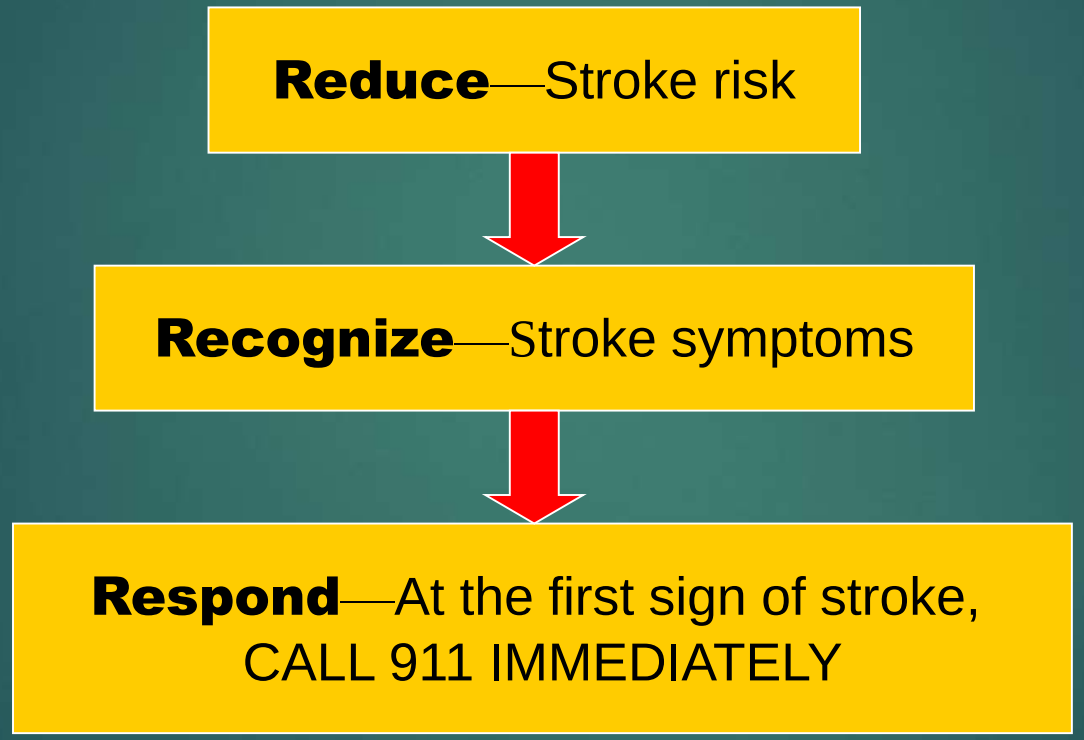
Stroke Prevention and Treatment

KAISER PERMANENTE SENIOR EDUCATION

CHARLES J. VELLA, PH.D.

MAY 4, 2016

Be Stroke Smart



What is bad for the heart is bad for the brain.

Remember: Heart ↔ Brain

- Anything that is good for heart is good for the brain
- Anything that negatively effects the heart negatively effects the brain
- Physical exercise is the most powerful brain fitness recommendation for reducing risk for all neurological disorders

Brain Vasculature

400 miles of blood vessels

Brain and Cardiovascular System

- Brain is particularly dependent on supply of blood: 20% of cardiac output each minute
- The brain needs a continuous blood supply, and interruption of cerebral blood flow (CBF) leads to brain dysfunction and death
- Decreased CBF precede signs and symptoms of CVD by 2 years
- 1 in 4 (60 million) have CVD

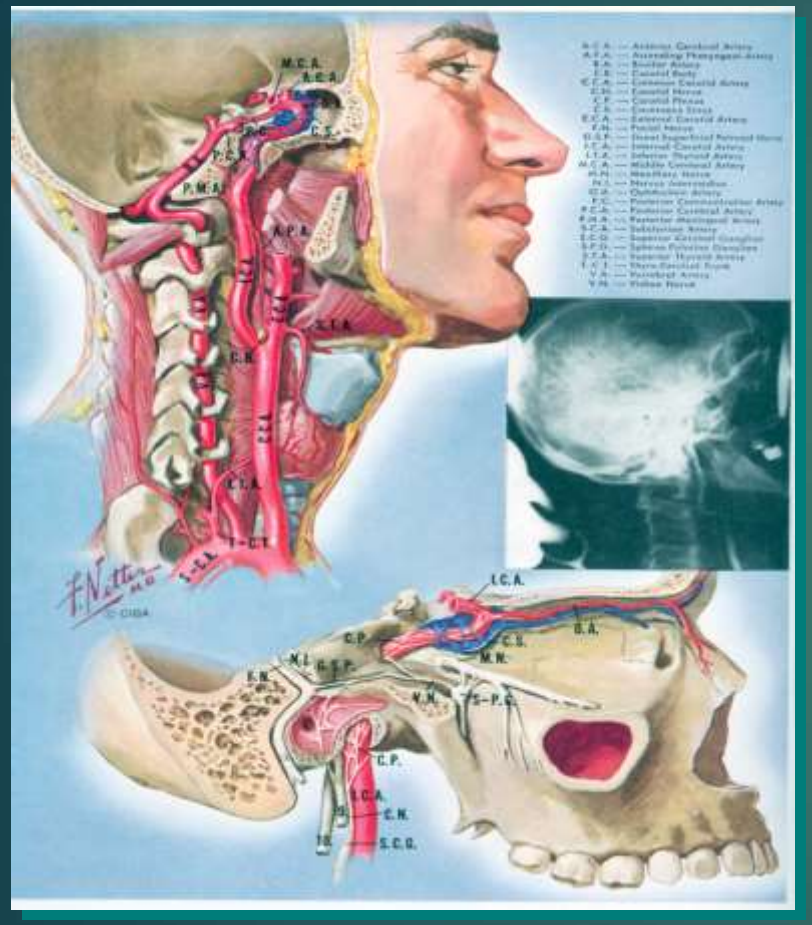
CV Basics – autoregulation of blood vessels

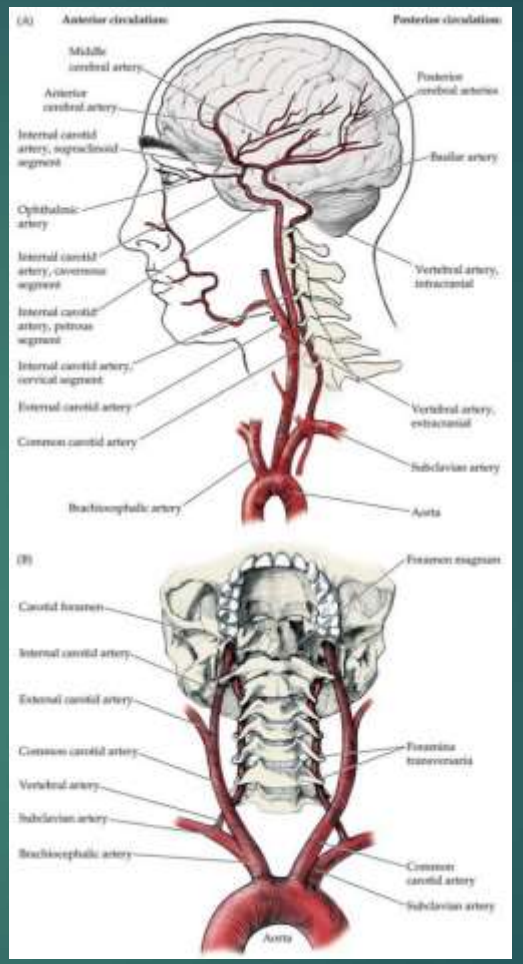
- Blood vessel autoregulation keeps Cerebral Blood Flow relatively constant within a range of blood pressures, protecting the brain from unwanted swings in blood pressure.

- In animal models, the major risk factors for Vascular and Alzheimer disease —hypertension, aging, and diabetes—impair blood vessel-dependent responses in the cerebral microcirculation and increase in blood flow.

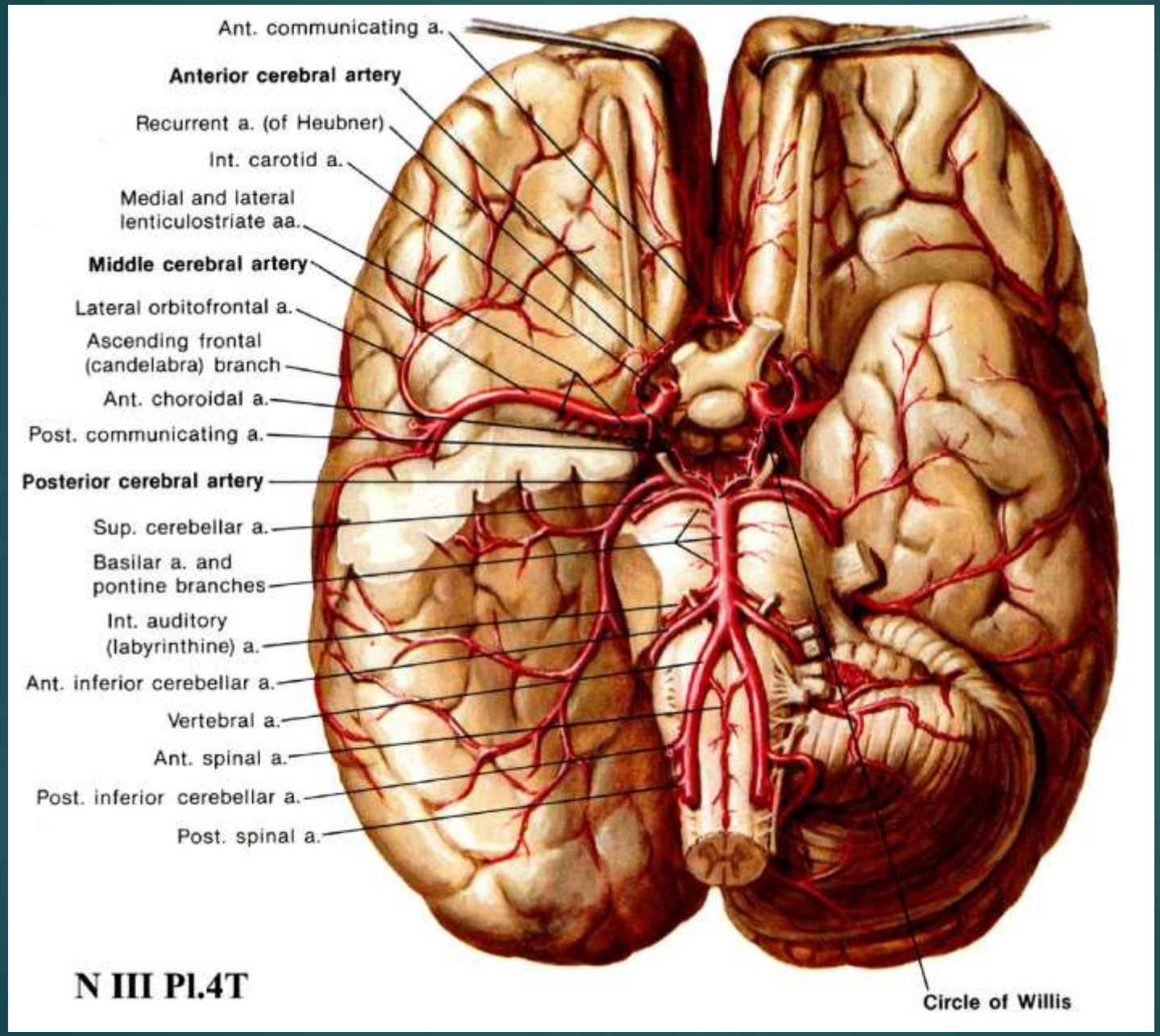
- Beta Amyloid is a potent vasoconstrictor and suppresses blood vessel autoregulation.

Blood Supply: Internal Carotid, Basilar, Carotid, Vertebral Arteries





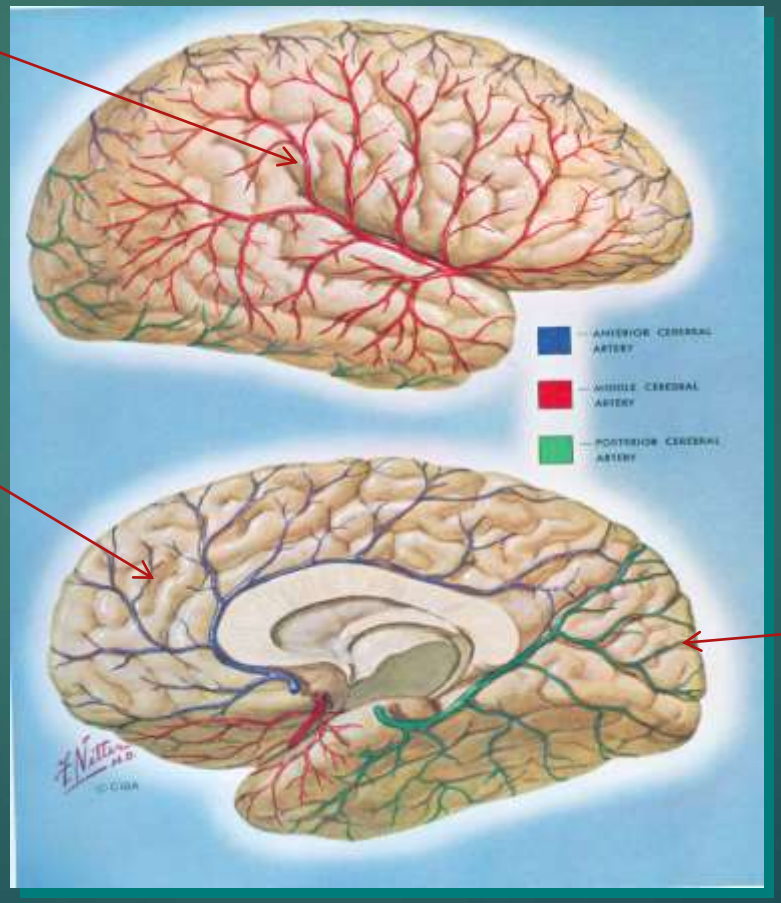
<u>Never let chiropractor do a neck adjustment</u>: basilar stroke


Ant. communicating a.
Anterior cerebral artery
Recurrent a. (of Heubner)
Int. carotid a.
Medial and lateral lenticulostriate aa.
Middle cerebral artery
Lateral orbitofrontal a.
Ascending frontal (candelabra) branch
Ant. choroidal a.
Post. communicating a.
Posterior cerebral artery
Sup. cerebellar a.
Basilar a. and pontine branches
Int. auditory (labyrinthine) a.
Ant. inferior cerebellar a.
Vertebral a.
Ant. spinal a.
Post. inferior cerebellar a.
Post. spinal a.
N III Pl.4T
Circle of Willis

Blood Supply 2: ACA, MCA, PCA

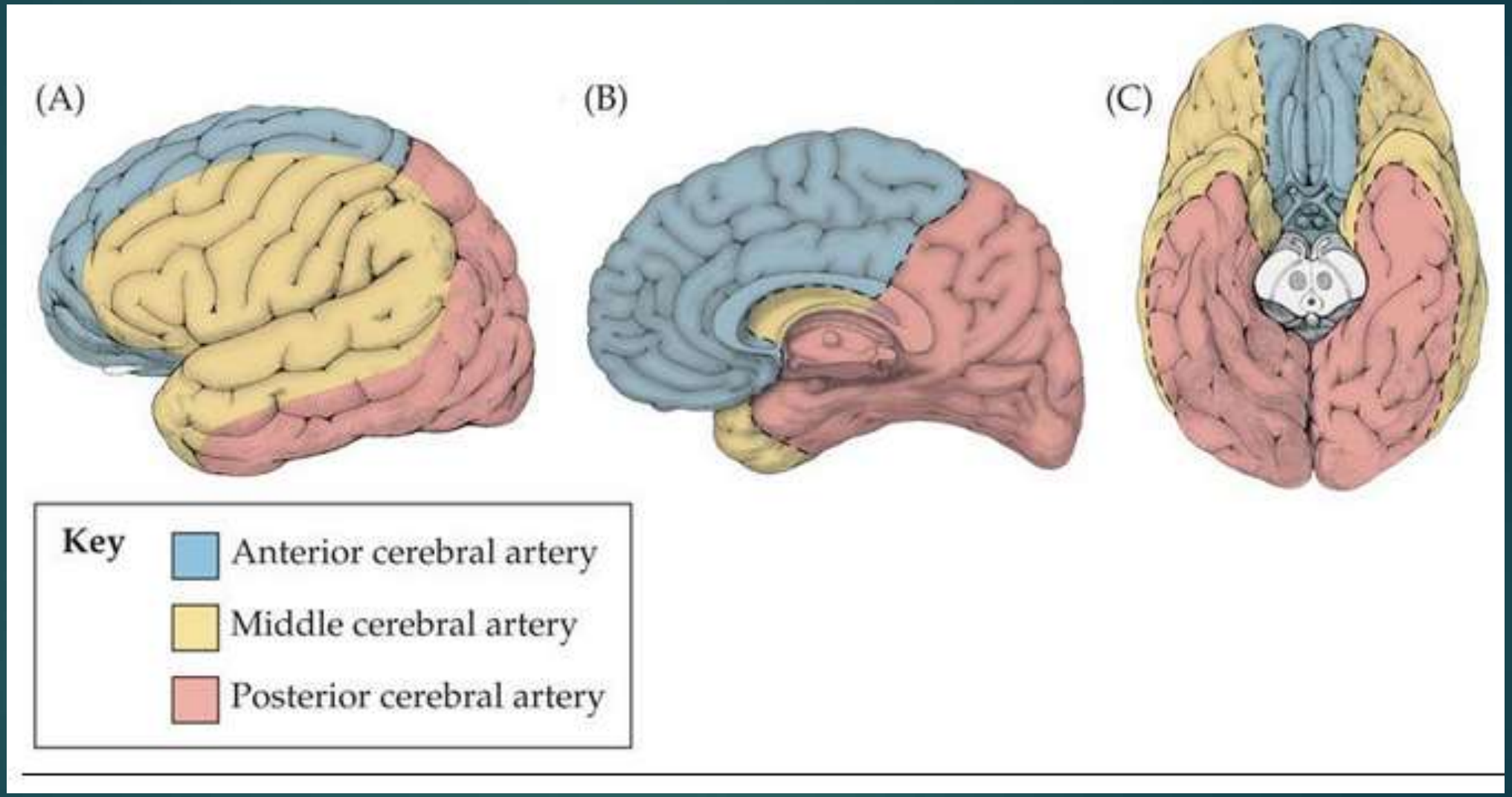
MCA

ACA



PCA

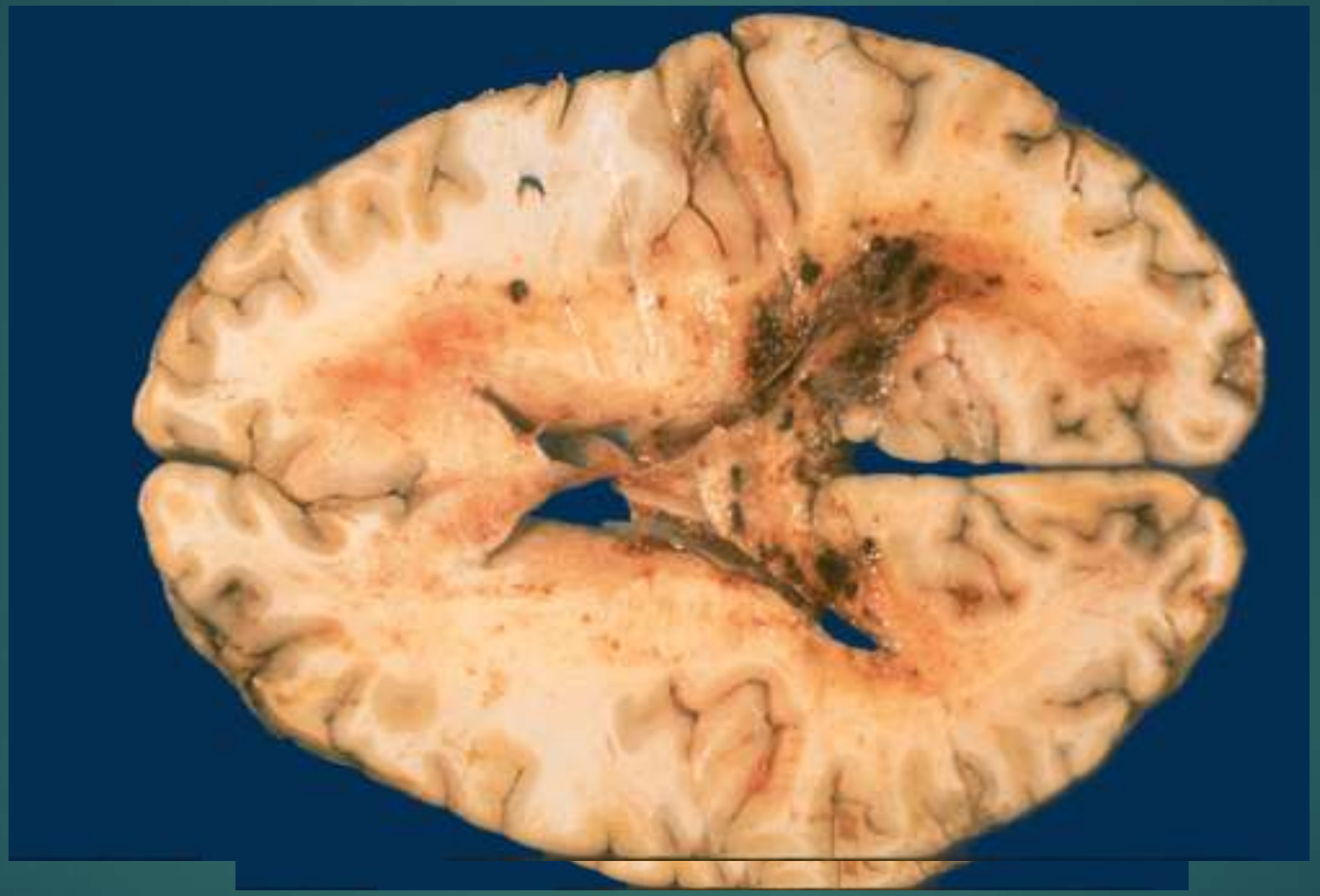
Artery Coverage Areas



Cardiovascular Disease

- Leading cause of disease and death in US
  - 41% of all deaths (Kaiser now: CA > CV)
  - 60 million have CVD: $128 billion
  - 600 T strokes per year:
    - leading cause of adult disability
    - 4th leading cause of death
    - 3.9 million have had stroke

Cerebrovascular disease



Stroke Risk Factors

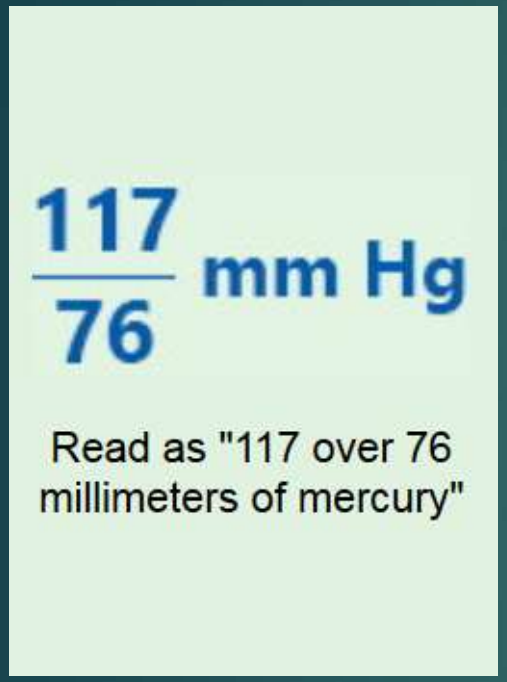
- Modifiable
  - Hypertension/High BP
  - Obesity
  - Atrial Fibrillation
  - Diabetes
  - Cardiac Disease
  - Dyslipidemia/High Choles.
  - Excessive Alcohol Intake
  - Physical Inactivity
  - Smoking
  - Stress
  - Diet
- Non-Modifiable
  - Age
  - Gender
  - Family History
  - Ethnicity
  - Previous TIA or Stroke

Question: How many of you have high blood pressure?

Hypertension: curse of the brain

- High blood pressure is the leading cause of mortality in the world
- Major precursor of most types of Stroke
- Can cause hemorrhagic (bleed) or ischemic (blockage) changes
- Can be associated with periventricular white matter changes on CT or MRI
- Causes auto-dysregulation of blood vessels

Blood Pressure



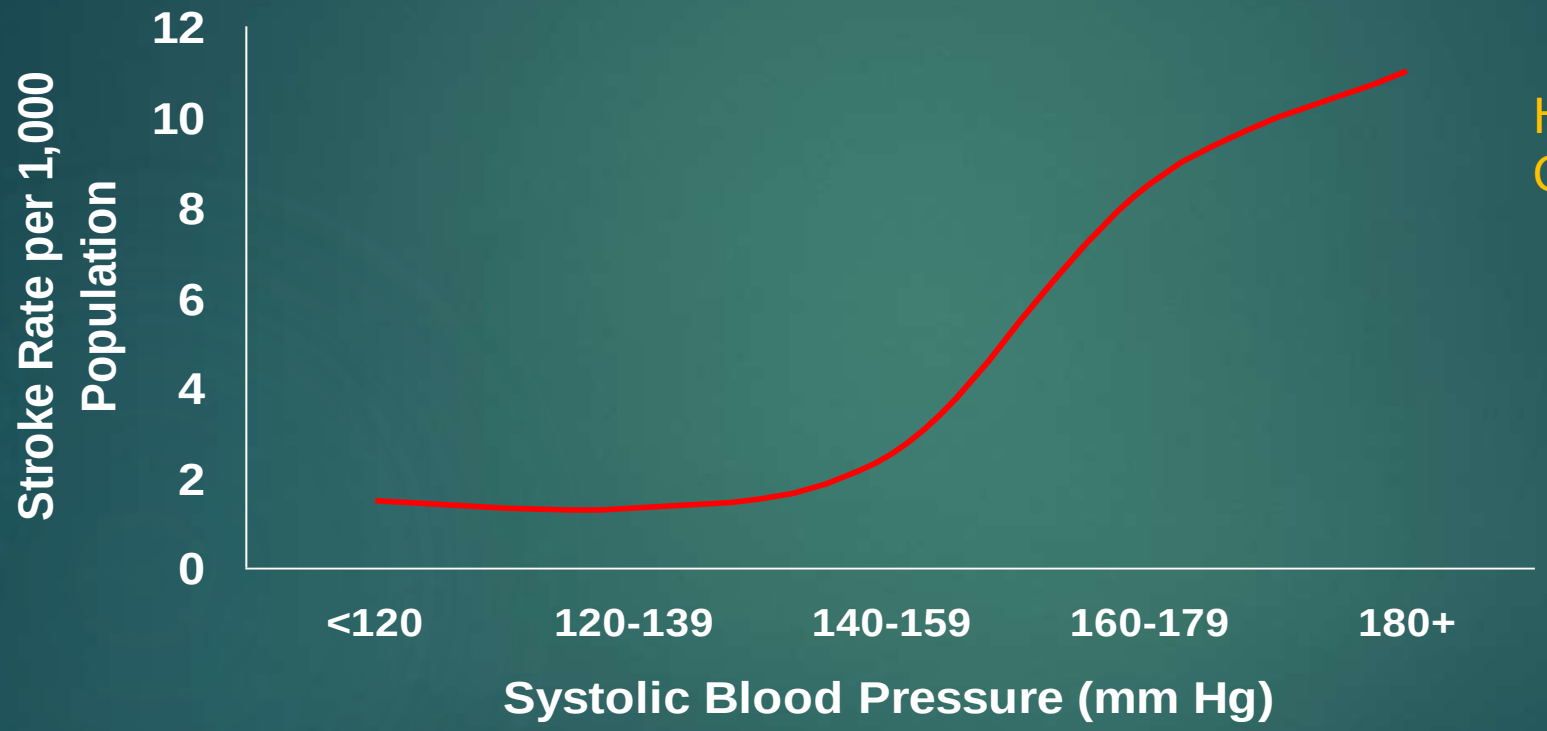
Systolic

The top number, which is also the higher of the two numbers, measures the pressure in the arteries when the heart beats (when the heart muscle contracts).

Diastolic

The bottom number, which is also the lower of the two numbers, measures the pressure in the arteries between heartbeats (when the heart muscle is resting between beats and refilling with blood).

Stroke Rates by Blood Pressure Level



Higher your BP,
Greater your risk of a stroke

Source: Framingham Heart Study, 1980

High BP increases the risk of:

- Coronary (ischemic) heart disease
- Stroke (all types)
  - Ischemic stroke
  - Hemorrhagic stroke
  - Subarachnoid hemorrhage
- Heart failure
- Hypertensive heart disease
- Sudden death
- Renal failure
- All-cause mortality

Prehypertension & Prediabetes

- Prehypertension, defined as
  - a blood pressure between 120 to 139 over 80 to 89 mm Hg

- Prediabetes, blood sugar between 100 and 125 mg/dL

- are two very early warning signs of potential for future heart attack or stroke.

SOURCES OF DIETARY SALT - risk factor for HTN

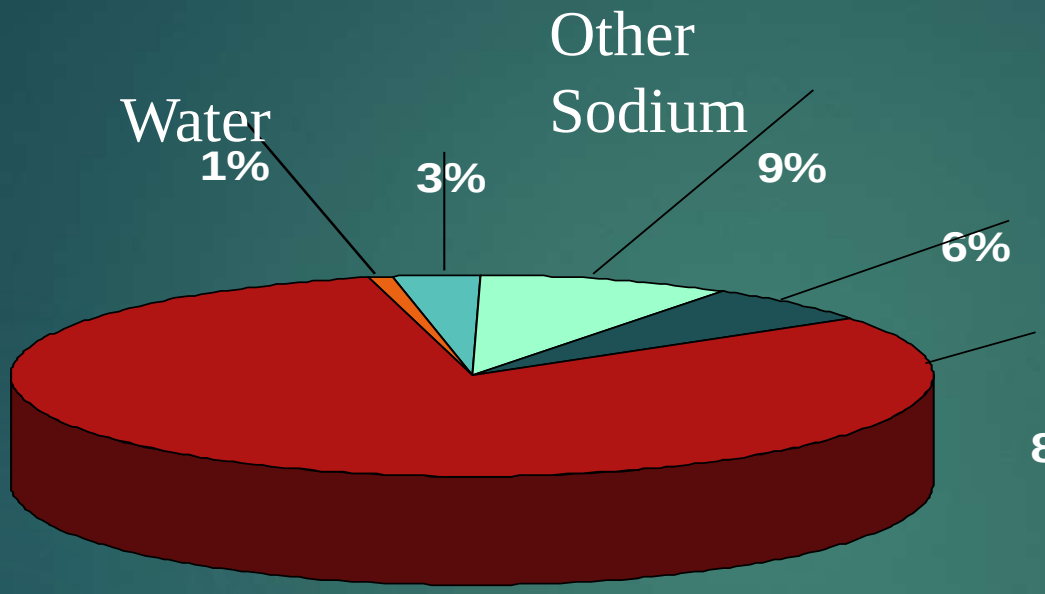


Table Salt

Cooking Salt

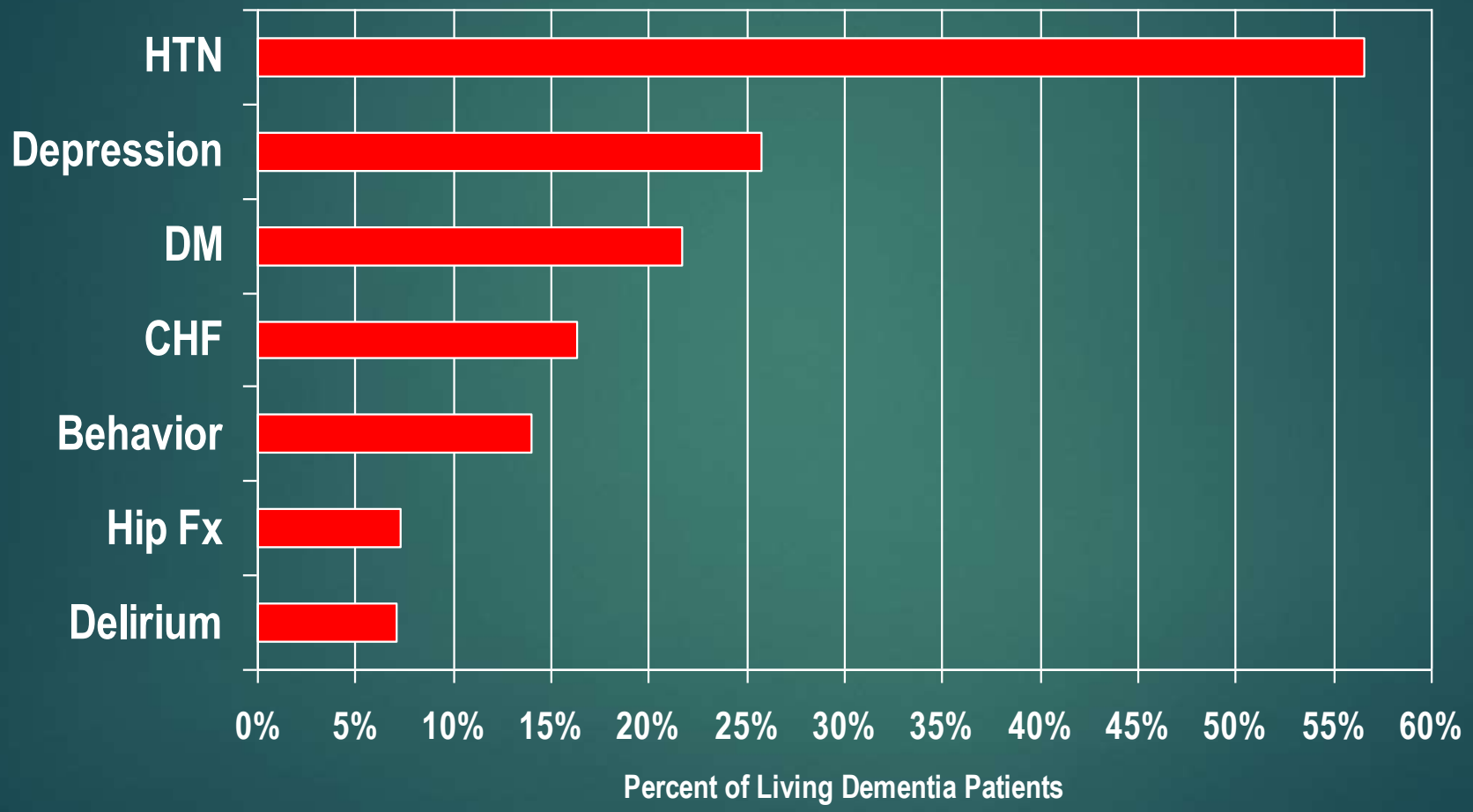
Processed Food:
High in salt, sugar, transfats

Source: James et al. The dominance of salt in manufactured food in the sodium intake of affluent societies. *Lancet* 1987;8530:426-428.

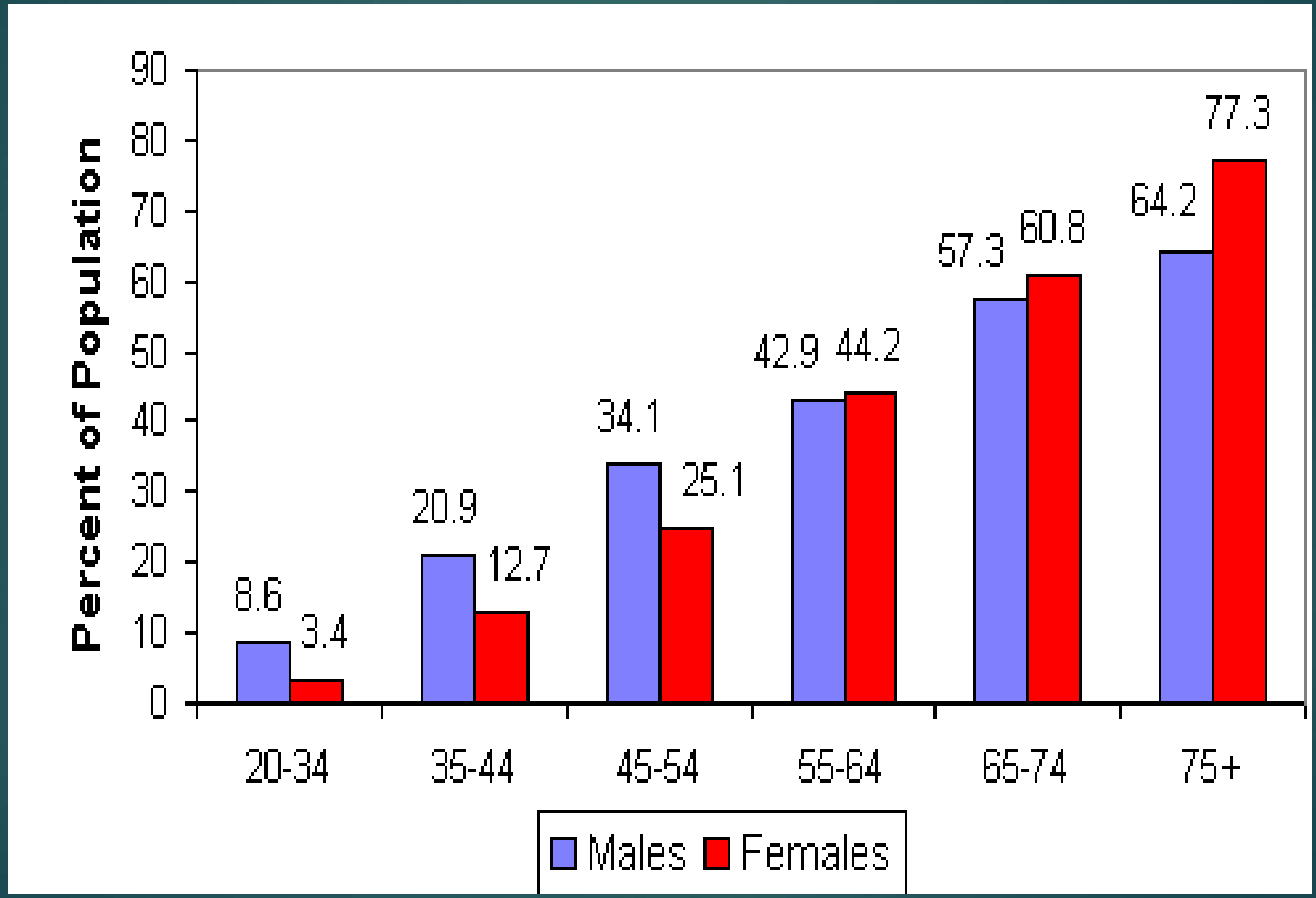
American Heart Association

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Normal	less than **120**	and	less than **80**
Prehypertension	**120 – 139**	or	**80 – 89**
High Blood Pressure (Hypertension) Stage 1	**140 – 159**	or	**90 – 99**
High Blood Pressure (Hypertension) Stage 2	**160** or higher	or	**100** or higher
Hypertensive Crisis (Emergency care needed)	Higher than **180**	or	Higher than **110**

Co-Morbidities of Northern Cal KP Dementia Pts



Hypertension increases with Age



Hypertension and Cognitive Function

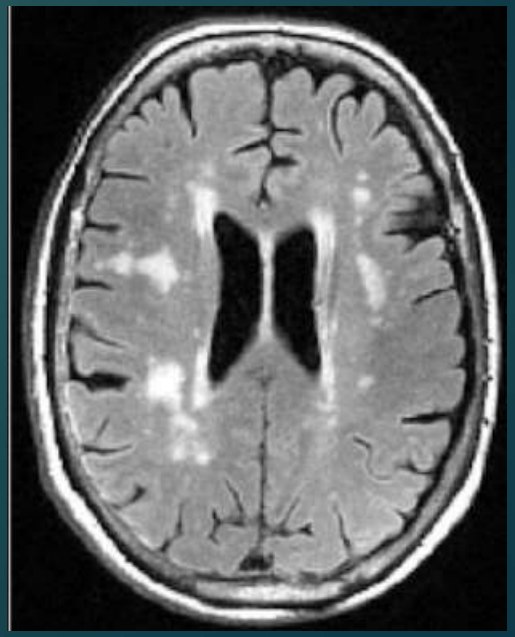
- > 140/90 = 50 million
- Essential HTN: unknown cause, 90-95%
- HTN is risk factor for atherogenesis, CHD, stroke
- Risk factors: male, African American
- 75% of all CHF & 35% of all Strokes due to HTN

Hypertension and Cognitive Function 2

- Cognitive Deficit: 1 s.d.↓
- Dose-response relationship between increasing HTN & cognitive functioning (as well as low BP)
- Memory, Attention, Executive↓

Hypertension and Cognitive Function 3

- Hypertension correlates:
  - Decrease in CBF and glucose utilization (in rats)
  - Structural effects: MRI hyperintensities in periventricular and deep white matter (reverses with TX)
  - All related to Cognitive decrease



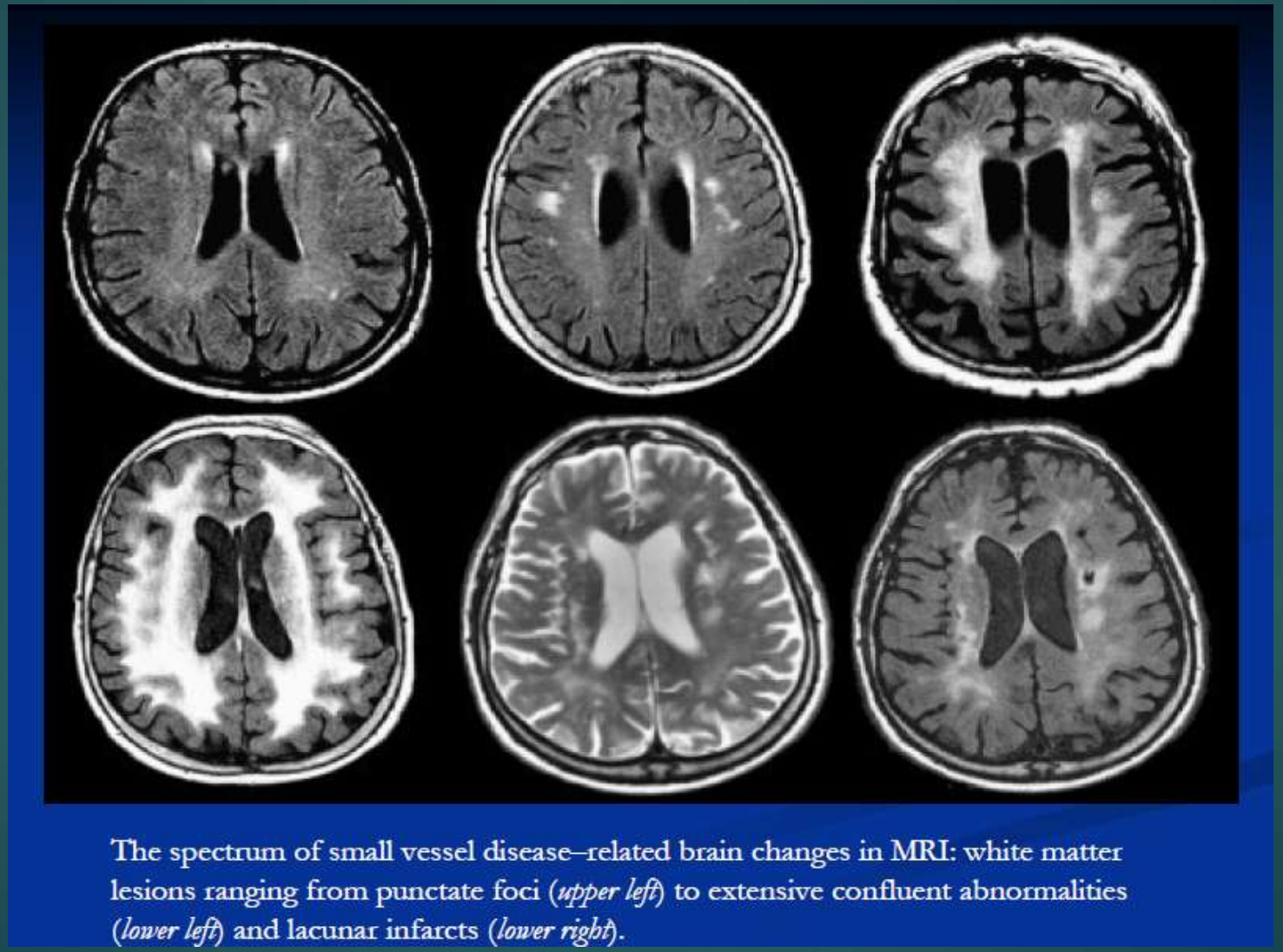
Good Cognitive Consequences of Antihypertensive Medications

- Untreated Hypertension: The Framingham Study: Untreated blood pressure level correlates with cognitive deficits: HTN →→ cognitive decline.

- Antihypertensive (BP) medication use →→ preservation of cognitive function in older Caucasian and African American adults.

- Antihypertensive use, (particularly diuretics, angiotensin-converting enzymes inhibitors, beta-blockers, and angiotensin receptor blockers), may be associated with a lower rate of cognitive decline (MMSE, Clock) in older adults, including those with AD.

HTN leads to Mild to Extensive Vascular Hyperintensities: Slower Processing Speed



The spectrum of small vessel disease–related brain changes in MRI: white matter lesions ranging from punctate foci (*upper left*) to extensive confluent abnormalities (*lower left*) and lacunar infarcts (*lower right*).

CVD and WMH

- Cerebral Vascular Disease (HTN, midlife abdominal girt, etc.) causes brain atrophy and WMH+ (white matter hyperintensities)
- Disruption of autoregulatory control of CV system is cause of WMH+, not microinfarcts
- HTN creates stiffer blood vessels; hypoperfusion when stand up (toilet flush effect)
- WMH+ doubles mortality risk

What is ‘metabolic syndrome’?

- 1 Abdominal obesity (fat belly)
- 2 Impaired glucose metabolism (diabetes, pre-diabetes)
- 3 High “bad” cholesterol (LDL) or low “good” cholesterol (HDL)
- 4 High blood pressure

- Almost all cases of adult onset diabetes begin as Metabolic Syndrome

- Each metabolic syndrome factor independently increases stroke risk

- Having all 4 doubles dementia risk

Each metabolic syndrome factor independently increases stroke risk

- Abdominal obesity:
  - Higher waist-hip ratio increases risk 2-3 times
- Diabetes:
  - Twice the risk of stroke versus no diabetes
- Cholesterol
  - Related to atherosclerosis
- High blood pressure
  - Directly related to degree of BP elevation

HDL and Cognitive Decline in normals

- HDL (good cholesterol) is positively correlated with more grey matter volume in the temporal lobes.

- A significant association between HDL and the Brief Visuospatial Memory Test, COWAT

- Those with decreased levels of HDL cholesterol may be experiencing cognitive changes and GM reductions in regions associated with neurodegenerative disease.

M. Ward, et al., 2010

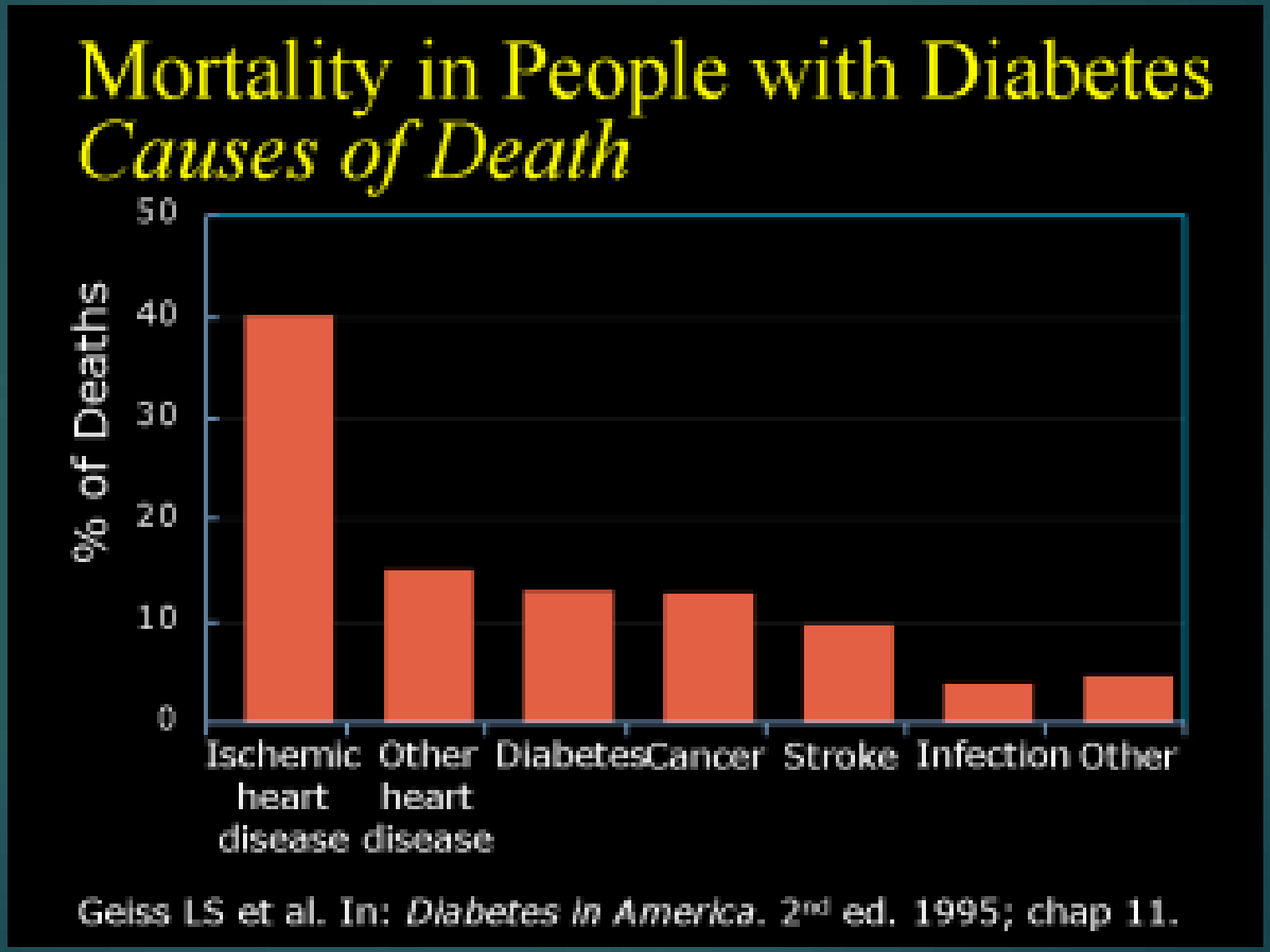
Cigarette smoking: stroke and dementia

- Cigarettes are lethal: 400,000 deaths per year
- Increases stroke risk by worsening atherosclerosis (blood vessel narrowing)
  - Even with passive ("second hand") exposure
- Five times faster decline in cognition/dementia in smokers compared to non-smokers
  - Study of 9,000 adults over age 65

Diabetes-Associated Cognitive Dysfunction

- DM and CVD intertwined
- DM adults have 2x rate of normals of:
  - Hypertension
  - High cholesterol
  - Heart disease
  - Stroke
- Cognitive deficits related to DM (independent of CVD)

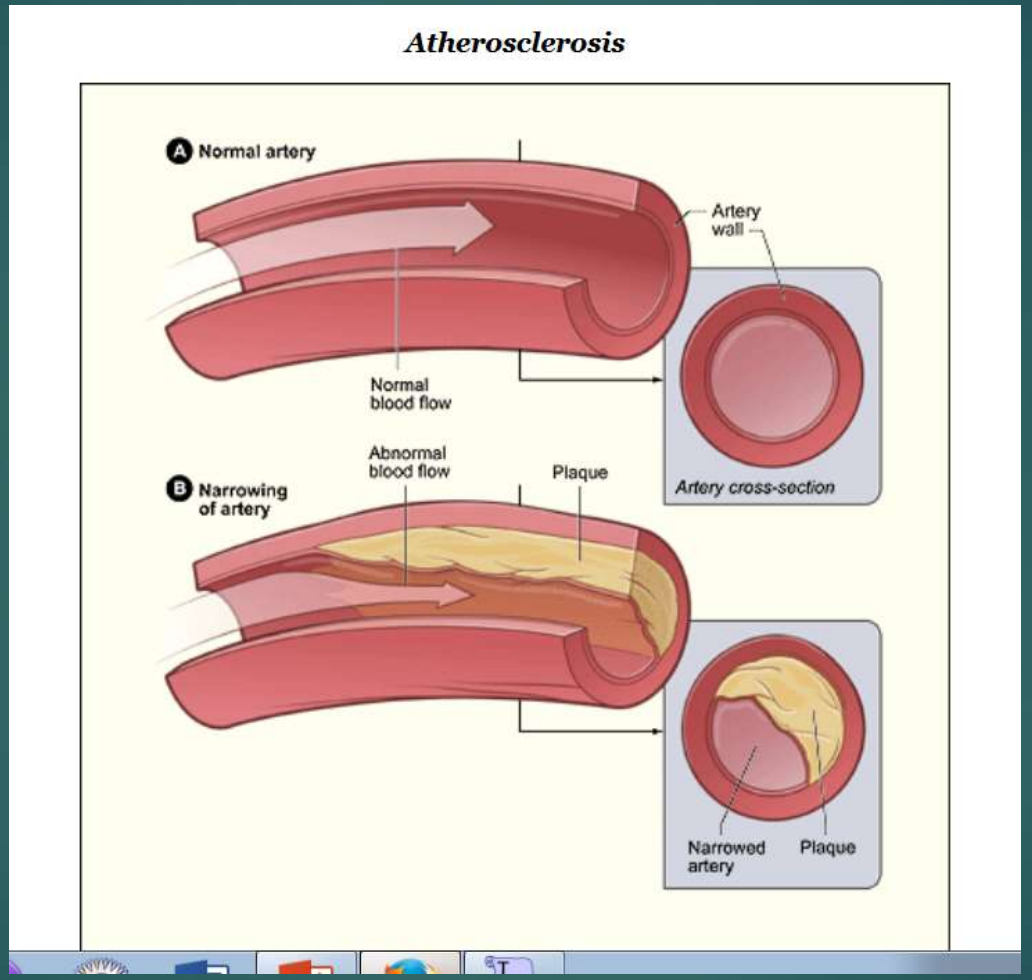
Diabetes: Ischemic Heart Disease



Cardiovascular Risk Factors and Cognitive Functioning

- There is cumulative impact of Cardiovascular disease risk factors on cognitive functioning
- For each risk factor at NP testing (WMS, COWAT, Similarities, Digit Span), risk of lower cognitive performance increased by 23% (Framingham study):
  - HTN
  - DM
  - Cholesterol
  - Smoking
  - Alcohol
  - Obesity
- Most effect from DM > HTN > obesity > smoking
- Cumulative effect: More risks, more deficits

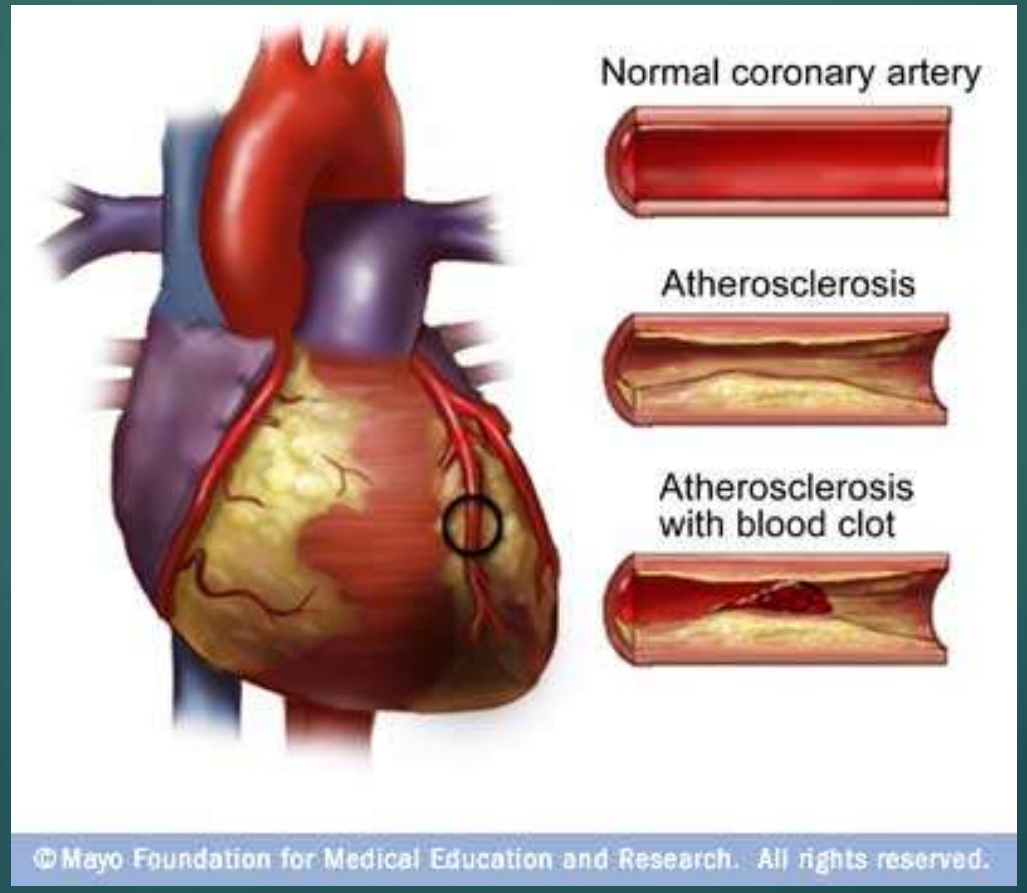
Atherosclerosis: blockage of blood vessel by wall plaque



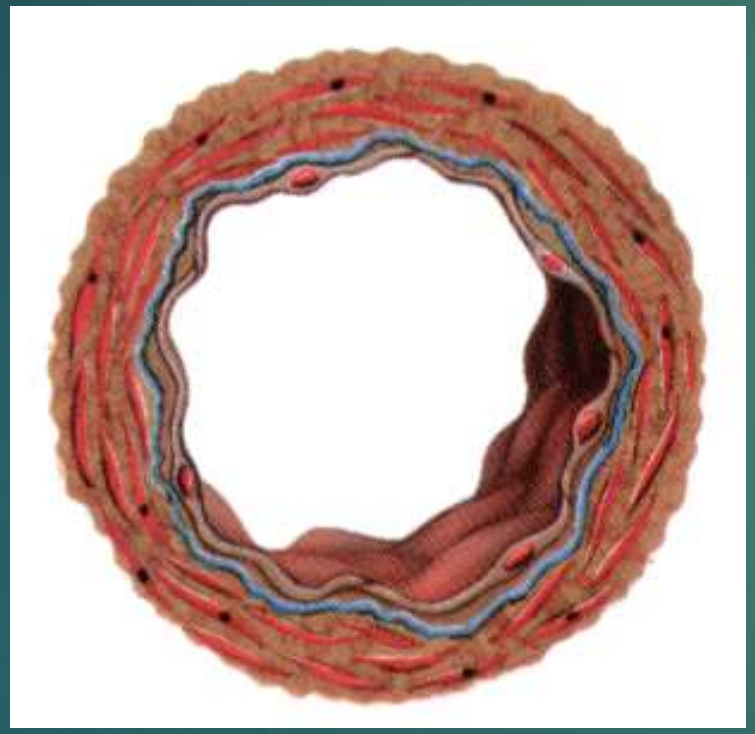
Obstruction can occur when narrowing of the vessel results from thickening and hardening of the arteries

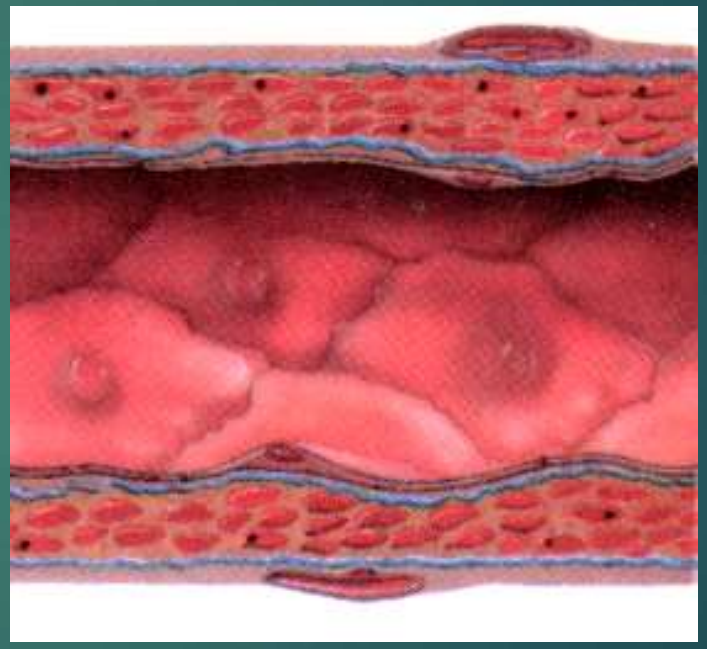
Atherosclerosis 1

Atherosclerosis: disease of arteries in which lumen (opening) of the artery becomes narrowed by fatty deposits and fibrous tissue that accumulate in the intimal layer of vessel wall.

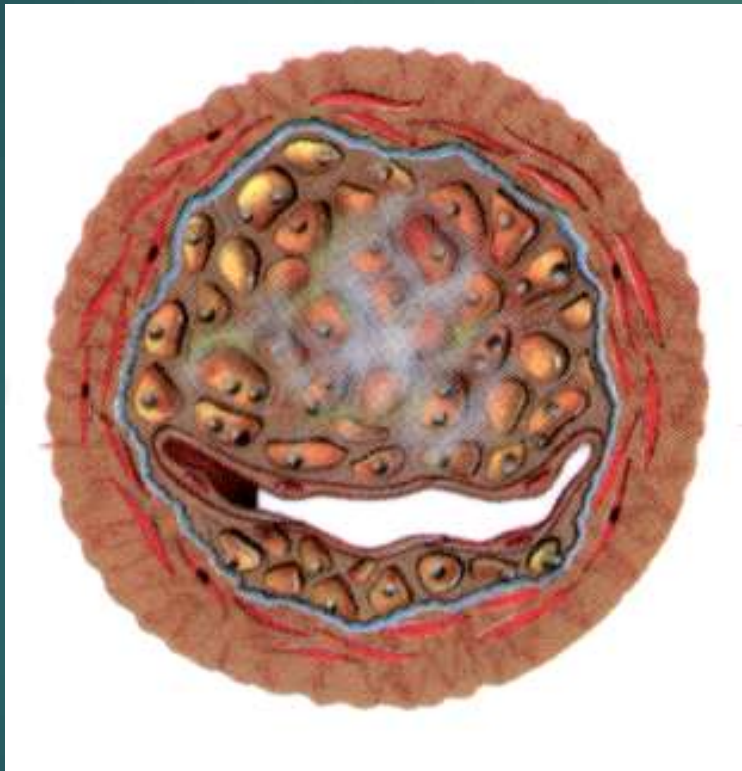


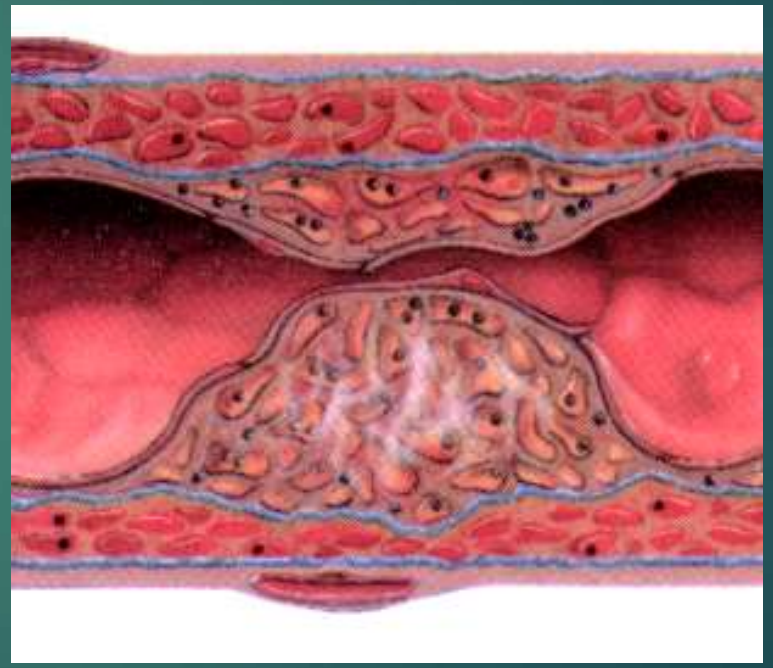
Normal Blood Vessel Wall



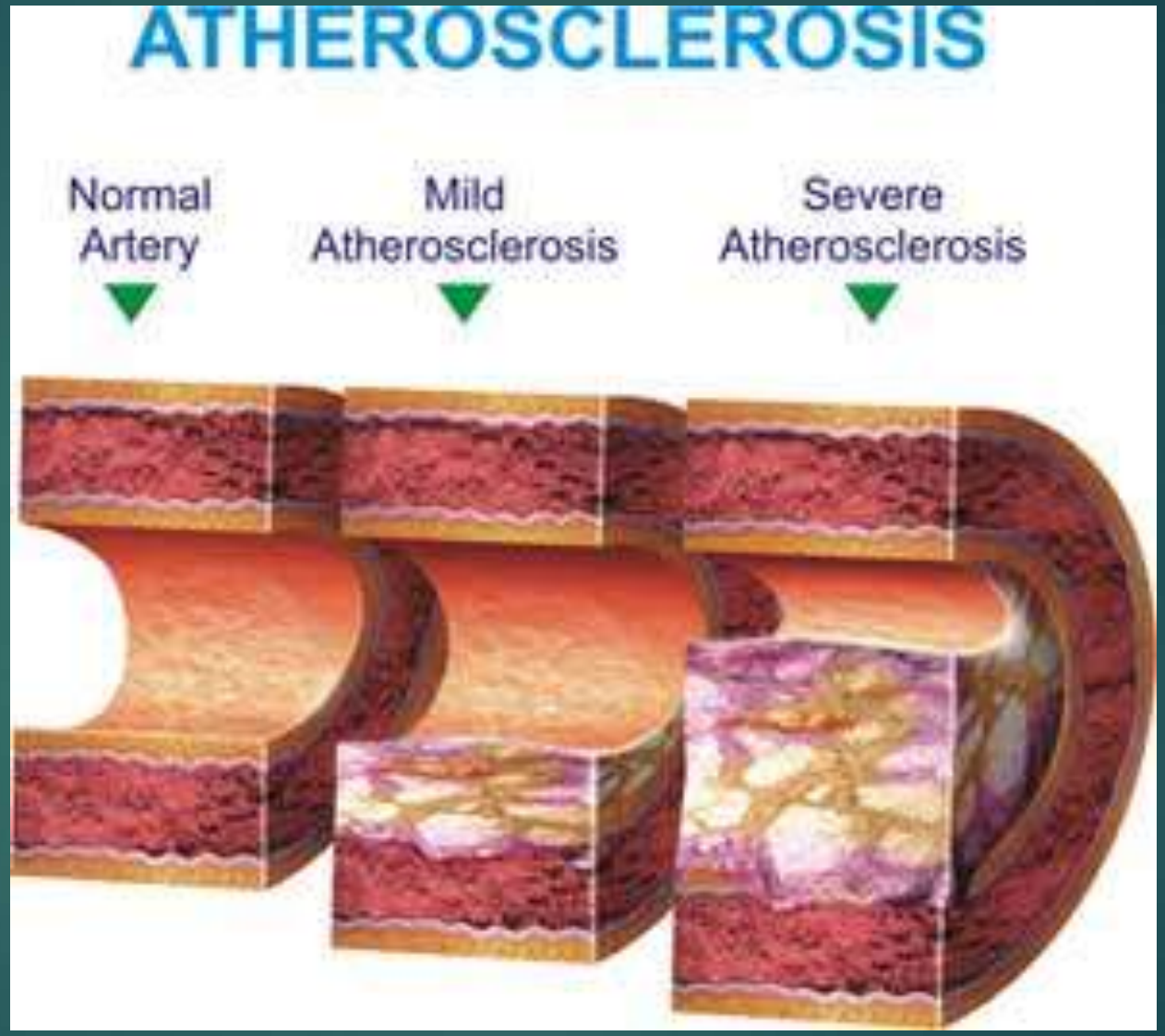


Plaque





Atherosclerosis 2



Atherosclerosis and Cognitive Functioning

- Atherosclerosis is cause of angina, heart attacks, and strokes

- In middle-elder aged, atherosclerosis related to cognitive decline in:
  - MMSE
  - TMT-B
  - Buschke Memory Test
  - Verbal Fluency
- Ultrasound of thickness of carotid arteries related to :
  - Digit Symbol
  - Delayed Recall
- Risk factors for atherosclerosis: HTN, DM, Smoking, Hyperlipidemia

Dental Health & CV Health

- Inflammation leads to atherosclerosis, and low grade inflammation have been consistently associated with a higher risk of cardiovascular disease

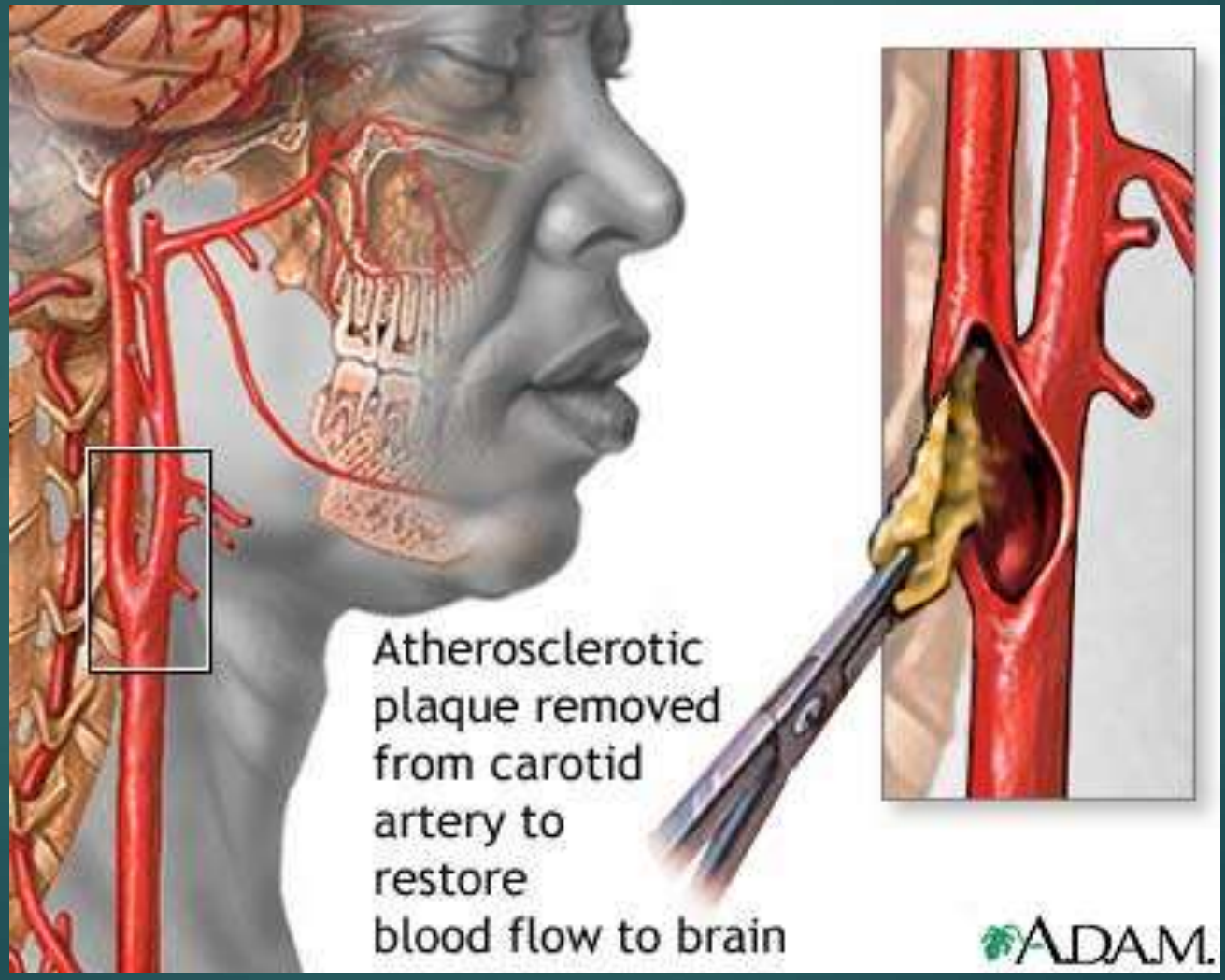
- Tooth brushing less than twice a day is associated with cardiovascular disease.

- Gum disease increases risk of Alzheimer's

Carotid Stenosis and Carotid Endarterectomies

- Clogged internal carotids can result in syncopal episodes, greatly increased risk of Stroke, and cognitive decline due to microembolisation in the cerebral arteries
- Endarterectomy can reduce the long-term risk of Stroke
- There is a risk of intra- or post-operative stroke due to particulate microembolisation (2 – 7%).

Carotid Endarterectomy



Atrial Fibrillation

- AF causes the heart to beat chaotically, increasing the risk of blood clots and, if the condition is left untreated, stroke.

- AF is an important determinant of cognitive and functional decline, even in the absence of clinical ischemic stroke.

Atrial Fibrillation

- Biggest problem with atrial fibrillation is that if the arrhythmia lasts for a day or two, the ineffective pumping action of the atria (caused by the chaotic electrical activity) can allow blood clots to form within the atria.

- If these blood clots break off and get into the bloodstream, a stroke can result.

- Thus, patients who are in prolonged or chronic atrial fibrillation have a significantly increased risk of stroke.

AF & Dementia

- Convincing evidence of an association between AF and dementia in patients with a history of stroke
- Among people who had survived a stroke, those with atrial fibrillation were 2.4 times more likely to develop dementia.
- The study found AF patients under the age of 70 had a 187% greater risk of all types of dementia compared with the general population.
- But their specific risk of Alzheimer's disease was also up - by 130%.

Brunch, 2009

Public Perceptions of Stroke

Myth – Stroke:

- Is not preventable
- Cannot be treated
- Only strikes the elderly
- Happens in the heart
- Recovery ends after 6 months

Reality :

- Up to 80 percent of strokes are preventable
- Stroke requires emergency treatment
- Anyone can have a stroke
- Stroke is a “Brain Attack”
- Stroke recovery can last a lifetime

Stroke

- Rapid onset of nonconvulsive neurological deficits
- Any brain disturbance related to alteration of cerebral blood flow (CBF)
  - Ischemic (infarction, arterial blockage)= 87%
    - Obstruction of blood flow by thrombosis or embolism
  - Hemorrhagic (bleeding into brain) = 13%

Pathophysiology

- Brain gets 15-20% of oxygenated blood pumped from heart.
- Blood brings glucose and oxygen and disperses heat and metabolic byproducts
- Severe ischemia (blockage) produces infarction
- Infarct: localized necrosis is resulting from obstruction of the blood supply

Pathophysiology of a stroke

- Blood supply to a specific part of the brain is disrupted and it does not receive adequate oxygen or glucose.

- After several minutes, an infarct is created (necrosis; dead or damaged tissue)

- Two prominent types:
  - Ischemic (obstructive)
  - Hemorrhagic (bleed)

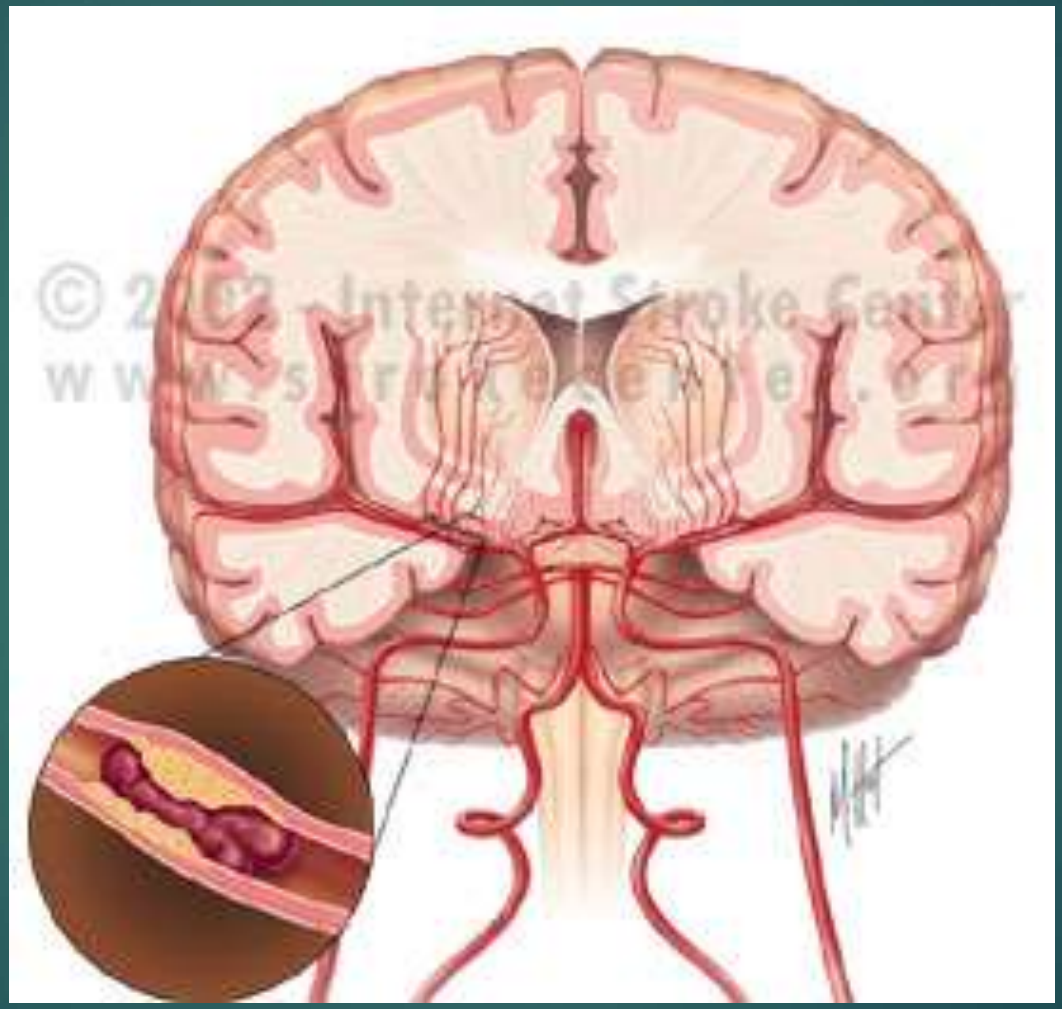
Ischemic strokes

- Acute ischemic stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function.
- Caused by blockage of a vessel
- 82%-92% of strokes are ischemic/blockages.
- 9.7% of deaths; fourth most common case of death (after heart disease, CA, lung)
- Causes death in 12-20% of cases within 1 month of stroke
- 80% preventable

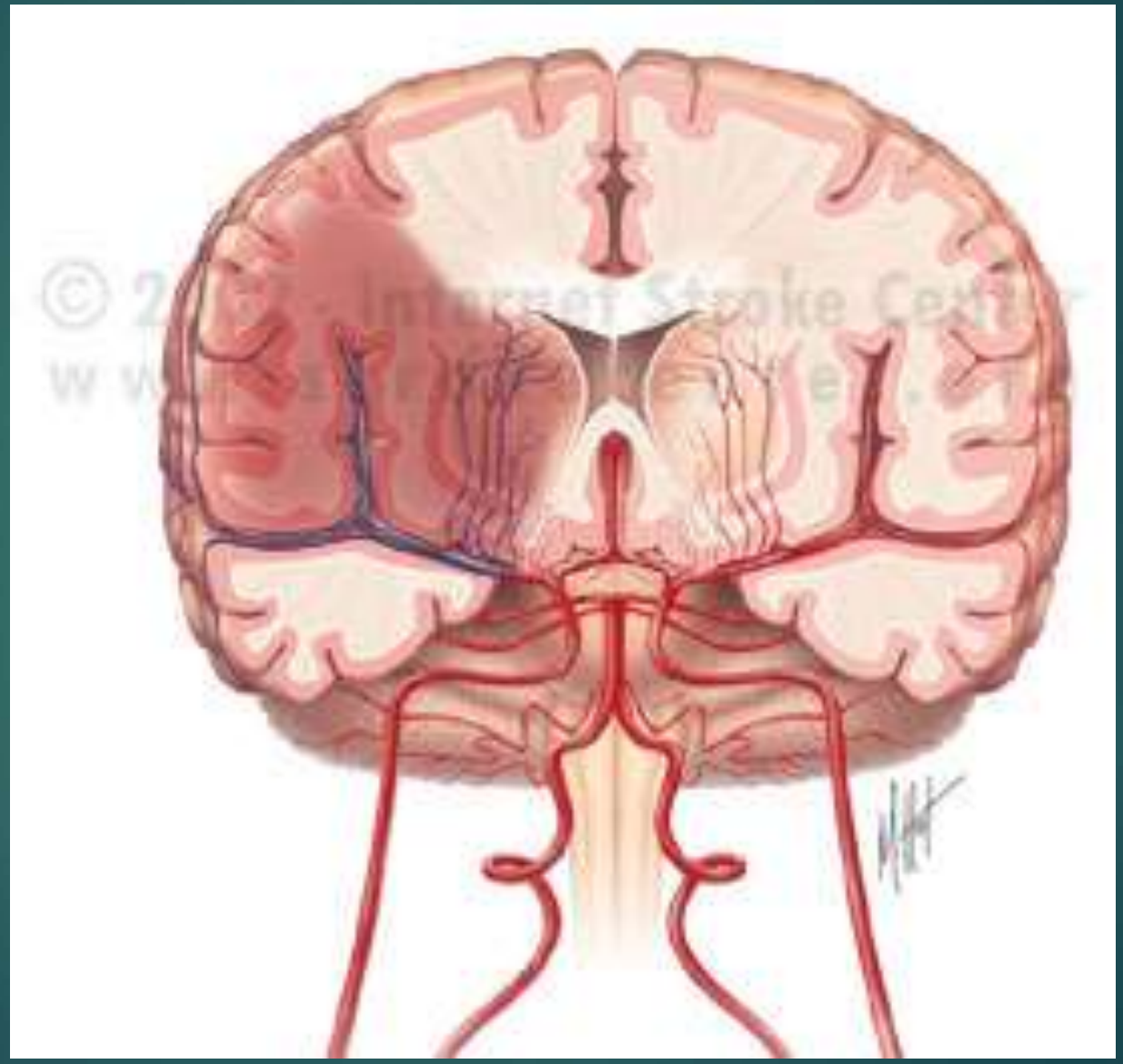
Ischemic Infarction: no Oxygen

- Ischemia: decrease of blood supply to the brain; CBF fails to meet Oxygen requirements of brain
- Whenever blood flow through arteries is blocked sufficiently to cause cell death.
- When perfusion drops 20%, cell death occurs
- Atherosclerosis:
  - Etiology when 50% stenosis of an artery
  - Via plaque fragment or obstruction of CBF, therefore low perfusion forward from that spot

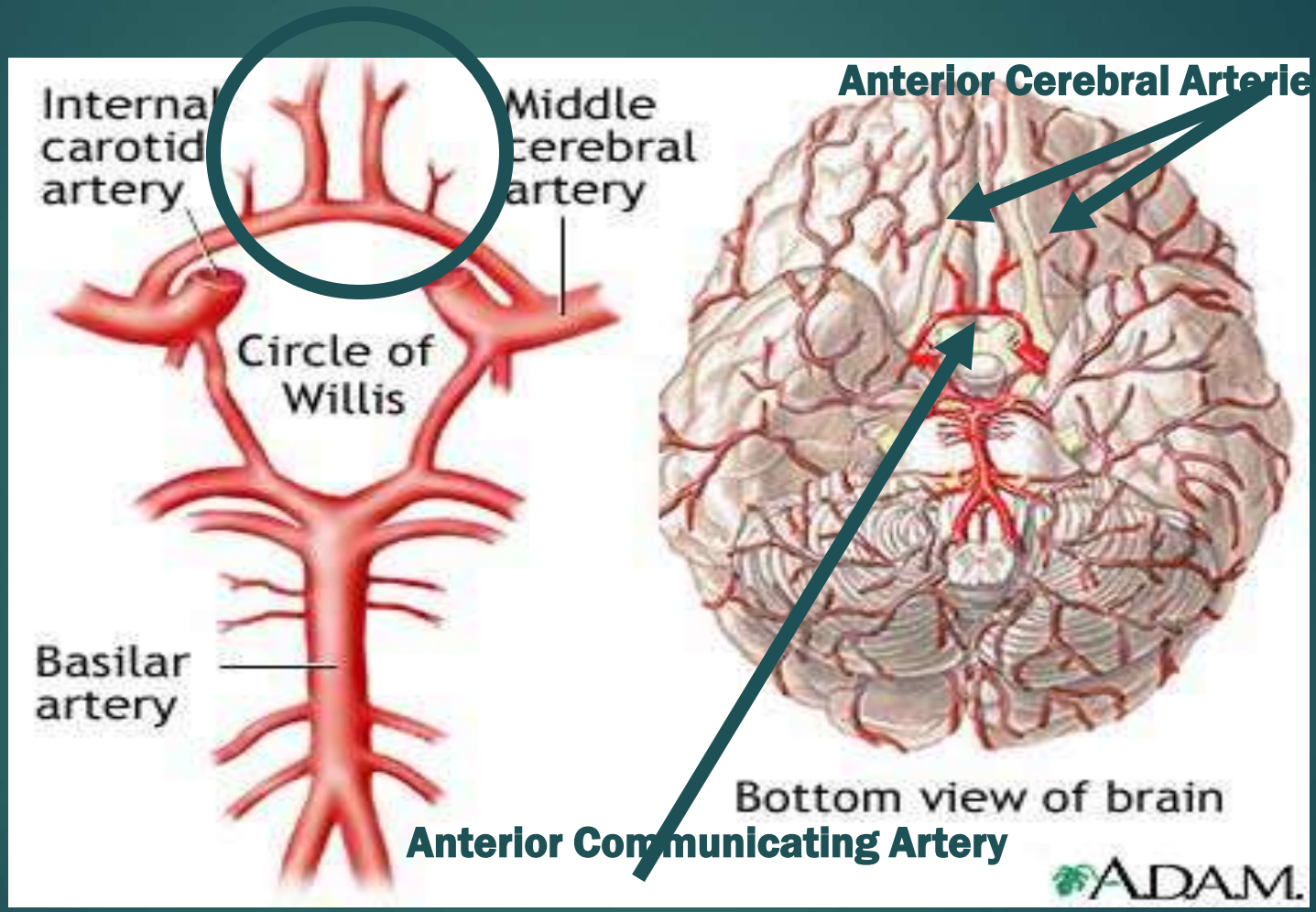
Ischemic stroke



Damage from ischemic stroke



Frontal Lobe Dysfunction in stroke

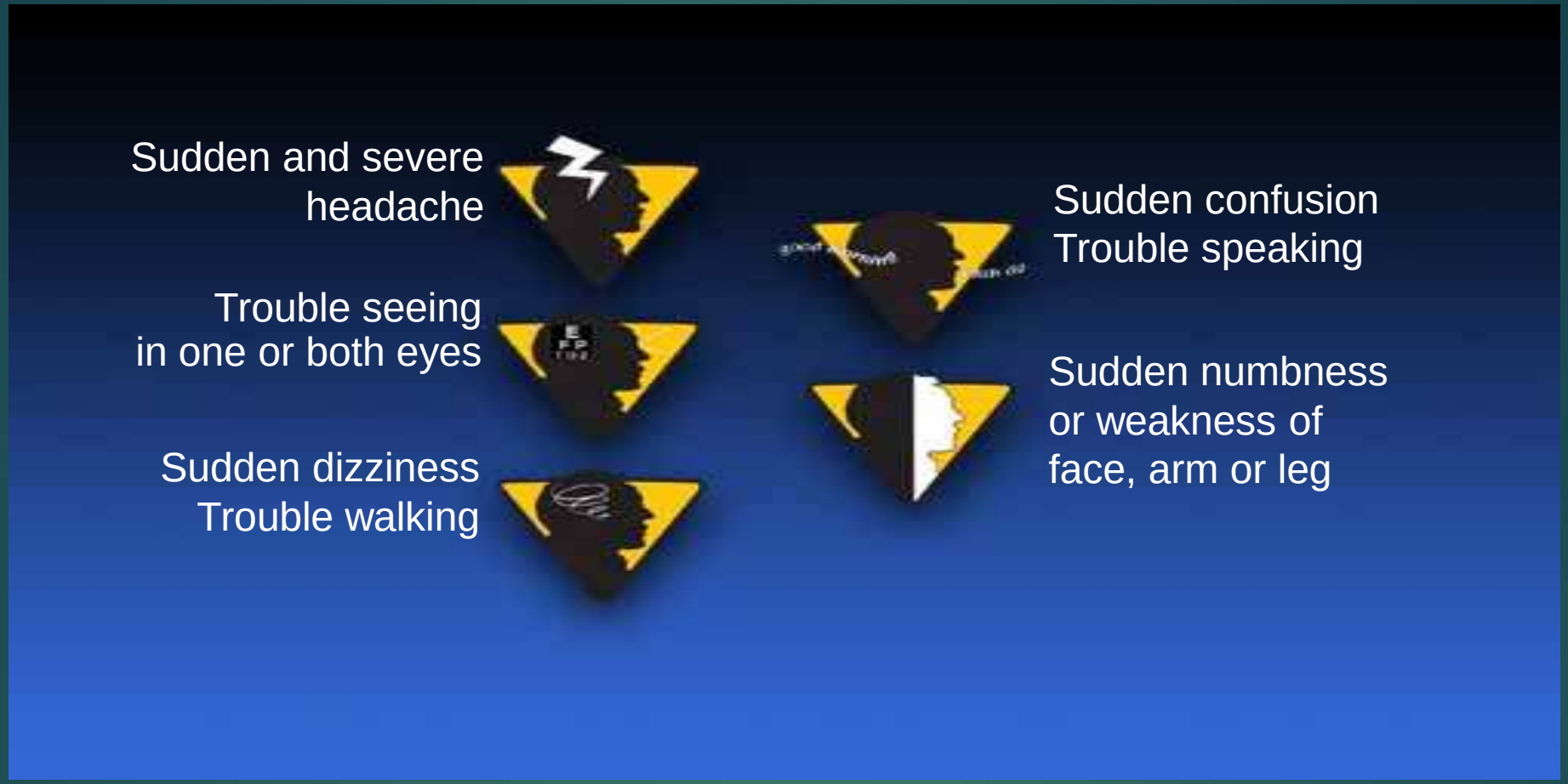


70% of all ischemic strokes occur in the anterior circulation.

Stroke = Brain Attack

- Brain Attack = powerful call to action.
- Warrants the same degree of emergency care as a heart attack.
- Immediate response is crucial because every minute matters – brain cells are dying.
- In other words TIME IS BRAIN Damage. The best thing to do is to call 9-1-1 for immediate assistance.
- Unfortunately, it takes the average person in the U.S. 12 to 24 hours to get to the hospital after experiencing the first stroke symptom

Stroke Symptoms



- **If you observe any of these symptoms,**
- **CALL 9-1-1 IMMEDIATELY**
- **Every minute matters!**

Famous Persons with Strokes

- Vladimir Lenin, age 52
- Woodrow Wilson
- Franklin D. Roosevelt
- Winston Churchill
- Joseph Stalin
- Gerald Ford
- Hank Williams

Stroke

- Stroke is the most common type of cerebrovascular disease
- The archaic terms: apoplexy, “cerebrovascular accident “
- Fifth most common neurological disorder in the US.
- Leading cause of functional disability

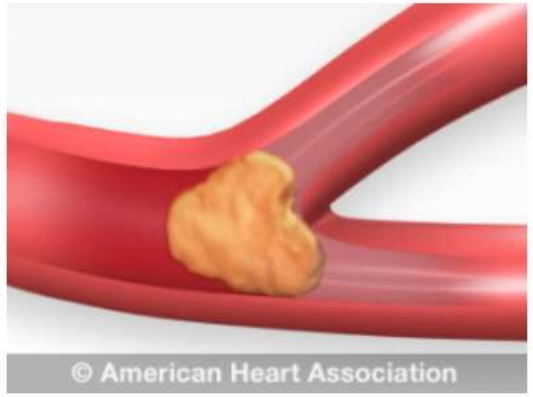
Prevalence

- 800,000 new strokes in US every year; 200, 000 recurrent
  - On average, one stroke every 45 seconds
  - >7 million stroke survivors; 13 million with silent strokes
- 3rd leading cause of death in USA
- Age is greatest risk factor; Women 3x greater risk in 45 to 54 age
- Good news: From 1998 to 2008, the stroke death rate fell approximately 35 percent and number of deaths fell by 19 percent

A blockage and resulting area of damage

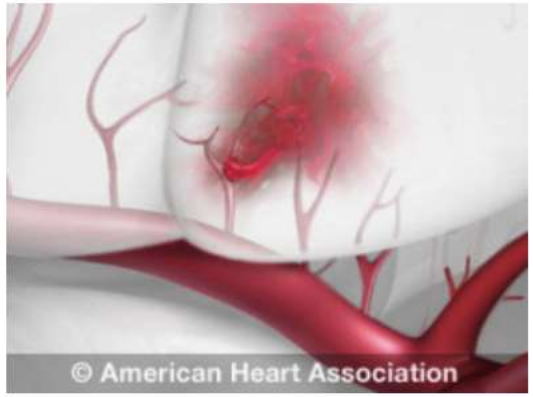
Ischemia, Hemorrhage, TIA

Ischemic (Clots)



Ischemic stroke occurs as a result of an obstruction within a blood vessel supplying blood to the brain. It accounts for 87 percent of all stroke cases.

Hemorrhagic (Bleeds)



Hemorrhagic stroke occurs when a weakened blood vessel ruptures. Two types of weakened blood vessels usually cause hemorrhagic stroke: aneurysms and arteriovenous malformations (AVMs). But the most common cause of hemorrhagic stroke is uncontrolled hypertension (high blood pressure).

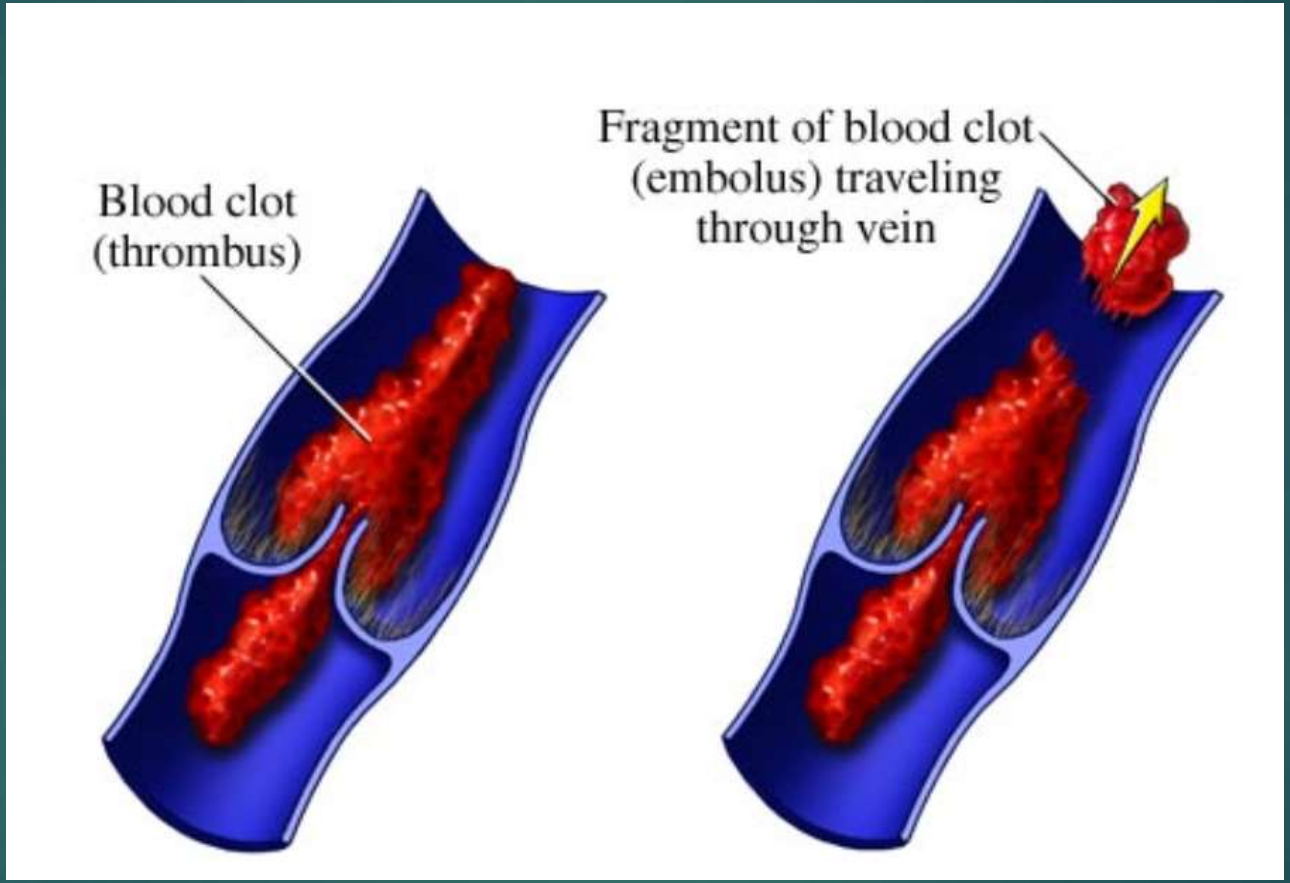
TIA (Transient Ischemic Attack)

TIA (transient ischemic attack) is caused by a temporary clot. Often called a "mini stroke", these warning strokes should be taken very seriously.

Blockage	Bleed	Transient
Ischemia	Hemorrhage	TIA

Illustration of occlusions

A **thrombus** is a solid mass of platelets and/or fibrin (and other components of blood)



An **embolus** is most often a piece of a thrombus that has broken free and is carried toward the brain by the bloodstream

Stroke

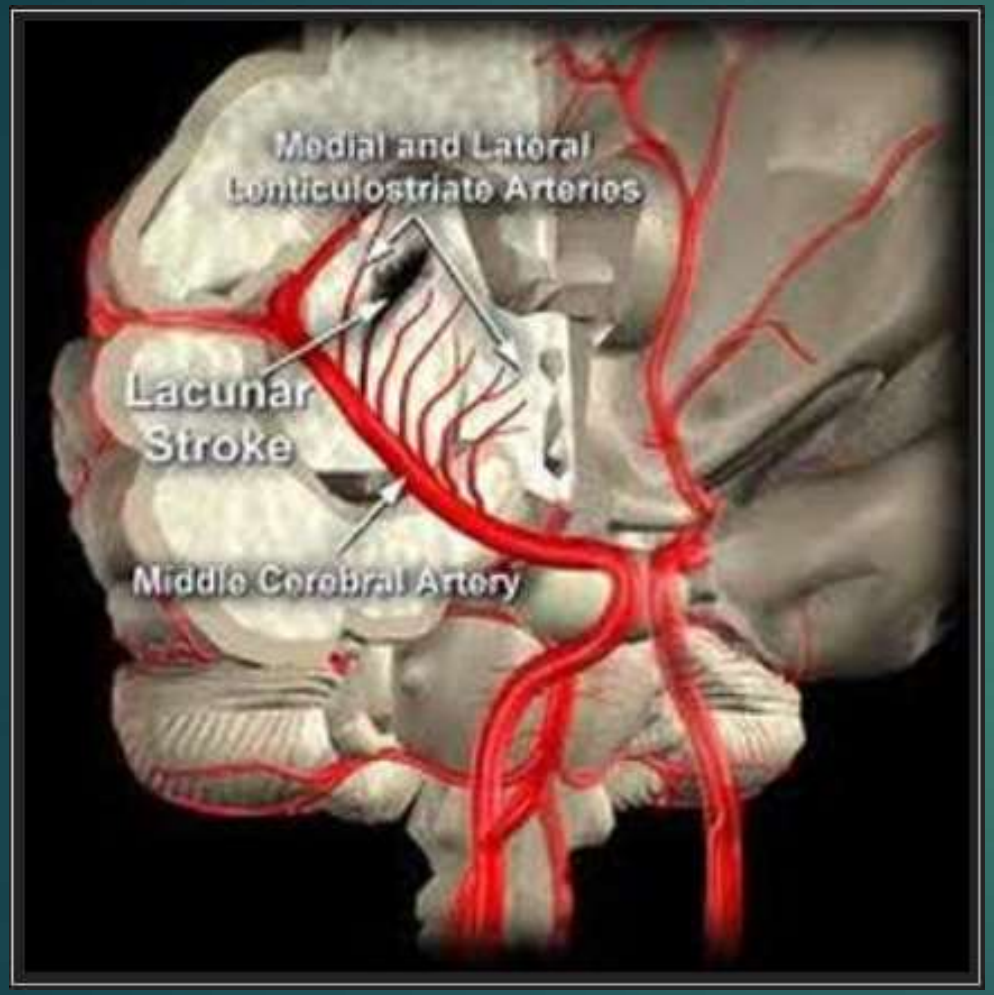
- Mortality: 25% in 1st month, 50% in 5 years
- Survivors:
  - 48% hemiparesis (one sided motor weakness)
  - 22% non-ambulatory
  - 25-50% Activities of Daily Living difficulty or dependence
  - 32% depression
- Atherosclerosis with thromboembolism = most common cause
- Stroke effect: depends on area, necrosis, edema
- Hypertension: major risk factor

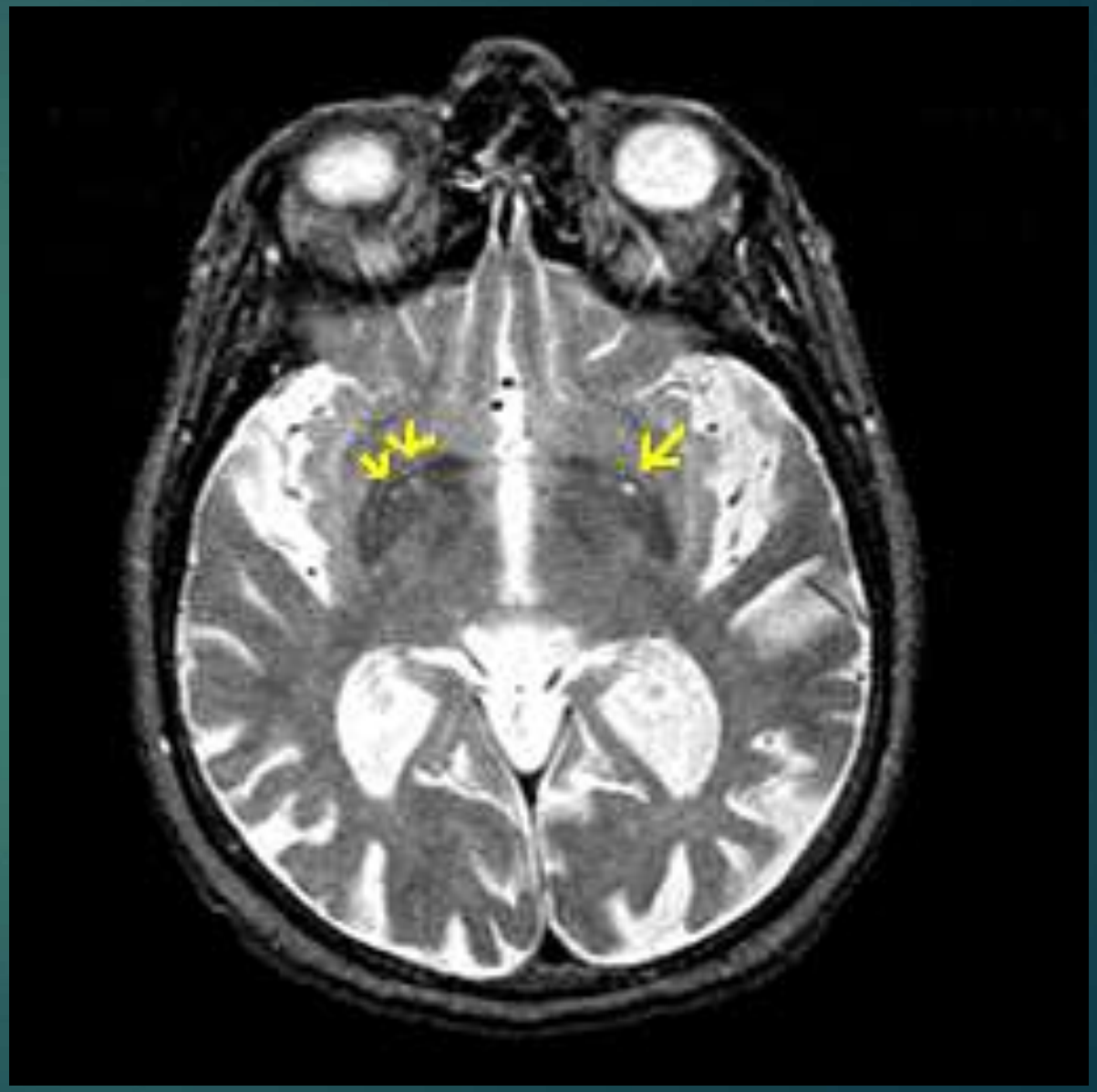
Stroke Mechanisms

Large vessel Stroke:

- Atherosclerosis is most common pathology, a plaque thrombus (formation or presence of a blood clot in a blood vessel).
- Enlargement of plaque
  - → narrow/occlusion of vessel
  - → stenosis

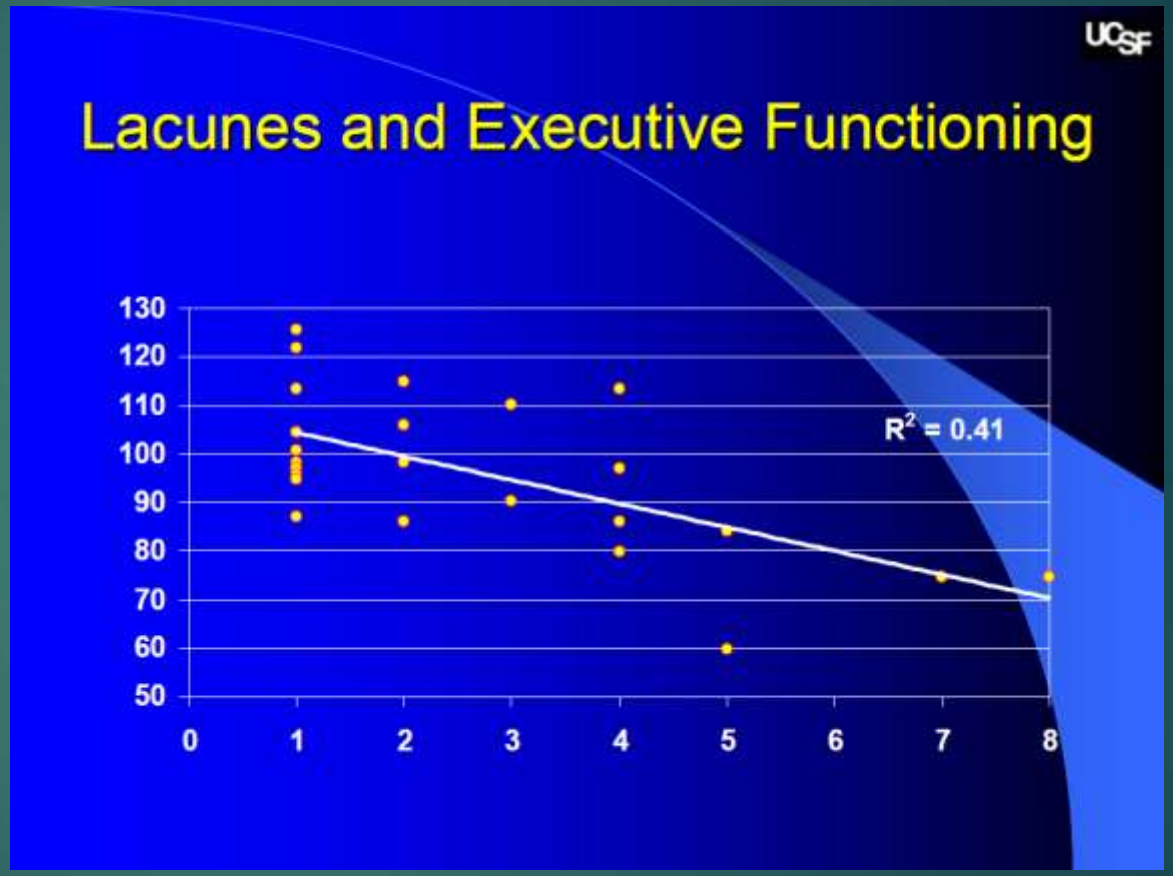
Lacunar infarcts: Account for 15-20% of strokes





Infarction is tissue death (necrosis) caused by a local lack of oxygen, due to an obstruction of the tissue's blood supply

Memory & executive function correlate negatively with brain infarcts, especially infarcts in cortical and sub-cortical gray matter.



Transient Ischemic Attacks (TIA)

- Temporary obstruction of a blood vessel; usually caused by a temporary clot

- Clinical sxs lasting less than 1-24 hours with absence of acute infarction on MRI

TIA: Transient Ischemic Attack

- 30 % of TIAs have stroke in 5 years
- TIA reduces survival by 4% in the first year and by 20% within 9 years.
- TIA has a minimal effect on mortality in patients <50 years old but heralds significant reduction in life expectancy in those >65 years.

TIA

- 50% of all people who have a major stroke following a warning stroke (a transient ischemic attack or mild stroke) have it within 24 hours of the first event; get to ER!

- Strong predictors of subsequent stroke:
  - 42% of all strokes during the 30 days after a first TIA occur within the first 24 hours
  - 9% of TIAs have stroke in 90 days;
  - 12% 1st year,
  - 24-29% in 5 years

- Half of these early recurrent strokes age disabling or fatal

Stroke: Symptoms

- Sudden numbness, weakness, or paralysis of your face, arm or leg -- usually on one side of the body
- Sudden difficulty speaking or understanding speech (aphasia)
- Sudden blurred, double or decreased vision
- Sudden dizziness, loss of balance or loss of coordination
- A sudden, severe "bolt out of the blue" headache or an unusual headache, which may be accompanied by a stiff neck, facial pain, pain between your eyes, vomiting or altered consciousness
- Sudden confusion or problems with memory, spatial orientation or perception

Hip Hop Signs of Brain Attack

- *There's a brand new dance that's sweepin' the nation by the National Stroke Association …*
- *… For those who can dance and clap your hands to it…*
- *One arm as you slur every word you speak.*
- *Imitate like you're paralyzed and weak…*
- *Walkin' funny … stagger unsteady.*
- *Stand in a line and pretend that you're BLIND…Loss of vision is one of the very first signs!*
- *A twisted face will show that you're ready.*
- *To do that dance that they call the STROKE!!*
- *Ice pick headache. IT AIN'T NO JOKE*
- Highest risk for stroke is among African Americans

5 Signs of Stroke

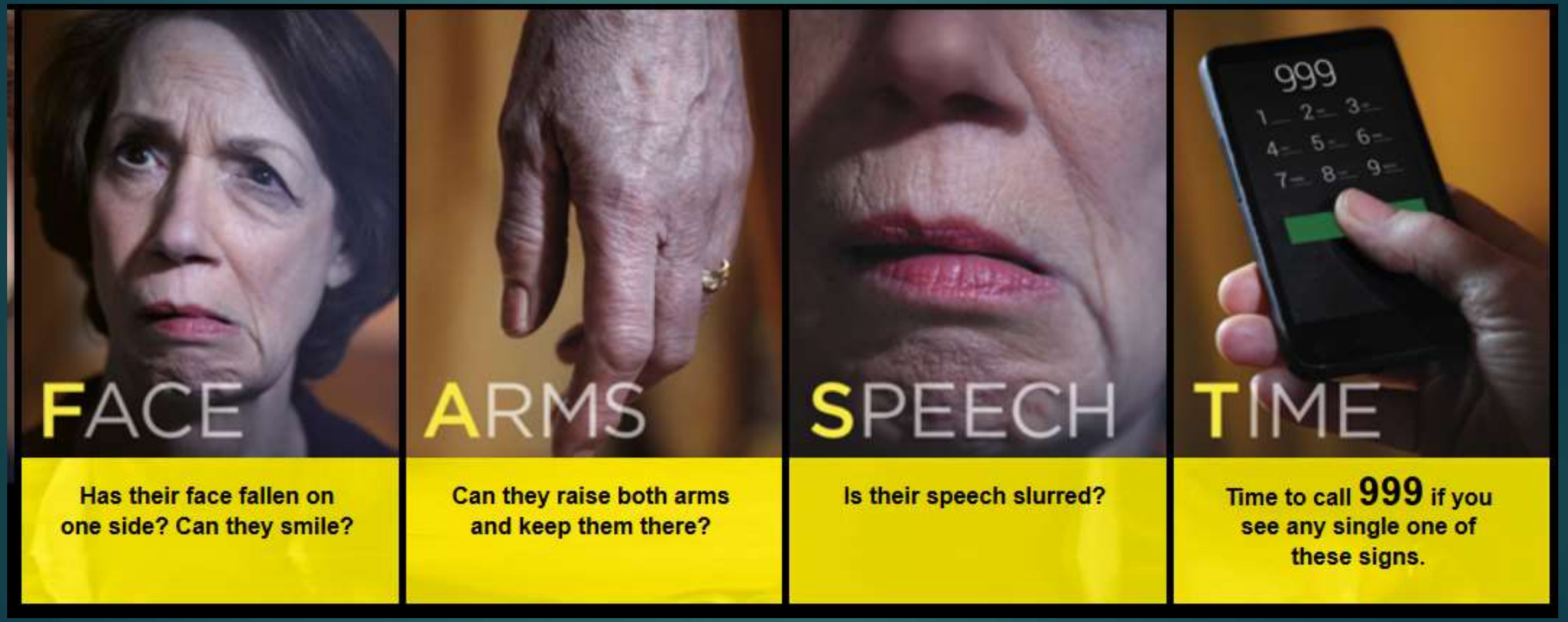
- Walk - Is balance off – 1 side off
- Talk – speech slurred, face droopy
- Reach – 1 side weak or numb
- See – vision all or partially lost
- Feel – severe HA

- Any of these, call 911

Act F.A.S.T.

- **F**ACE
  - Ask the person to smile.
  - Does one side of the face droop?
- ARMS
  - Ask the person to raise both arms.
  - Does one arm drift downward?
- **S**PEECH
  - Ask the person to repeat a simple sentence.
  - Are the words slurred? Can he/she repeat the sentence correctly?
- **T**IME
  - If the person shows any of these symptoms, time is important.
  - Call 911 or get to the hospital fast. Brain cells are dying.

FAST


FACE
Has their face fallen on one side? Can they smile?
ARMS
Can they raise both arms and keep them there?
SPEECH
Is their speech slurred?
TIME
999
Time to call 999 if you see any single one of these signs.

Signs of Strokes: Get to ED

- Time lost is brain function lost:

- Each hour lost: 120 million neurons, 830 billion synapses, and 714 km (447 miles) of myelinated fibers are lost

Time is crucial = Neuron loss in Stroke

- In acute stroke, “time is brain”: irreversible neuronal damage is rapid; early intervention can lead to improved outcomes.

- The average duration of nonlacunar stroke evolution is 10 hours (range 6 to 18 hours)

- In patients experiencing a typical large vessel acute ischemic stroke, 120 million neurons, 830 billion synapses, and 714 km (447 miles) of myelinated fibers are lost each hour.

- In each minute, 1.9 million neurons, 14 billion synapses, and 12 km (7.5 miles) of myelinated fibers are destroyed.

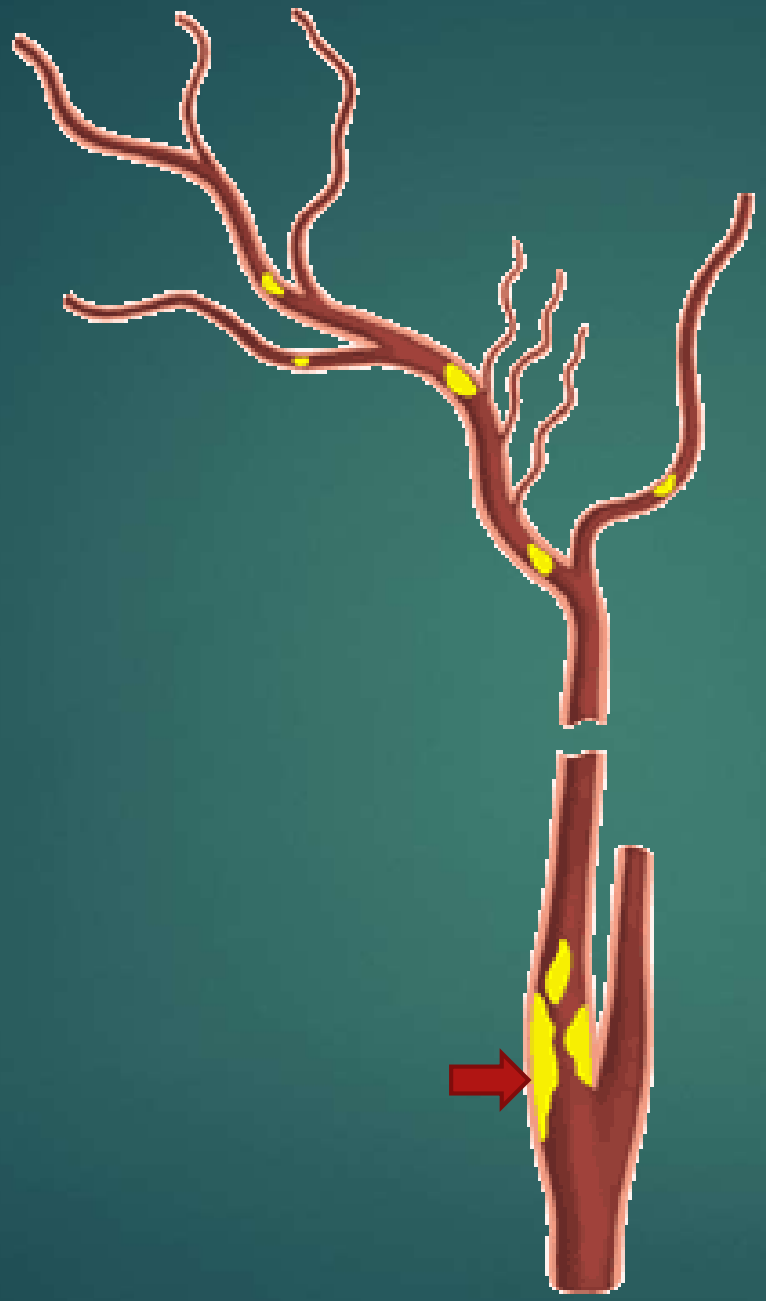
Cerebral Thrombosis

- Obstruction due to buildup of atherosclerotic plaques, which are fat deposits within the artery walls.
- Accounts for 50-70% of all strokes.
- Results from accumulation of coagulated blood, plugs of tissue, or plaques *that remain at the point of formation*.

Cerebral Thrombosis 2

- Usually happens where blood vessels branch or at lesion sites on the vessel walls.
- Usually occur suddenly, but often take 1/2 hour to develop fully.
- Occasionally (up to 1/3 of cases) evolve for hours or days.
- Often preceded by TIA's (50-80% of cases)

Emboli



Blockage of a blood vessel by abnormal particle circulating in the blood

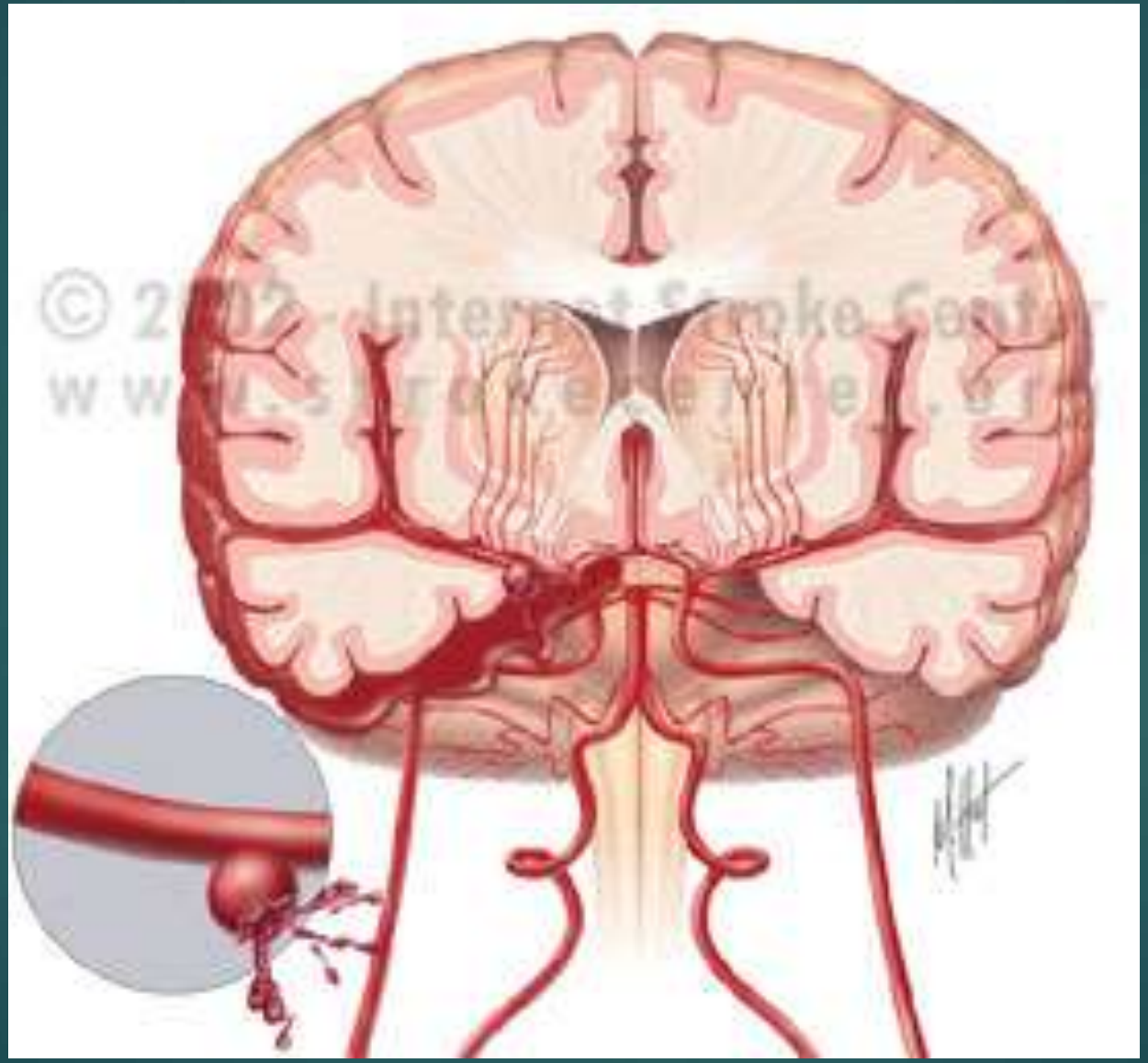
Embolic disease

- Emboli travel from heart or arteries: platelet aggregates, calcium particles, cholesterol crystals, air, fat
- Tend to have abrupt onset without warning precursors such as TIA or headache
- Predilection for middle cerebral artery

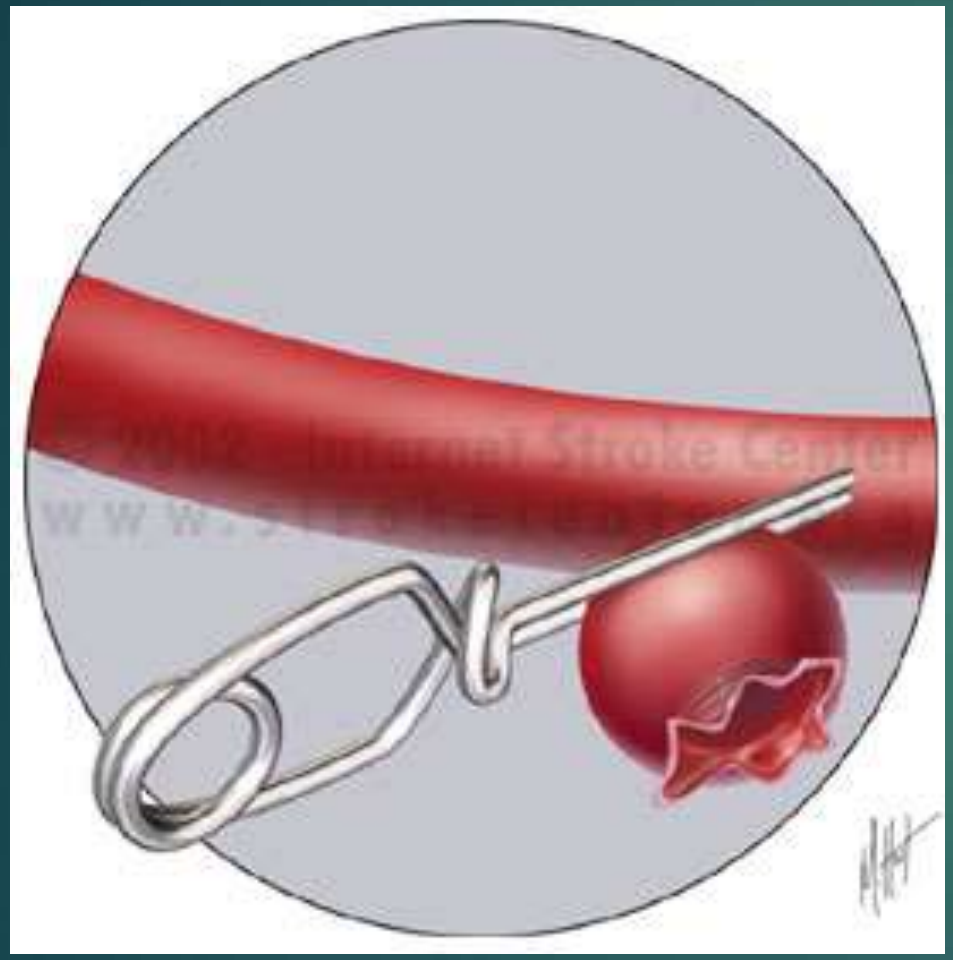
Hemorrhagic Stroke

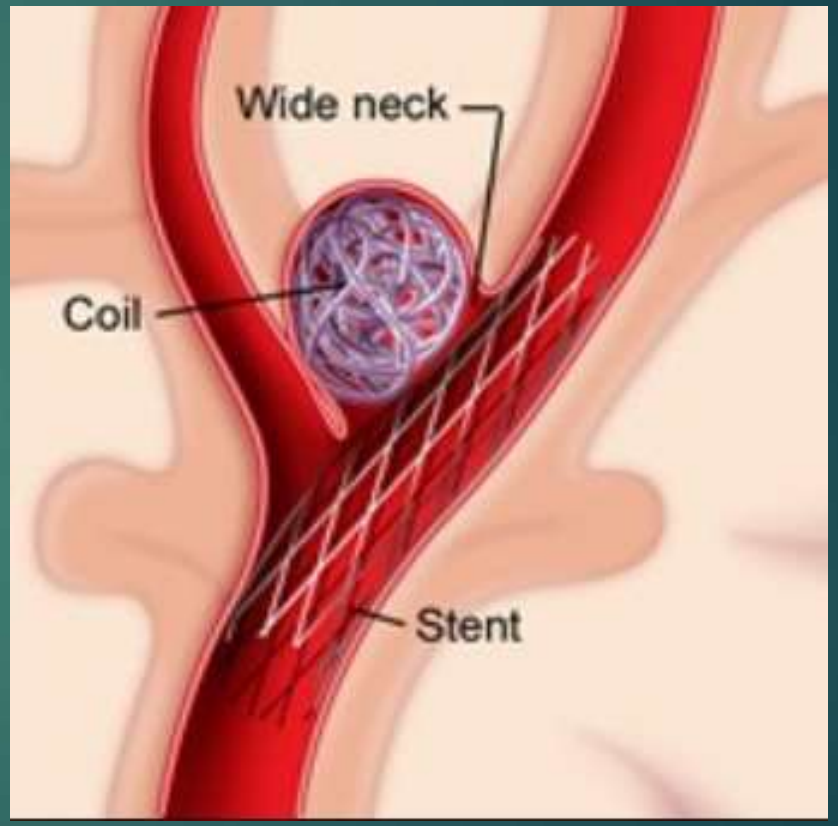
- Rupture of a blood vessel: a non-traumatic bleeding into the brain; classified by location; Accounts for 12% of all strokes
- Due to
  - hypertension (the major risk factor for intracerebral)
  - arteriovenous malformations (AVM); major risk factor for subarachnoid
  - tumors, bleeds due to TBI
  - Improper use of anti-coagulants (Warfarin)
  - speed/stimulants,
  - ruptured aneurysm (branch points of circle of Willis): common cause of subarachnoid hem.)

Subarachnoid hemorrhage



Aneurysm clipping & coiling





Warning signs of hemorrhagic stroke

- Painful headaches
- Nausea and vomiting
- Focal neurologic signs

Silent strokes

- Strokes that go unnoticed until CT or MRI reveals them
- Tend to be small, lacunar lesions situated deep in brain structures
- Sudden change of behavior in an elderly person may be caused by a silent stroke
- 11% of strokes; most in basal ganglia (52%),
- White matter lesions (WMLs) are even more common; start at 30; everyone by old age

Outcome statistics for stroke survivors

- 20% live in SNFs or private hospitals
- 50% live without institutional care (with assistance)
- Only 30% remain independent in ADLs
- Pts w/stroke account for more hospital and SNF bed days than any other condition
- Lifetime costs range from $59,800 to $230,000 per stroke patient

(Barker-Collo & Feigin, 2006)

Outcome of Strokes

- 26% of 1st ever stroke had impaired Mental Status 1 month following; 21% at 6-12 months
- 35% have cognitive impairment
- Dependent living if cog. impairment
- Level of cog decline at 3 months predicts that at 12 months
- Predictors of dependency include sustained attention, praxis, emot. control, and memory

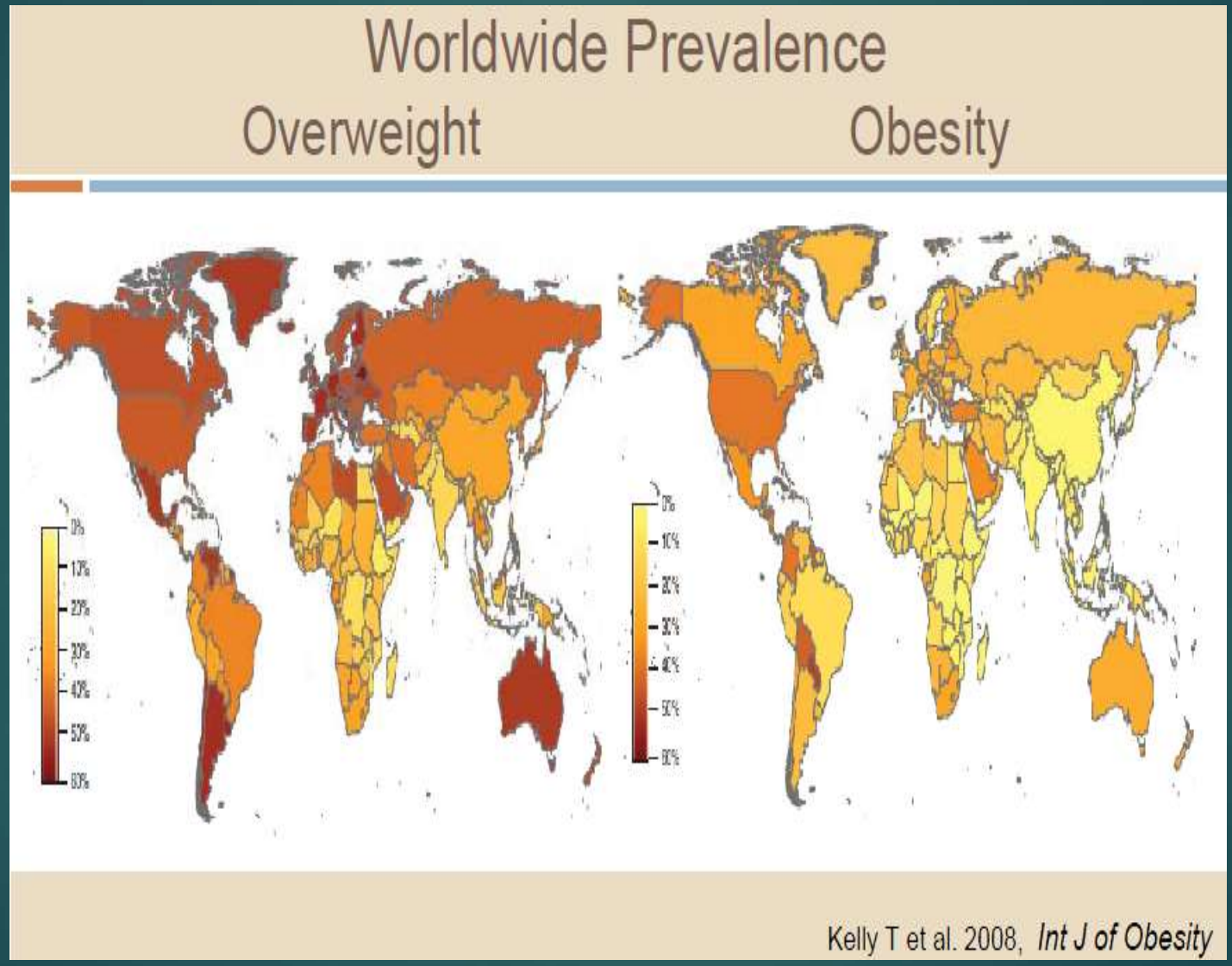
Southern Stroke Belt

- People born in the Southern "stroke belt" (NC, SC, TN, AR, MS and AL) have a higher risk of dying from stroke as adults, even if they later move away.

- Also higher rates of CV disease, and cognitive deficits.

- Higher rates of hypertension, low SES, high fat diet, cultural lifestyle, quality of health care facilities, smoking, and infections.

Obesity


Worldwide Prevalence
Overweight
Obesity
Kelly T et al. 2008, Int J of Obesity

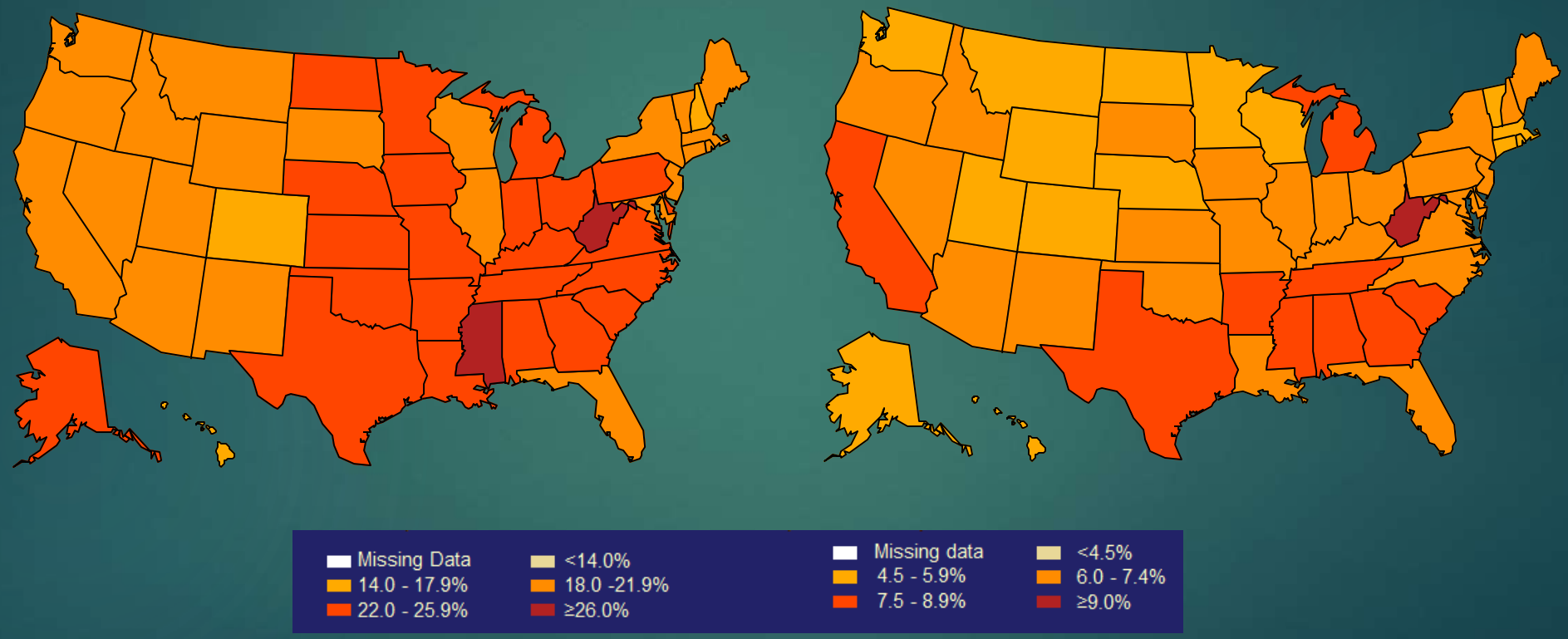
We are overweight

- 50% of US adults are overweight
- 22% of US adults are obese (30 lbs.)

Run 1 mile = 100 calories

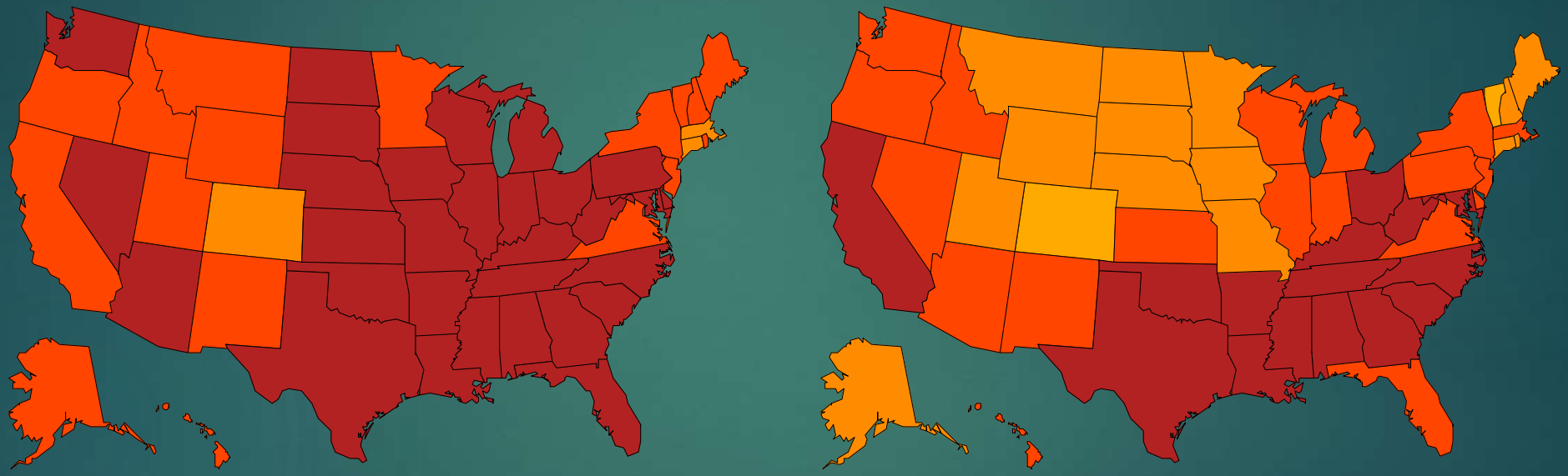
Age-adjusted Percentage of U.S. Adults Who Were Obese or Who Had Diagnosed Diabetes

2002

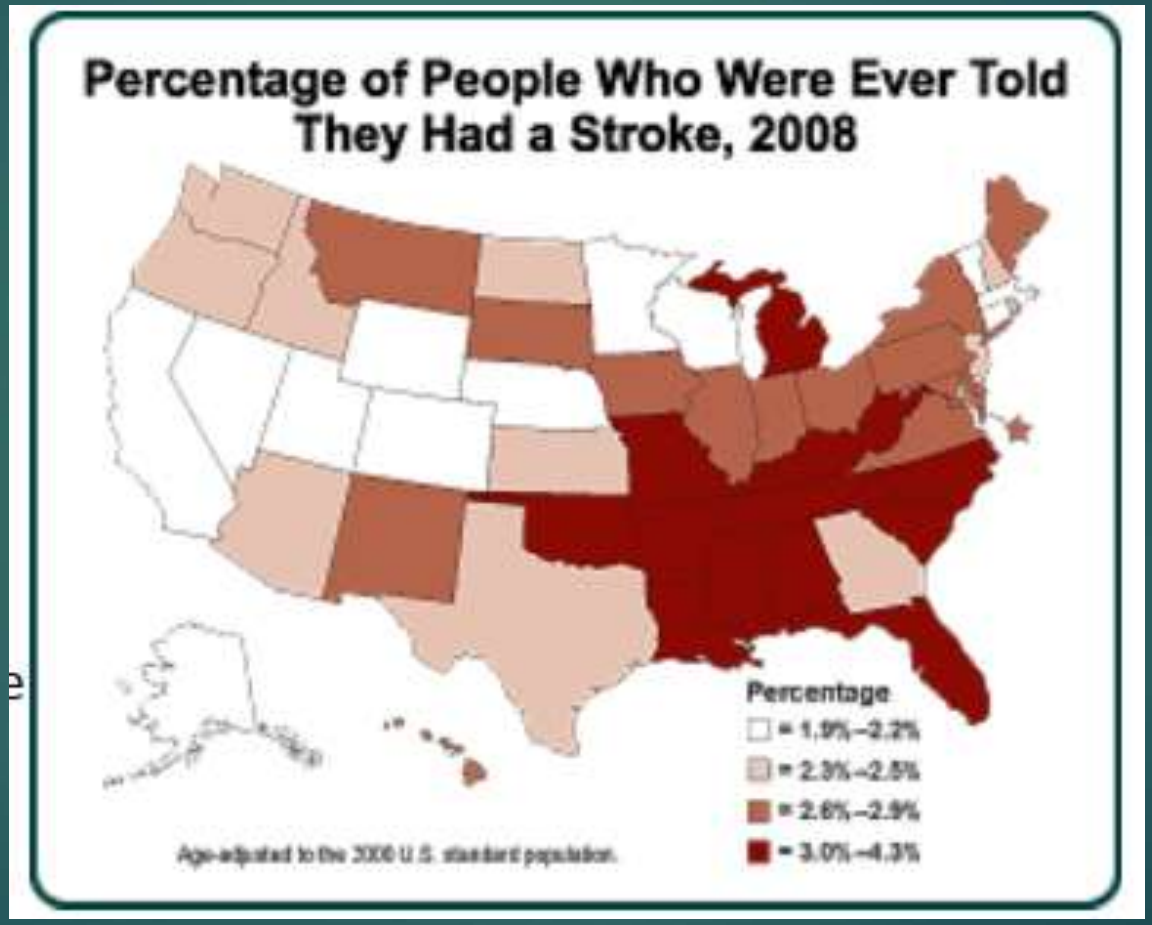


Obesity **Diabetes**

2009

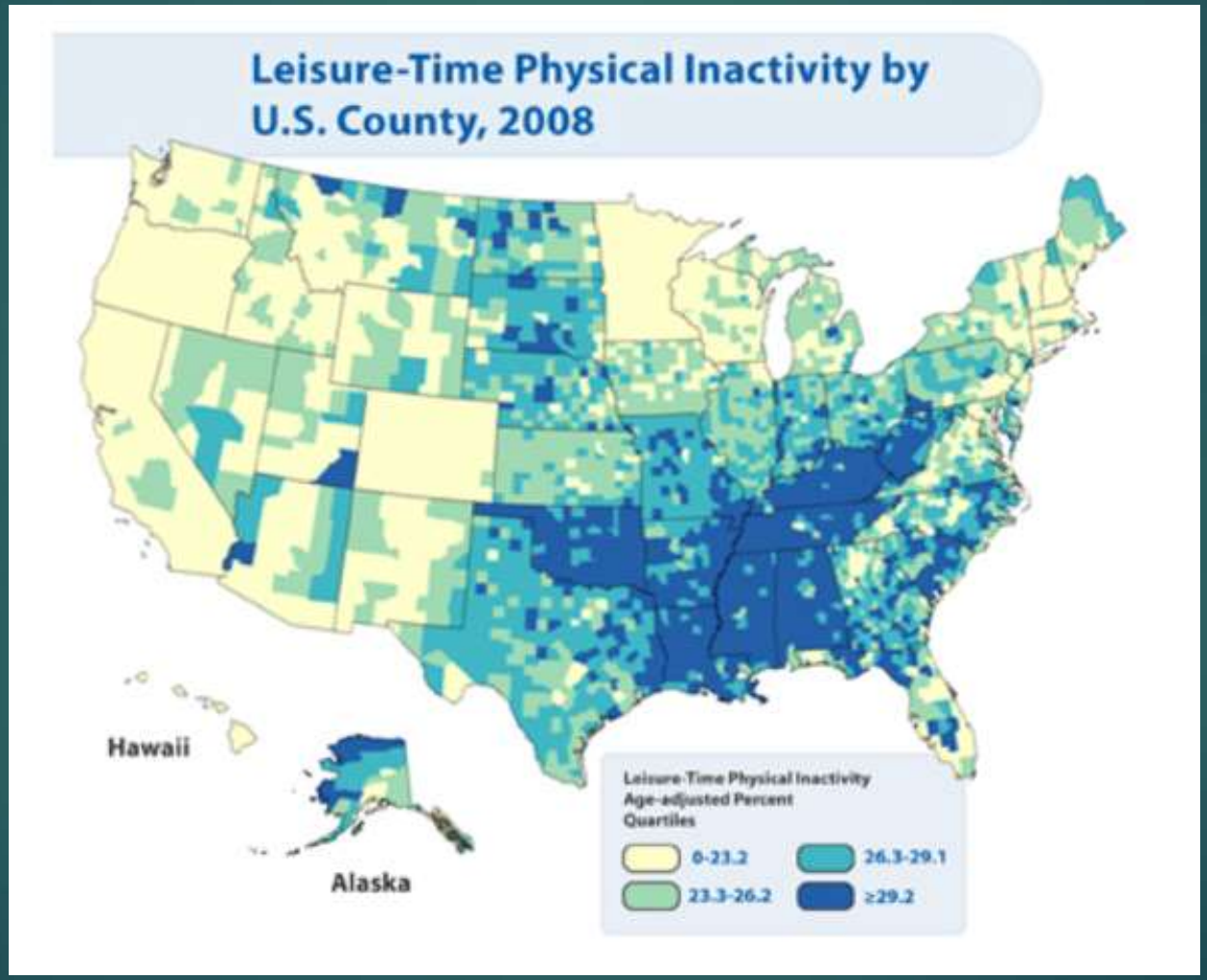


CDC % Stroke



Highly tied to high consumption of fried and processed foods

CDC Physical Inactivity



Risk factors for Stroke

- 1 – Age: most important; after 55, risk doubles each decade
- 2 – Genetics
- 3 – Ethnicity:
  - African American (higher HTN, DM), Hispanics (DM, cholesterol)
  - AA, Hispanics, Asians > hemorrhagic

Modifiable Risks for Strokes

- 4 – Hypertension: single most important factor, esp. for ischemic strokes
  - Even borderline HTN have 50% increase
  - 38% reduction in strokes in treated HTN
- 5 – Heart Disease
- 6 – DM/hyperglycemia: 4x greater risk; atherosclerosis accounts for 80% of mortality of DM pts

Modifiable Risks for Strokes

- 7 – Lipids ↑(cholesterol, LDL, HDL); Hyperlipidemia - >240mg/dl: 36% of people
- 8 – BMI: BMI>30 = obesity; association between BMI and Ischemic heart disease is continuous; any increase in BMI increases the risk of CVD;
- 9 - Smoking
- 10- Homocysteine
- Also Sickle cell disease & Coagulation disorders

Novel risk factors

- Infection and inflammation (Chlamydia, Helicobacter pylori, Cytomegalovirus, Herpes virus, Periodontal disease)
- Leisure time inactivity
- Fast food restaurant abuse (Increased trans fatty acid intake from fried foods)
- Second hand smoke

Stroke Prevention Treatments: See Your Doctor

- Daily Aspirin: if history of heart disease (heart attacks, stokes, or angina); diabetes; risks for the development of heart disease (high blood pressure, high cholesterol, or are a smoker)
- Anticoagulant Therapy (Aspirin or Warfarin): atrial fib
- Blood pressure meds
- Cholesterol meds: statins
- Any heart meds
- Physical activity: will ↓ insulin resistance, LDL and weight & will ↑ HDL
- Weight control: your diet

Chronic Depression increases Stroke Risk

- Depression is a risk factor for stroke
- LF Stroke often produces depression
- Risk is higher if have past hx of depression
- Treatment can improve both depression and cognitive effects.

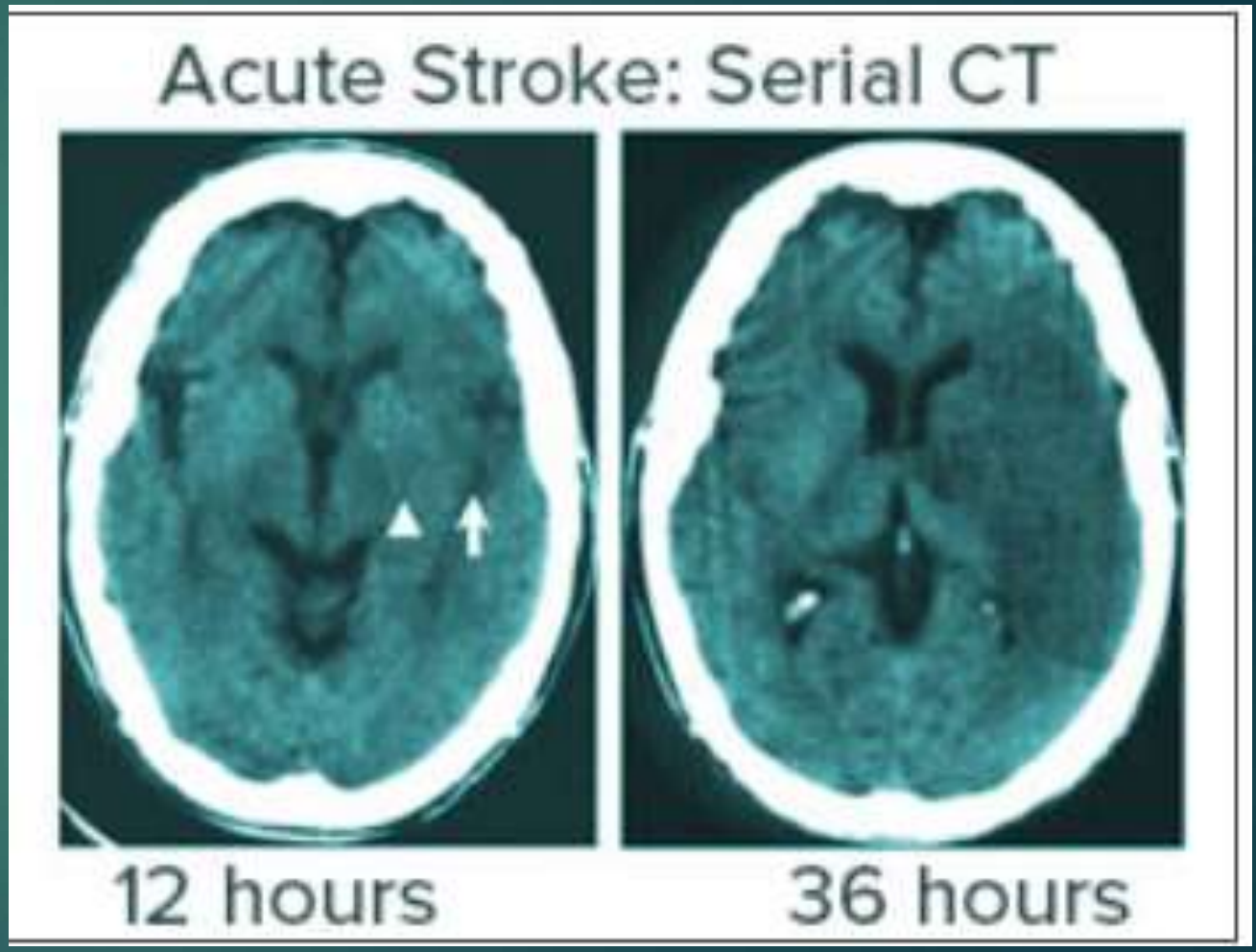
Sleep Apnea is a stroke risk

- Obstructive sleep apnea is associated with an increased risk of stroke in middle-aged and older adults, especially men.
- Men with moderate to severe sleep apnea were nearly three times more likely to have a stroke.
- In women, however, the increased risk of stroke was significant only with severe levels of sleep apnea.

Susan Redline, 2010

Evaluation of Stroke

- Noncontrast CT scanning is the most commonly used form of neuroimaging in the acute evaluation of patients with apparent acute stroke.



Acute Stroke Treatments

- **Ischemic stroke** (brain clot)
  - Clot busting medication: tPA (tissue plasminogen activator)
  - Clot-removing devices: Merci Retriever, Penumbra
- **Hemorrhagic stroke** (brain bleed)
  - Clipping
  - Coiling

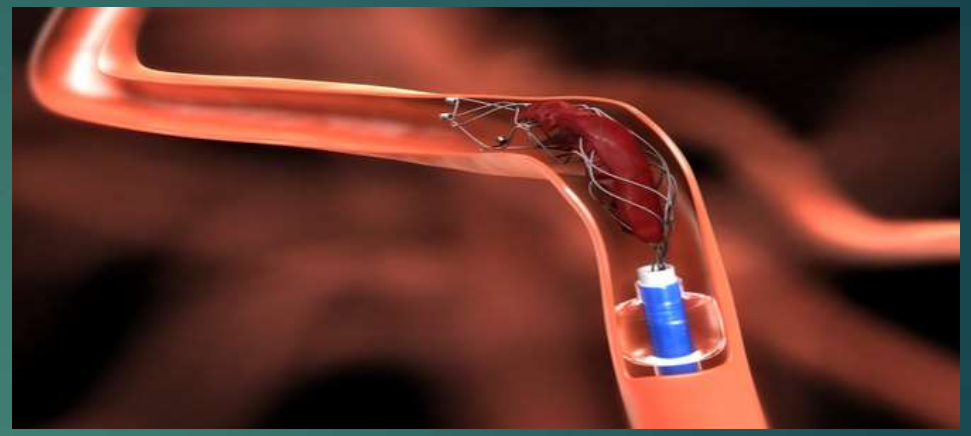
Treatment of ischemic stroke

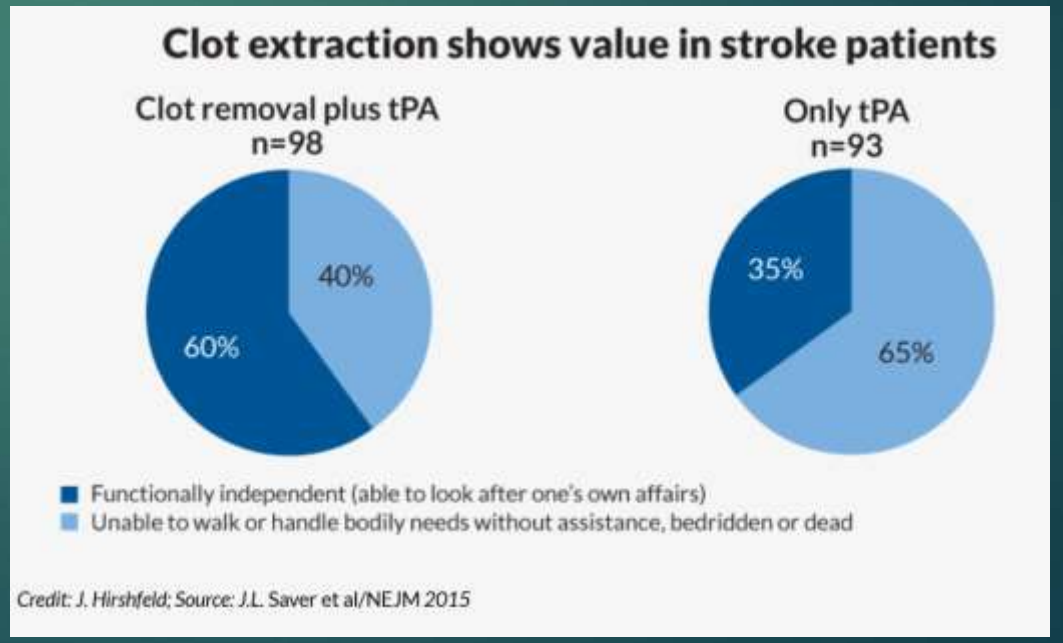
- The only fibrinolytic agent that has been shown to benefit selected patients with acute ischemic stroke is alteplase.
- While streptokinase may benefit patients with acute myocardial infarction, in patients with acute ischemic stroke, it increases the risk for intracranial hemorrhage and death.

- Fibrinolytics (ie, tPA, tissue plasminogen activator) restore cerebral blood flow in about 30% of patients with acute ischemic stroke; good if within 3 to 4.5 hours after stroke.
- Proper patient selection and protocol adherence is essential because fibrinolytics may also cause symptomatic intracranial hemorrhage.

Solitaire, a clot retrieving device

- A clot retrieval stent can extract 80-90 % of strokes; dramatically better if pt is awake during procedure.
- If within 6 hours of stroke
- tPA can still be used.





Beware…

- Chiropractic neck maneuvers
- Yoga neck and plough positions
- Both can produce strokes

Prevention of CV disease

- Reducing high blood pressure, esp. in mid life.
- Control high cholesterol and abnormal blood sugar
- Smoking cessation
- Increase physical exercise
- Consume a moderate level of alcohol (i.e., up to 2 drinks for men and 1 drink for non-pregnant women) for those who currently consume alcohol
- Maintain a healthy weight

Alcohol

- J shaped relationship with ischemic stroke
  - 1-2 drinks/day = lowest risk
  - >5 drinks/day = highest risk
- Linear relationship with hemorrhagic stroke
- Wine associated with reduced risk in ischemic stroke

CMAJ 2008;179(12 Suppl):E1-E93.

Preventable Cardiovascular Risk Factors:

Stop Strokes & Heart attacks

- Cigarette smoking
- Poor nutrition
- Physical inactivity
- Excessive alcohol use
- Hypertension
- High cholesterol
- Diabetes
- Metabolic Syndrome (Insulin resistance)
- Atherosclerosis→ Impaired cerebral blood flow →Brain infarction (stroke)

7 cardiovascular health metrics

- Presence of a greater number of cardiovascular health metrics is associated with a graded and significantly lower risk of total and CVD mortality
- 1 Not smoking
- 2 being physically active – 3-5x per week
- 3 having normal blood pressure - <120/<80 mm Hg
- 4 blood glucose - less than 100 mg/dL
- 5 total cholesterol levels - level less than 240 mg/dL
- 6 weight - BMI less than 30
- 7 eating a healthy diet: (fruits and vegetables (≥4.5 cups/d), fish (≥two 3.5-oz servings/wk), fiber-rich whole grains (≥three 1-oz–equivalent servings/d), sodium (<1500 mg/d), & sugar-sweetened beverages (≤36 oz/wk))

Most Strokes Can Be Prevented; 1 in 6 People Will Have a Stroke

- Know your personal risk factors: high blood pressure, diabetes, and high blood cholesterol.
- Take your medications faithfully.
- Be physically active and exercise regularly.
- Avoid obesity by keeping to a healthy diet.
- Limit your alcohol consumption.
- Avoid cigarette smoke. If you smoke, seek help to stop.
- Learn to recognize the warning signs of a stroke.

Hormone Replacement Therapy as risk

- Increased risk of ischemic stroke associated with HRT in postmenopausal women.

- This was confirmed in recent meta-analyses showing a 30% increased risk of stroke, identical for estrogens alone or in combination with progestogen.

Cognitive deficits post stroke

- Cognitive deficits are common after stroke and are predicted based on stroke type, vessels affected and location of injury
- Also influenced by underlying CVD variables
- NP deficits post stroke improve over time and tend to recover over time.

Left-Hemisphere strokes

- Speech and language disorders
- Right-sided hemiplegia (paralysis) or hemiparesis (weakness)
- Depression, catastrophic reactions

Right-Hemisphere strokes

- Perceptual and visuospatial distortions
- Left hemiplegia or hemiparesis
- Left-sided inattention/neglect: 45%
- Restricted emotional expression
- Anosognosia (lack of awareness of deficits)

Right-Hemisphere strokes 2

- Inability to interpret implicit messages
- Inability to interpret the speaker’s intent or mental state
- Lack of empathy (RH stroke: higher divorce rates)
- Impaired learning of the topography of new settings

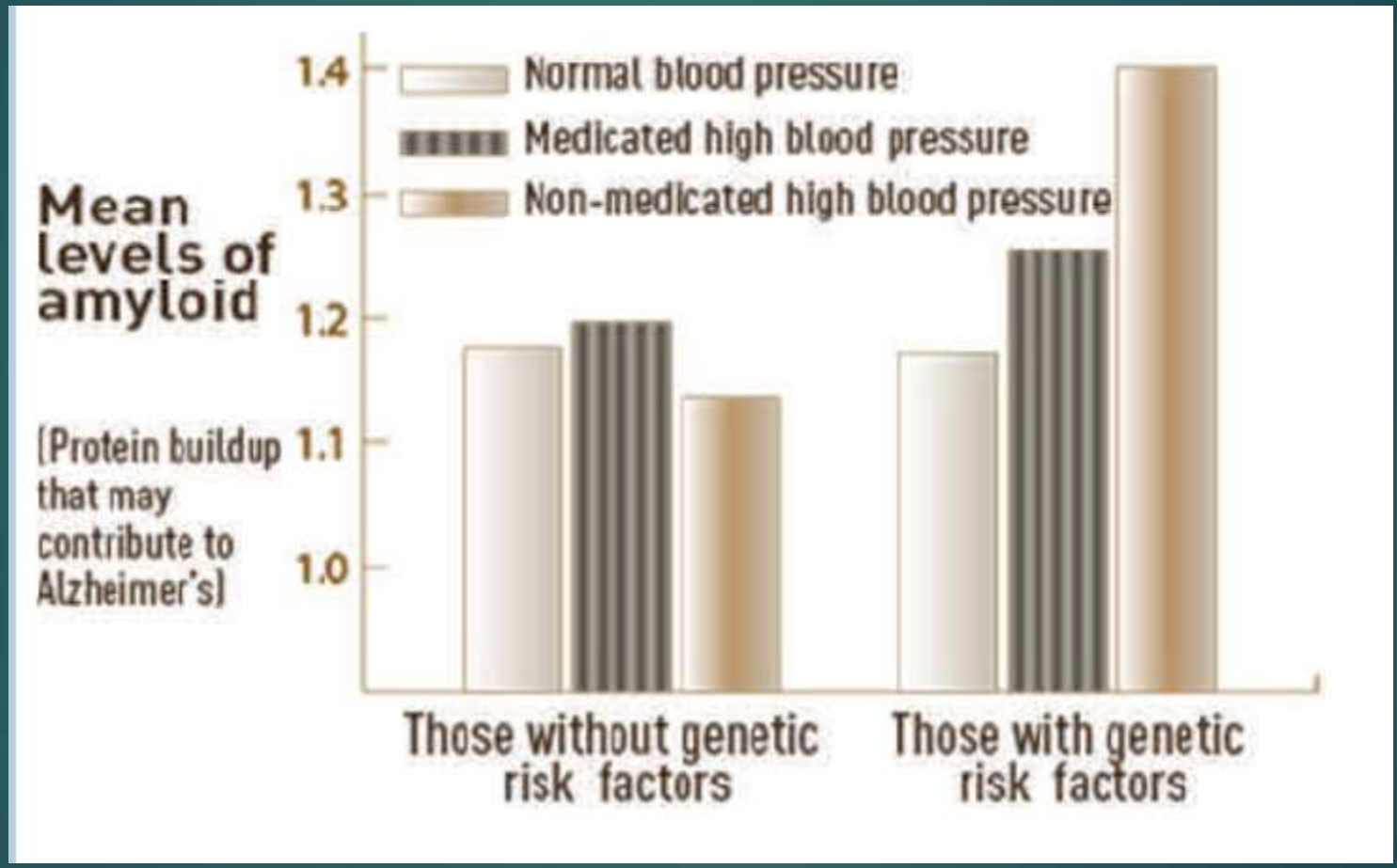
Frontal strokes

- Often caused by blockage or bleed from anterior communicating artery
- Executive function deficits
- Flat affect
- Decreased motivation and initiation
- Apathy
- Disinhibition

AD and CVD

- Increasing evidence that AD has a vascular component
- Major NCD is often “mixed” with both AD and vascular pathology

Hypertension Increases Beta Amyloid



Bad news: APOE4 & non-medicated hypertension

Vascular and Alzheimer's dementia: You often get both

- Almost half of those with clinically probable Alzheimer disease have mixed pathology, most commonly Alzheimer disease and infarcts

- Infarcts are additive with Alzheimer disease pathology in lowering cognitive function and increasing the odds of dementia or clinical Alzheimer disease.

Subcortical Ischemic Vascular Dementia

- 2nd most common dementia
- Sudden, stepwise, focal, often motor
- 2 subcortical types:
  - Lacunar
  - Binswanger's: periventricular, white matter

Risk Factors for Vascular Dementia

- Atherosclerosis:
  - includes HTN, high cholesterol, diabetes, cigarette smoking
- Cardiovascular disease
- High blood hemoglobin concentration
- Advancing age
- Gender (men < women)
- Race
- Alcohol abuse/dependence, smoking
- Afib

Stroke Recovery

- 10 percent of stroke survivors recover almost completely
- 25 percent recover with minor impairments
- 40 percent experience moderate to severe impairments requiring special care
- 10 percent require care within either a skilled-care or other long-term care facility
- 15 percent die shortly after the stroke

Stroke Recovery 2: Characteristics associated with poor recovery

- Lower IQ
- Older age
- Larger lesion volume
- Greater severity of unilateral neglect
- Diabetes was the only vascular risk factor assoc w/poor recovery in a single domain (i.e., abstract reasoning)
- Loss of consciousness (Ebrahim & Harwood 1999 and others)

Stroke Recovery 3: Characteristics assoc with good recovery

- Higher IQ
- Younger age
- Smaller lesion volume
- No h/o prior Stroke
- Less severe initial neurological deficit
- Stroke involving cortical structures
- Left hemisphere lesions

Possible mechanisms of improvement

- “Hebbian learning mechanism”: involves experience-dependent dendritic sprouting (seen in normal learning)
- Neuronal regeneration
- Brain plasticity: peri-lesional changes and contralateral reorganization
- Cognitive reserve theory: pre-existing ability improves ability to create compensation strategies

The good news

- In a study by Shahar, et al 1995, rates of survival post-Stroke improved significantly between 1980 and 1990.
- Death within 2 years was 40% lower in 1990 than it had been in 1980
- Most of the improvement was attributable to improved odds of surviving ischemic stroke.
- No evidence of improved survival for hemorrhagic stroke.

Cognitive Assessment & Functional Outcome

- Cognitive factors are more important determinants of functional outcomes after stroke than physical disability

  (Barker-Collo & Feigin 2006)

- Cognitive abilities linked to functional outcome:

  Sustained attention, working memory

  Apraxia

  Pathological emotional reactions

  Language functions (e.g., verbal comprehension)

  Verbal memory (impairment linked to reduced functional independence)

  Verbal abstract reasoning

Recovery

- Majority of functional recovery from stroke occurs over the first few (3-6) months
- Less pronounced recovery occurs over the next 6-12 months
- After 12 months, improved functioning due to compensation and adaptation to deficits
- Marked variability of deficits

Lifestyle Changes for Survivors and Caregivers

- Daily living skills
- Dressing and grooming
- Diet, nutrition and eating difficulties
- Skin care problems
- Pain
- Sexuality/Intimacy
- Behavior
- Depression & Anger
- Emotional Liability
- One-sided Neglect
- Memory Loss
- Communication Problems

Stroke Rehabilitation

- Physical therapy (PT)
  - Walking, range of movement
- Occupational therapy (OT)
  - Taking care of one’s self
- Speech language therapy
  - Communication skills, swallowing, cognition
- Recreational therapy
  - Cooking, gardening

Types of Recovery Services

- Rehabilitation unit in the hospital
- In-patient rehabilitation facility
- Home-bound therapy
- Home with outpatient therapy
- Long-term care facility
- Community-based programs

Stroke Prevention

- Strokes are preventable!!

1. Know your blood pressure. Have it checked at least annually. If it is elevated, work with your healthcare professional to control it.
2. Find out if you have atrial fibrillation (Afib) – a type of irregular heartbeat. If you have it, work with your healthcare professional to manage it.
3. If you smoke, stop.

Stroke Prevention

4. If you drink alcohol, do so in moderation.

5. Know your cholesterol number. If it is high, work with your doctor to control it.

6. If you are diabetic, follow your doctor’s recommendations carefully to control your diabetes.

Stroke Prevention

7. Include exercise in your daily routine
8. Enjoy a lower sodium (salt) and lower fat diet
9. If you have circulation problems, work with your healthcare professional to improve your circulation.
10. If you experience any stroke symptoms, call 9-1-1 immediately. **Every minute matters!**

Lifestyle Modifications and Blood Pressure

Modification	Approximate Systolic BP Reduction (range)
Weight Reduction	5-10 mmHg/10kg
Adopt DASH eating plan	8-14 mmHg
Dietary sodium reduction	2-8 mmHg
Physical activity	4-9 mmHg
Moderation of alcohol consumption	2–4 mmHg

Keep your heart fit

- 1 - Get moving:
  - People who exercise regularly have a 30 to 40 percent lower risk of heart disease;
  - but prolonged sitting lowers levels of HDL (good) cholesterol, raises artery-clogging triglycerides, and decreases the insulin sensitivity that boosts the risk of type 2 diabetes.

- 2 - Eat more plants: people who eat 8 servings of fruit and vegetables daily--especially dark-green vegetables, orange fruit and vegetables, and citrus fruit--have a 17 percent lower risk of heart disease

Keep your heart fit 2

- Make plant foods and fish the centerpiece of your meals.
  - When you do eat meat or poultry, stick to 3-to-4-ounce portions and choose lean cuts.
  - Replace saturated fat, such as butter, with canola, olive oil, and other unsaturated oils.
- 3 - Relax

- 4 - Drink (a little): raise a low HDL (good) cholesterol level and reduces the risk of death from heart disease by about 25 percent. It may also help prevent type 2 diabetes and ischemic strokes, the kind caused by blood clots.

- 5 - Quit smoking: Smokers are 2 to 4 times more likely to develop heart disease than nonsmokers.

Charles J. Vella, PhD

- Download talk:
- www.charlesjvellaphd.com
  - Neuropsych Seminar
    - Logon: Kaiser
    - Password: Kaiser

- charlesvella@Comcast.net

- 415-939-6175