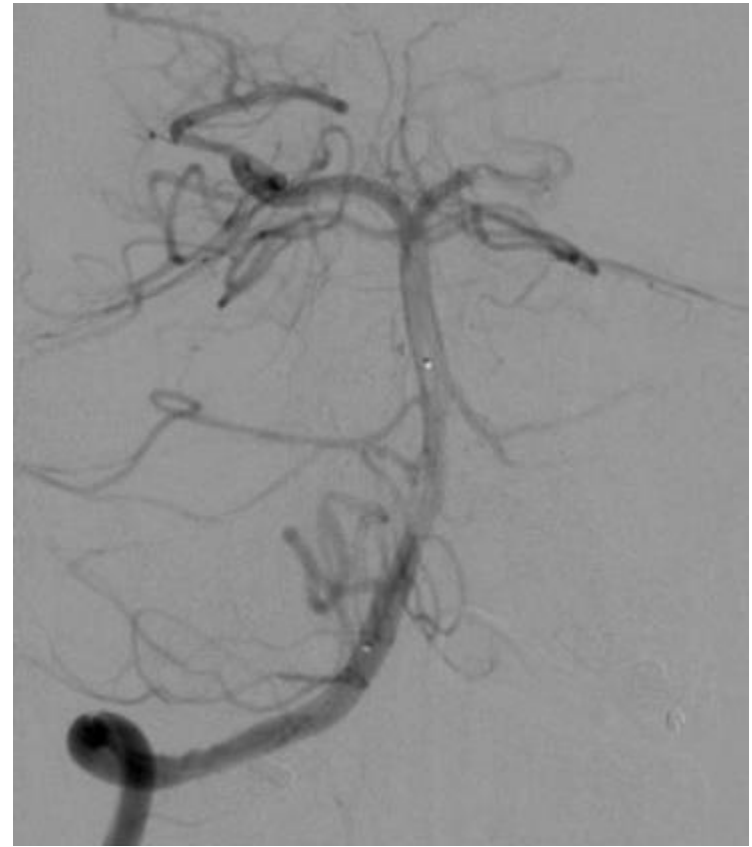
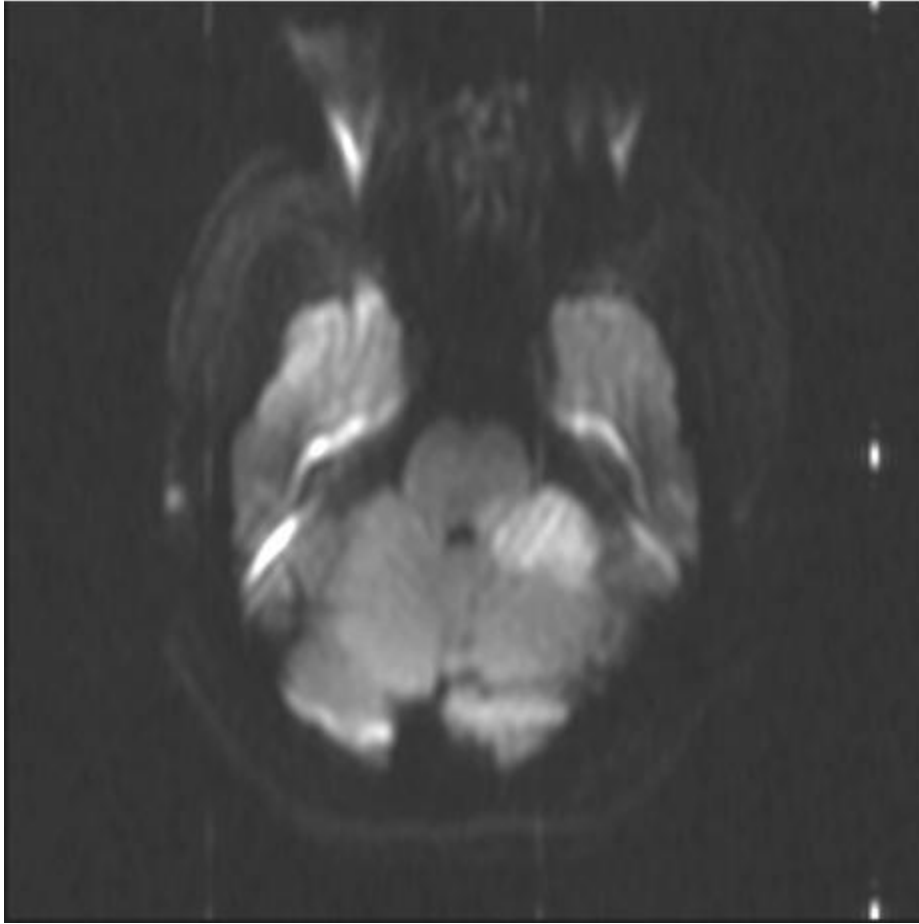
Arterial dissection in a 38 yr F



Basilar artery thrombosis



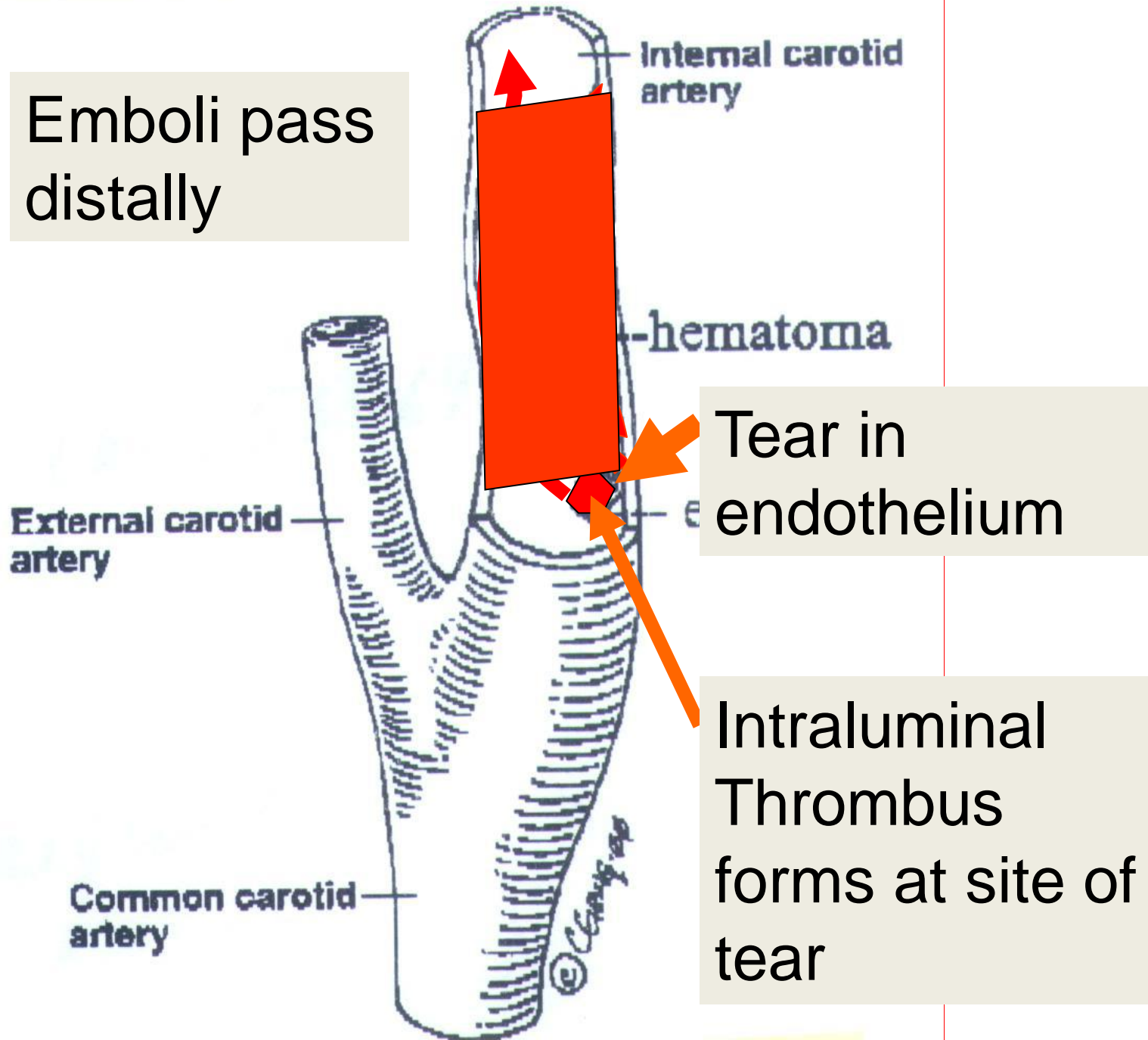
Stroke in pons and cerebellum secondary to left vertebral artery **dissection**



Dissection

- Very common cause of stroke in younger patients (15% in one study)
- Internal carotid artery just above the bifurcation
- Vertebral artery just as it enters the vertebral canal (C2 level) or just before piercing the dura
- Subintimal tearing causes hematoma which can cause stenosis, occlusion or embolization

Emboli pass distally



Stroke risk factors in younger adults

- **Smoking:**

- 1 to 10 cigarettes per day **doubles the odds of stroke**
- 40 cigarettes per day increases the odds of stroke **9 times**

- **Migraine:**

- Migraine with aura **doubles the odds of stroke**
 - **Smoking and OCP increases the risk further**
- Migraine without aura carries no added risk
- Migraine is often associated with other conditions that cause stroke, e.g. MELAS, CADASIL

Stroke risk factors in young adults

- **Pregnancy:**

- Stroke is rare during pregnancy
- The highest risk time is in the days before birth and 6 months pos-partum
- Cause is not always clear, but can include:
 - Hypercoagulable state
 - Reversible cerebral vasoconstriction
 - Peripartum cardiomyopathy

Stroke risk factors in young adults

- **Oral contraceptives:**

- Controversial
- High dose estrogen quadruples stroke risk; low dose estrogen doubles stroke risk; progestagen doesn't affect stroke risk
- Overall the excess risk from oral contraceptive use is small (4 strokes per 100,000 women per year of oral contraceptive use)
- However, in women who smoke or have a history of prothrombotic conditions, OCP elevates stroke risk significantly

Stroke risk factors in young adults

- **Illicit drugs:**

- Frequency of illicit drug use in young stroke patients can be as high as 12%
- IV drug use can result in embolisation of foreign material or endocarditis
- Amphetamines, crack, cocaine have sympathomimetic activity and can cause stroke from acute hypertension, enhanced platelet aggregation and rarely, vasculitis

Back to our patient

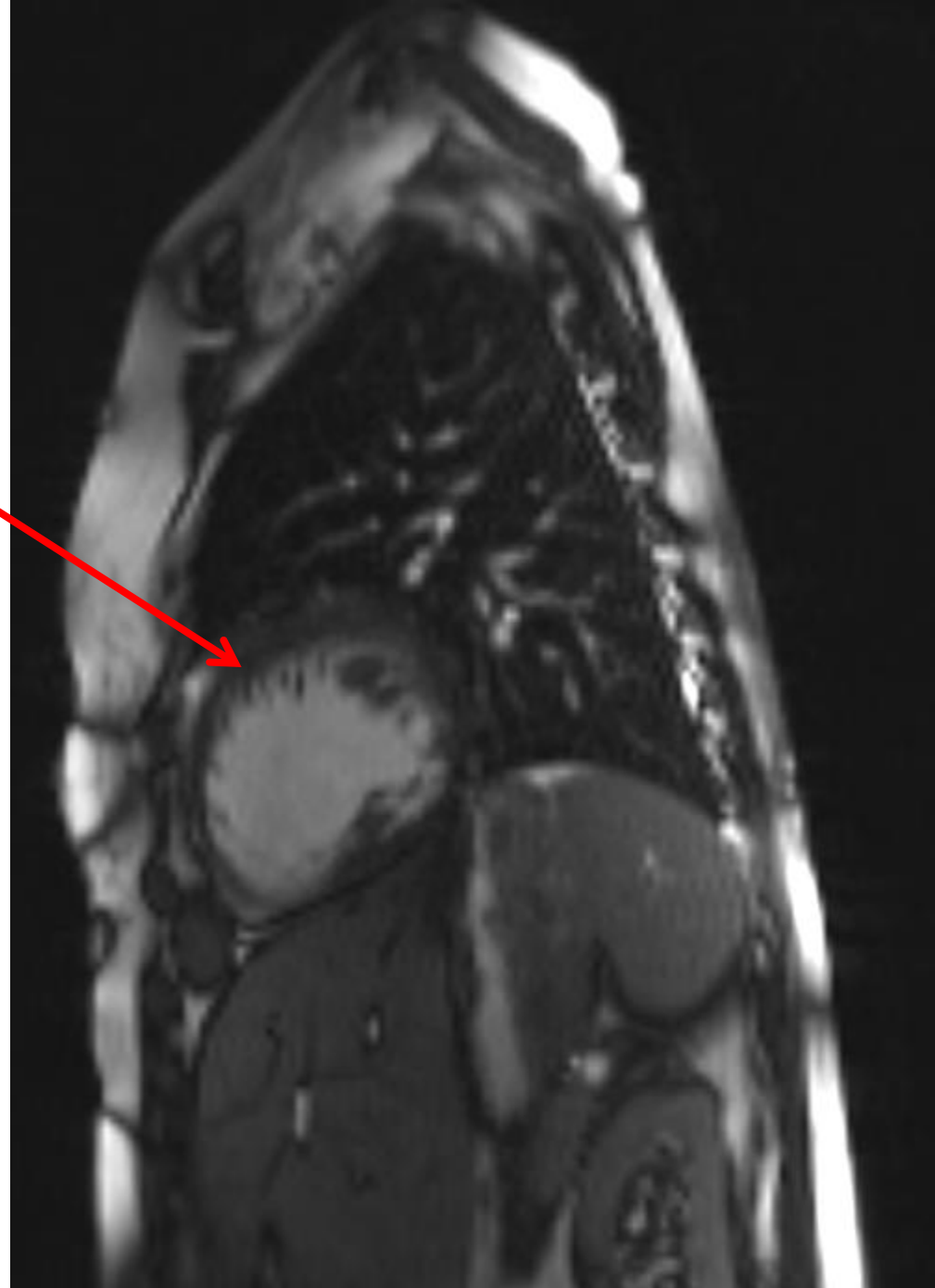
- Except for migraine and OCP, none of these stroke risk factors seems to be in play
- What about the history of “cardiomyopathy secondary to viral illness”?

Recall recent TTE

- 1st TTE (Brockville, Aug 2009): EF 44%
- 2nd TTE (Brockville, Nov 2009): EF 35-40%
- Patient doesn't want to have TEE...

Cardiac MRI

- ? Increased trabeculation of LV



? Non-compaction cardiomyopathy

- LV is hypokinetic and dilated
- Increased trabeculation along posterior wall and apex, thinning of myocardium
- Ratio of maximal thickness of noncompacted to compacted layer = 2



Non-compaction cardiomyopathy

- Prevalence in young adults ranges from 0.05% to 0.24%
- Intrauterine arrest of a loosely interwoven network of myocardial fibers that normally compact toward the epicardium during embryogenesis
- Major clinical correlates include systolic and diastolic dysfunction, at times complicated by arrhythmias and systemic embolic events
- The incidence of thromboembolic events including stroke, TIA, PE and mesenteric infarction ranges from 10% to 37%

Is NCC a risk factor for stroke?

- NCC alone is not considered a risk factor for stroke in the absence of LV dysfunction (EF < 40%)
- However, in the presence of LV dysfunction or in patients with a history of embolic phenomena, some suggest that lifelong anticoagulation is indicated
- In a cohort of Japanese children with 17 year follow-up, no embolic events were reported

Conclusions

- Although stroke in young adults is uncommon, the incidence increases dramatically between age 40 to 49, with significant mortality risk
- The causes of stroke in young adults tend towards the unusual, or remain undetermined in many cases

Conclusions

- In our patient with asymptomatic cerebellar and supratentorial deep white matter and deep grey matter lesions, the cause of these lesions remains undetermined
 - Cardioembolism, migraine-induced hemodynamic changes and even hypercoagulability are possible infarct mechanisms
 - Non-compaction cardiomyopathy, or cardiomyopathy secondary to viral illness are possible etiologies for cardioembolism
 - Oral contraceptive use, elevated fibrinogen and low B12 may have contributed to increased the risk of thrombosis