

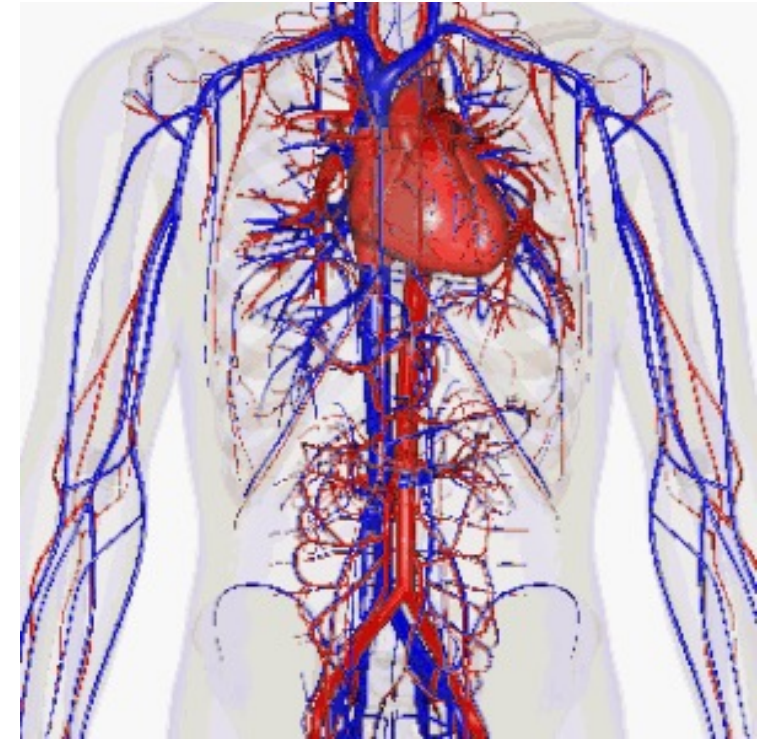
Vascular Disease

Exploring the development, treatment, and prevention...

Mini Med School

20 May, 2021

Nicole Cameron



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Medicine



University
of Victoria

let's talk  science

Territorial Acknowledgement

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and WSÁNEĆ peoples whose historical relationships with the land continue to this day.

Introductions and Disclosures

- About the optional survey – last chance!
- This talk will be recorded

Introductions and Disclosures

- I am a first year medical student
- This talk is intended for your entertainment and education, and is not meant to replace advice from your family physician or another health care professional
- All pictures used are free stock photos or photos available under a Creative Commons license unless otherwise noted
- Thank you for joining us!

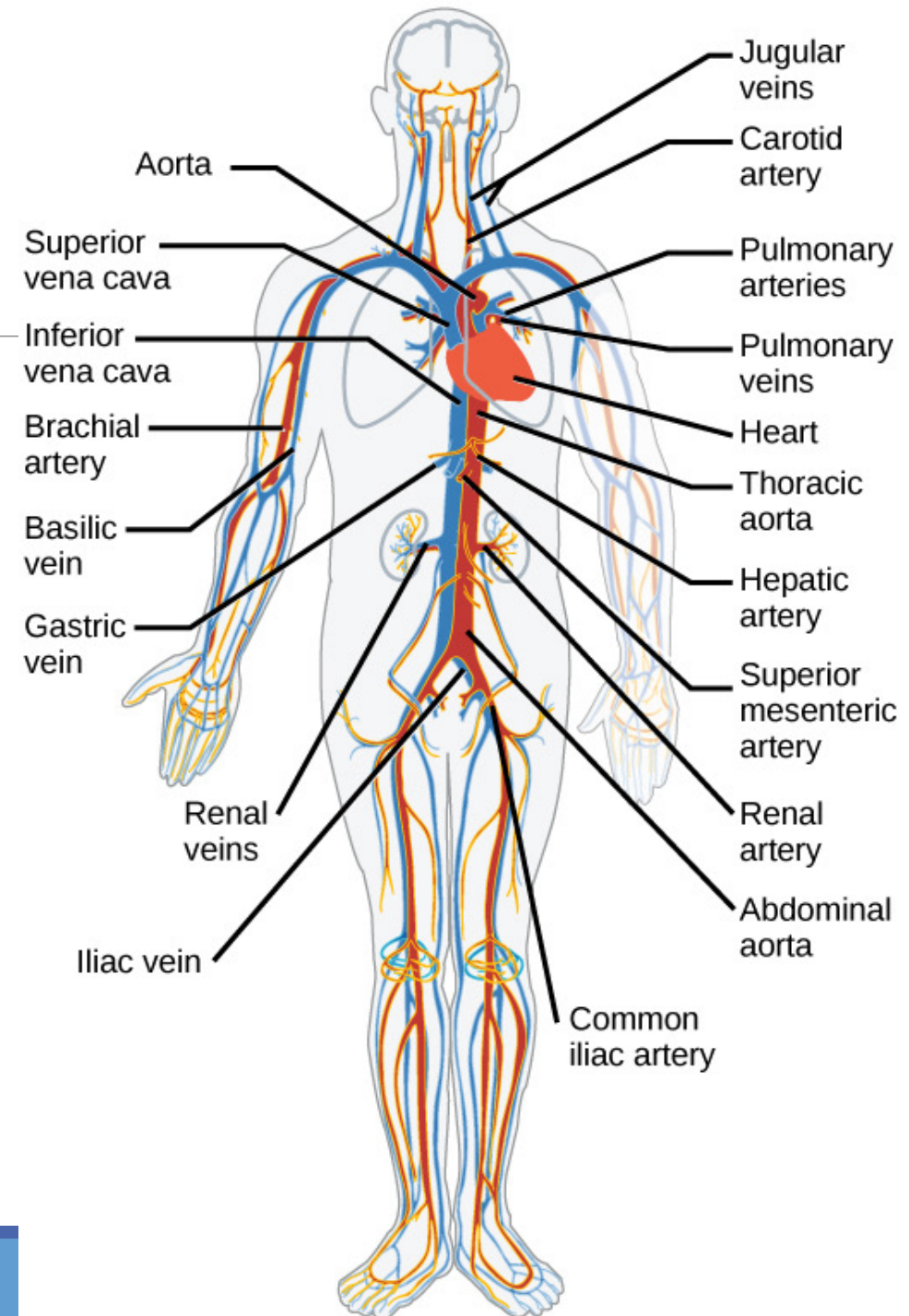
Agenda

- Blood vessels
 - Anatomy
 - Function
- Vascular disease
 - What it is
 - How it develops
- *Intermission*
- Q&A
- Health outcomes
- Treatments
- Prevention
- Suggested Resources
- Q&A



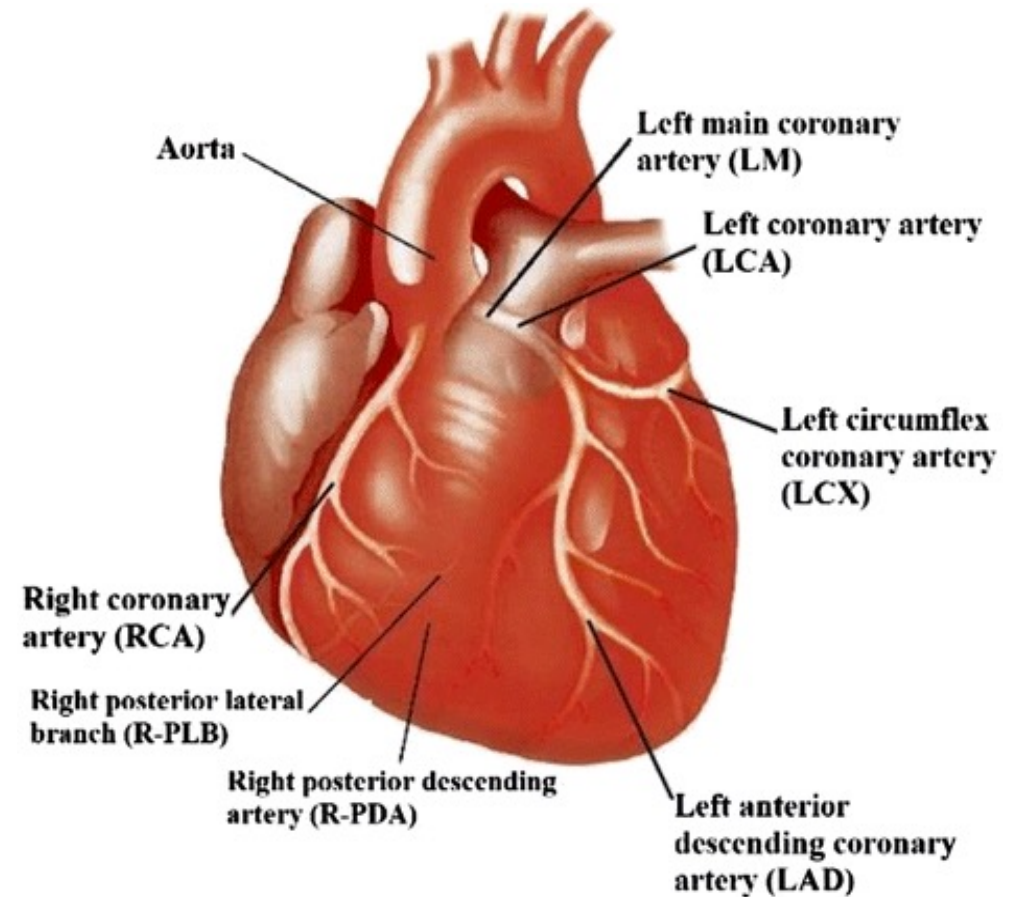
Blood Vessels - Anatomy

- Arteries
 - Blood *away* from the heart
- Veins
 - Blood *toward* the heart
- Capillaries
 - Gas exchange



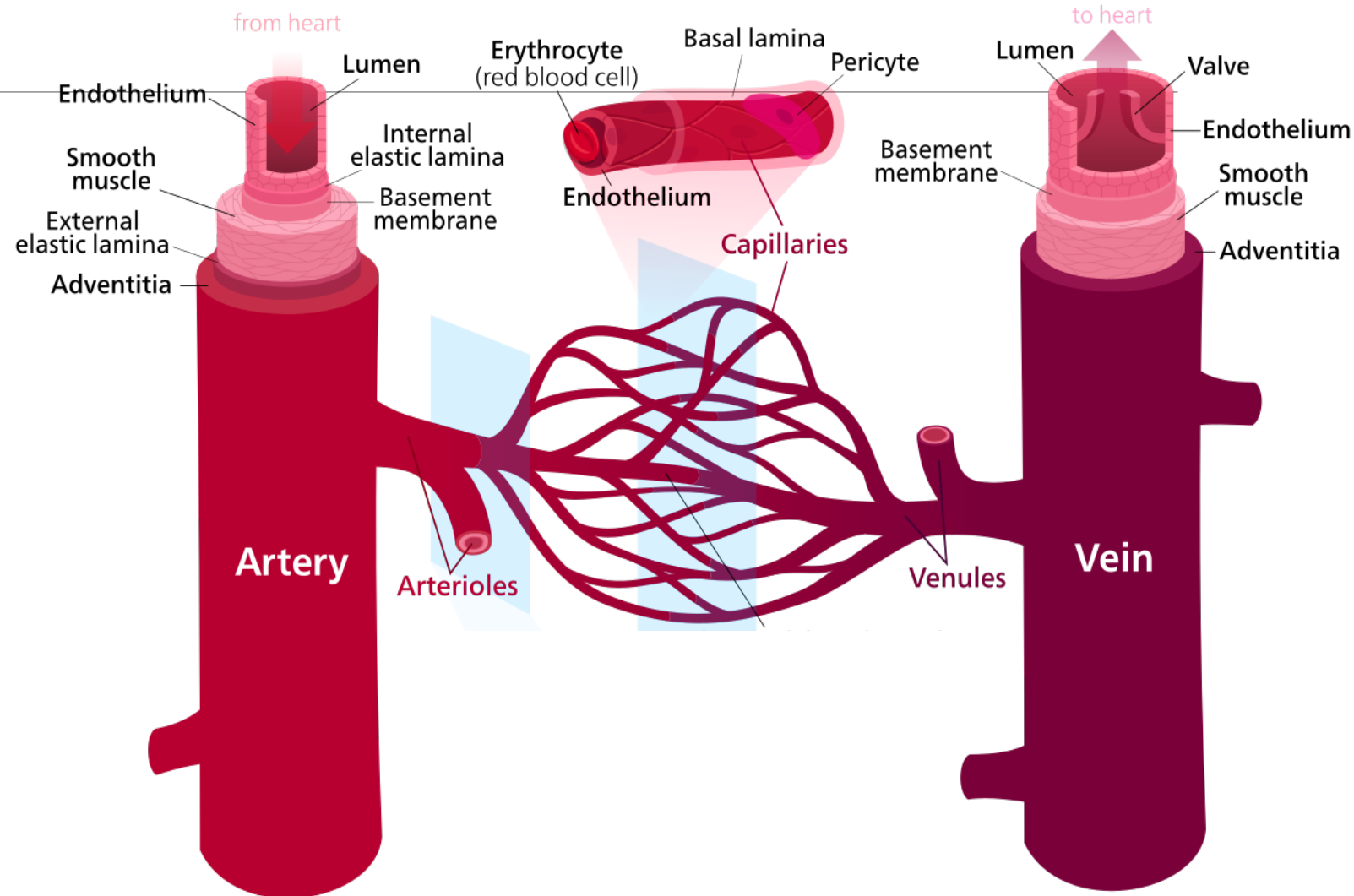
Blood Vessels - Anatomy

Coronary Arteries



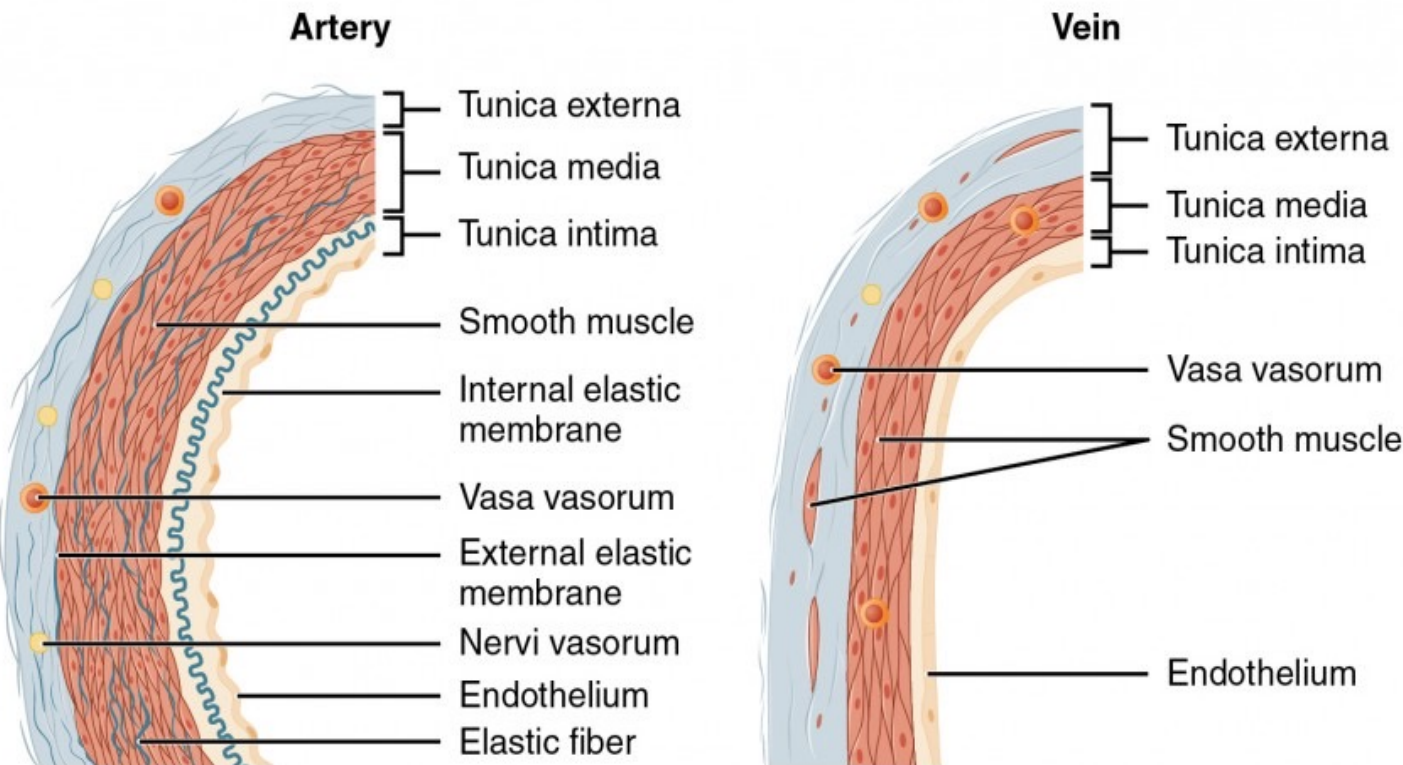
Blood Vessels – Structure and Function

- Arteries and veins have 3 layers
 - Tunica externa
 - Tunica media
 - Tunica intima
- Capillaries have 1 layer
 - Endothelium

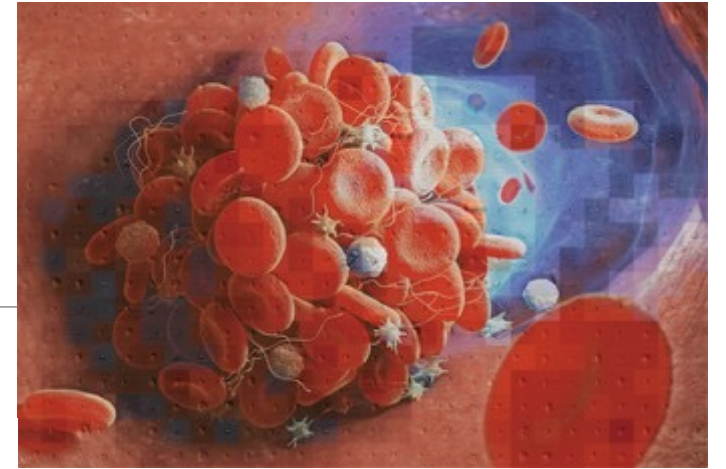


Blood Vessels – Structure and Function

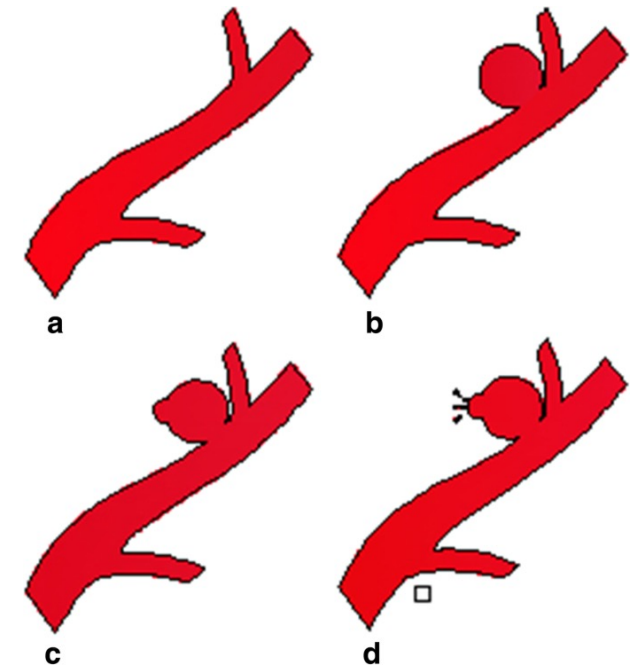
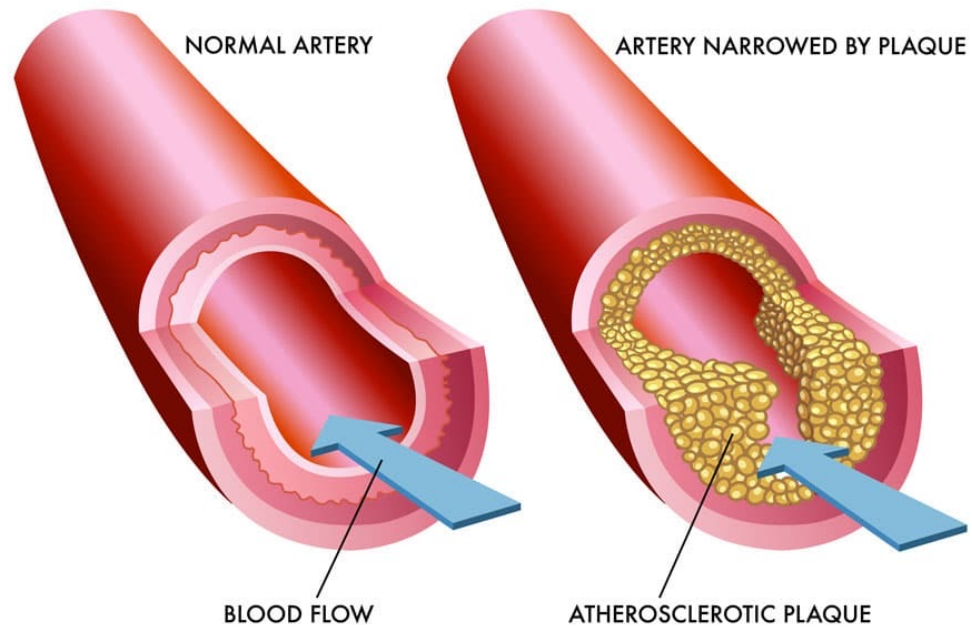
- Arteries have thick walls to withstand the high pressure created by the heart
- Veins have thinner walls and special valves



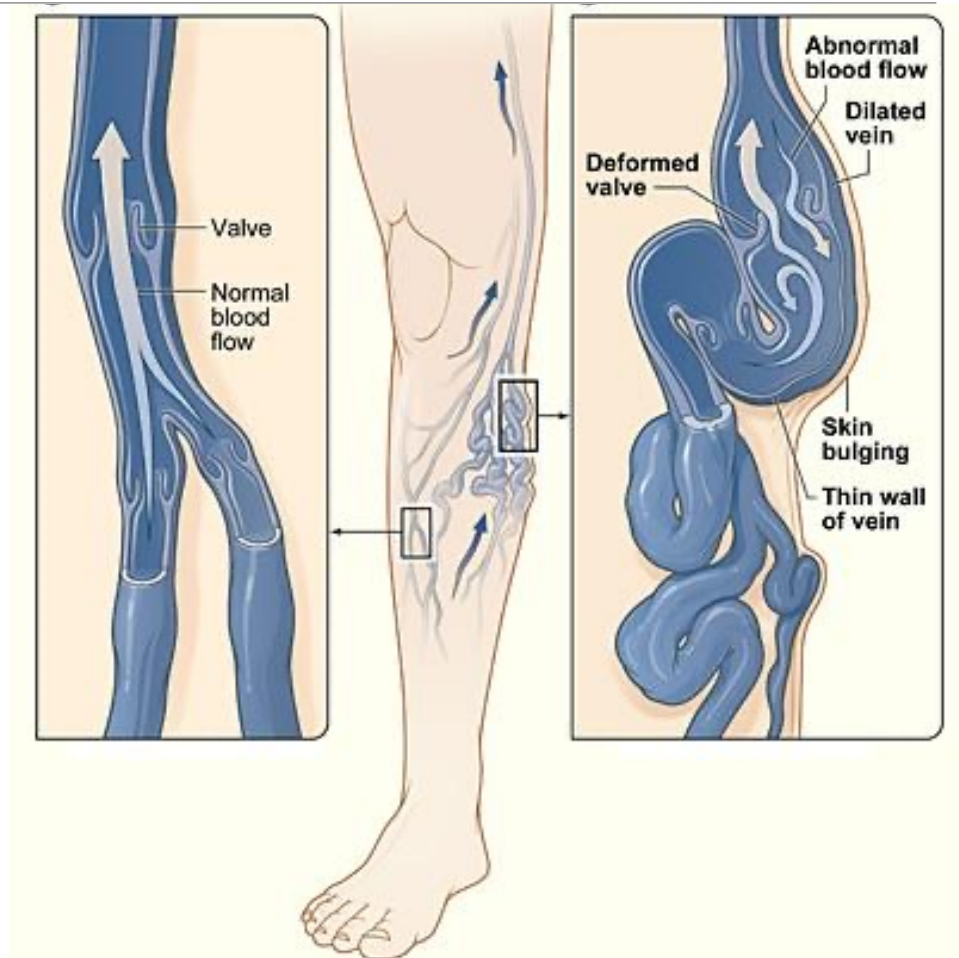
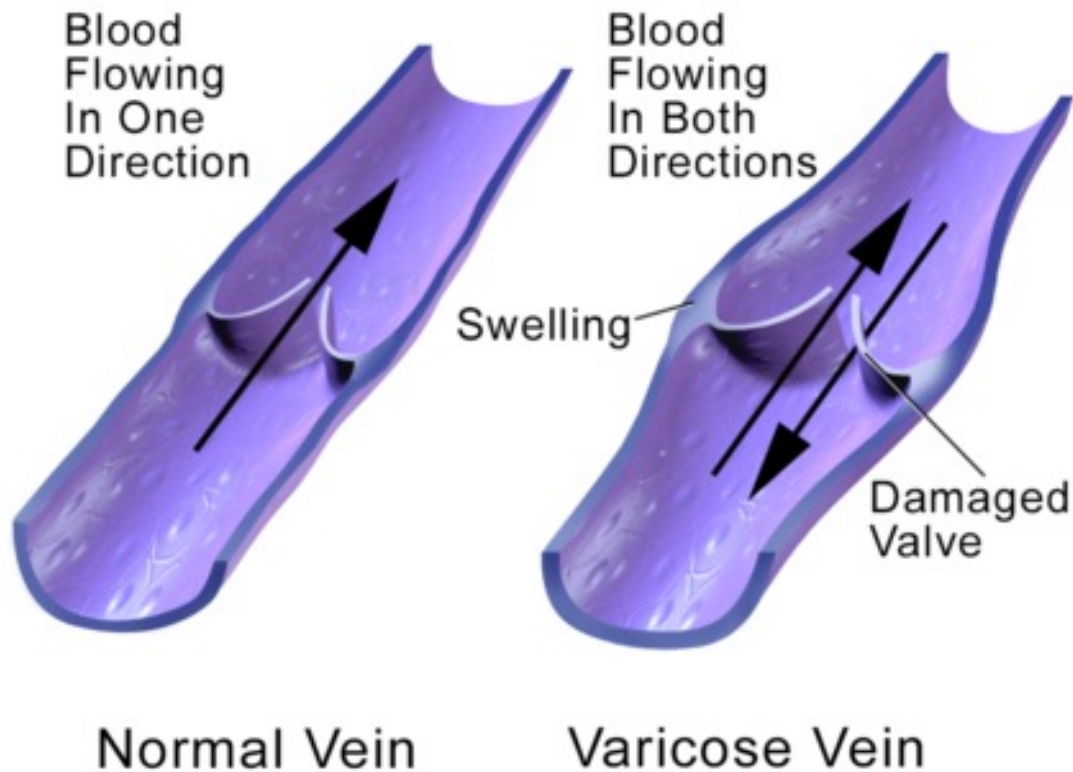
Vascular Disease



ATHEROSCLEROSIS



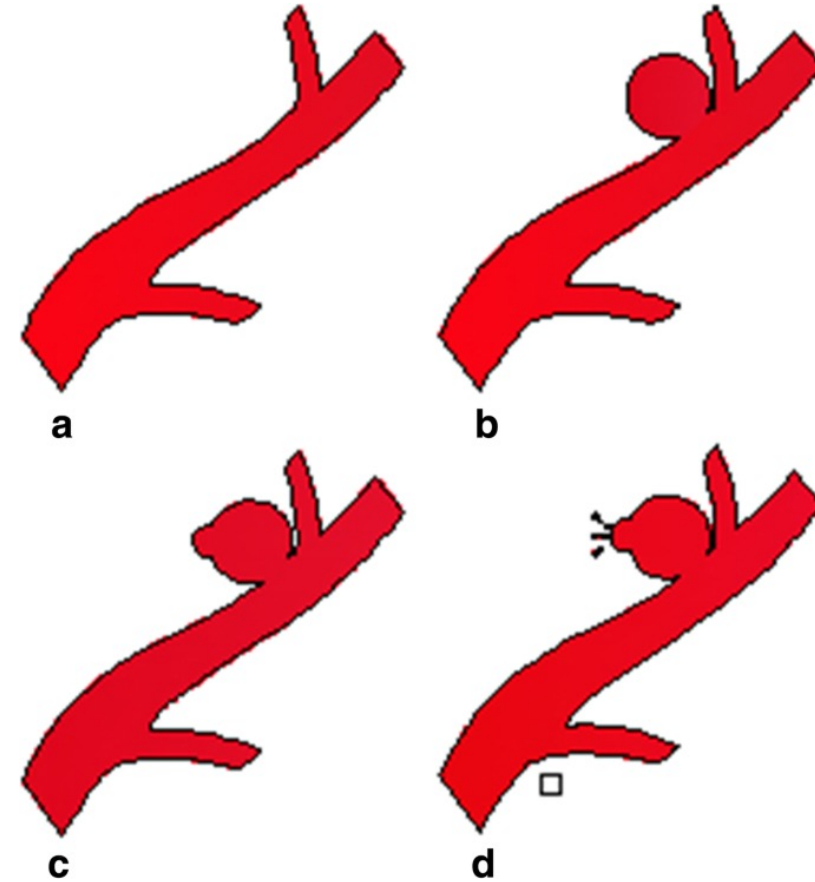
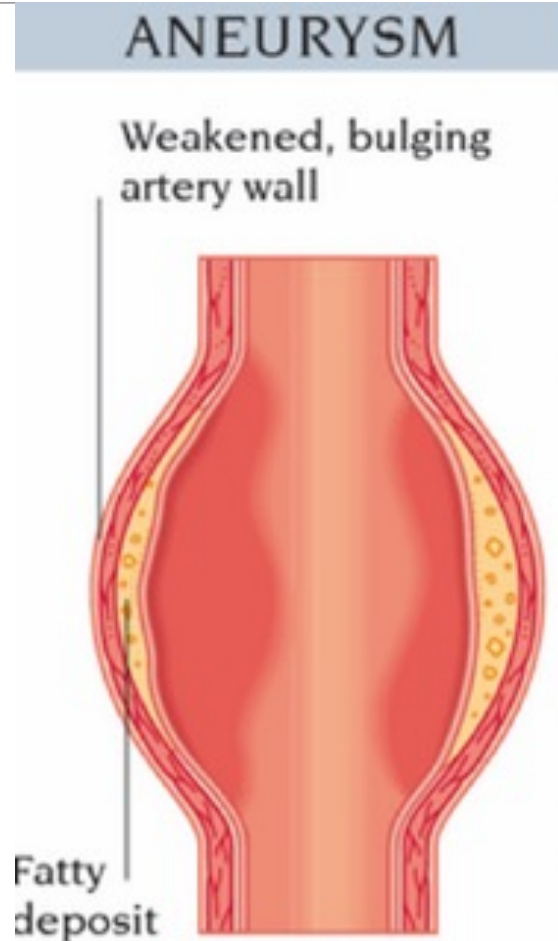
Vascular Disease – Varicose Veins

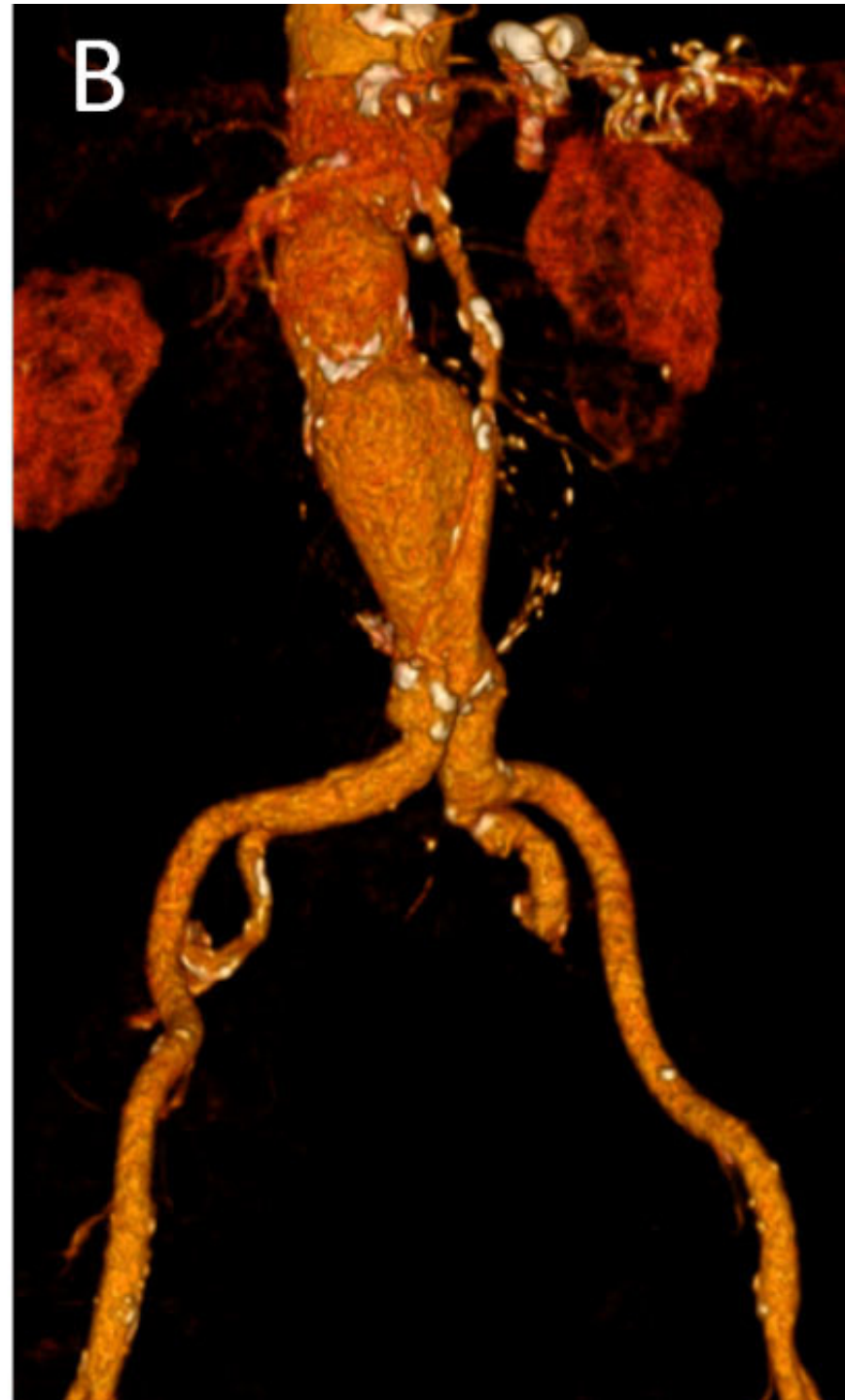
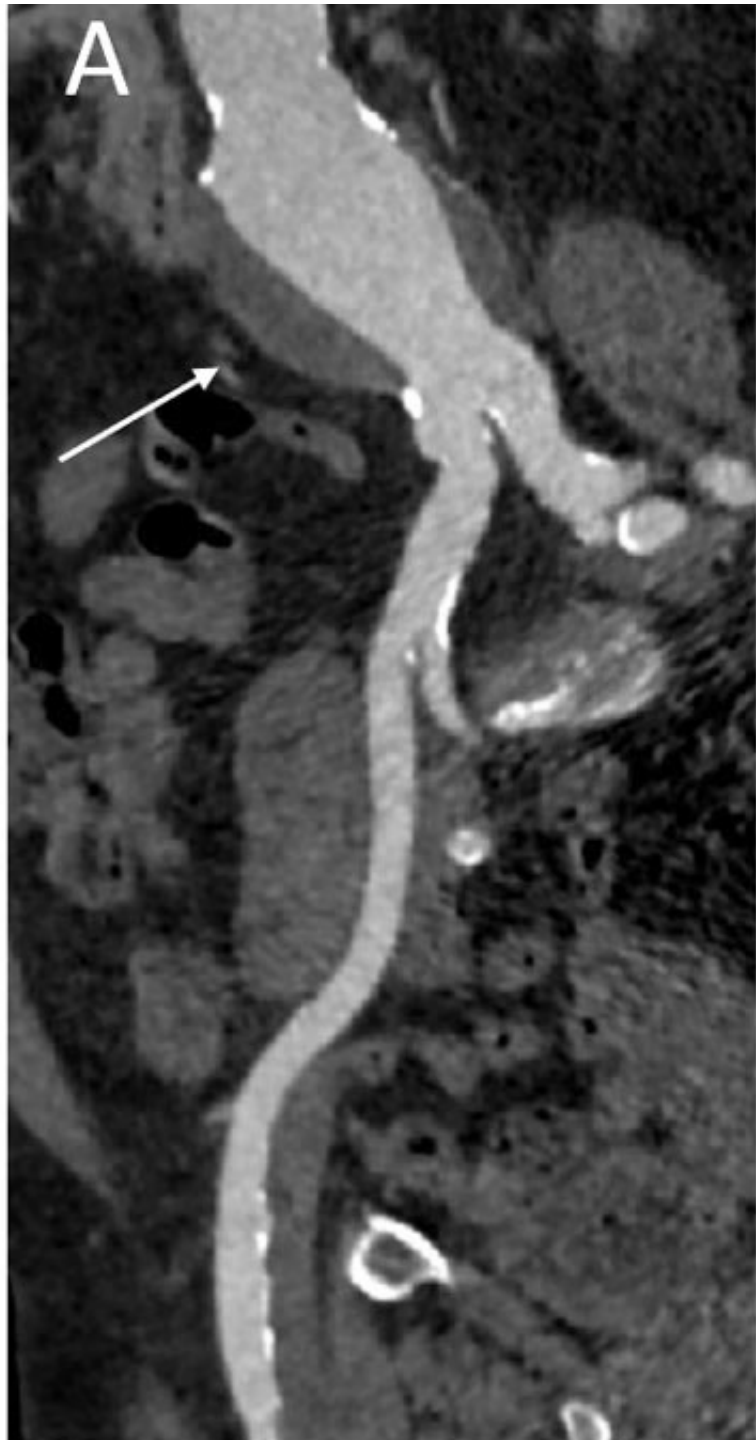


Vascular Disease – Varicose Veins

- Not a serious health risk, so don't need to be treated unless causing discomfort
 - Some people opt for treatment for cosmetic reasons
 - Treat by sealing off the vein with heat (endothermal ablation)
 - Treat by surgically removing them (vein stripping)
 - Horse chestnut extract (Venastat) can reduce symptoms of pain related to varicose veins

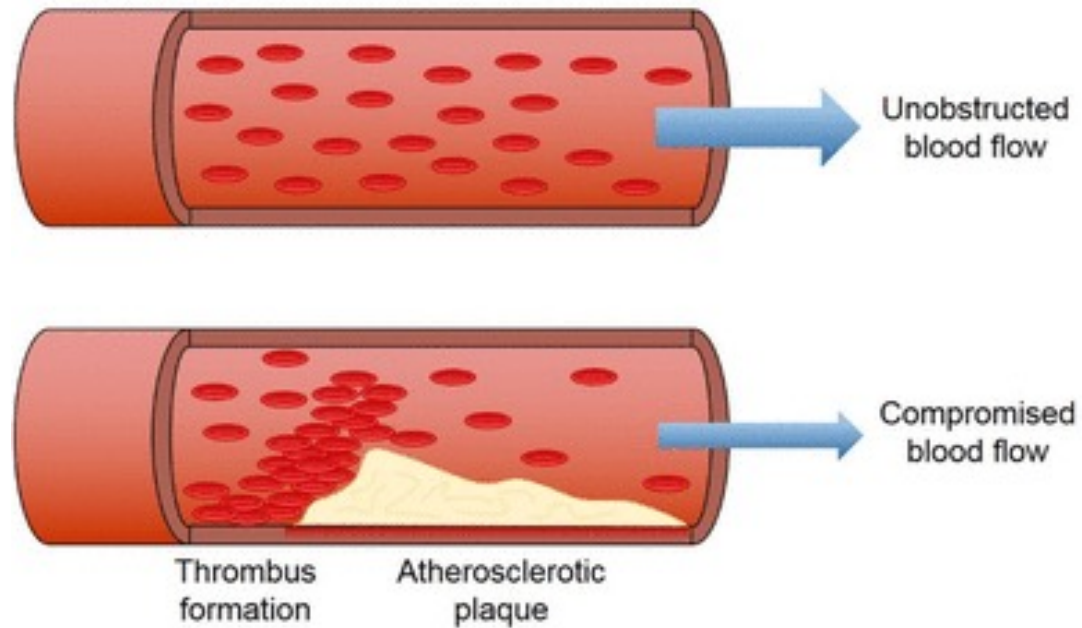
Vascular Disease - Aneurysm



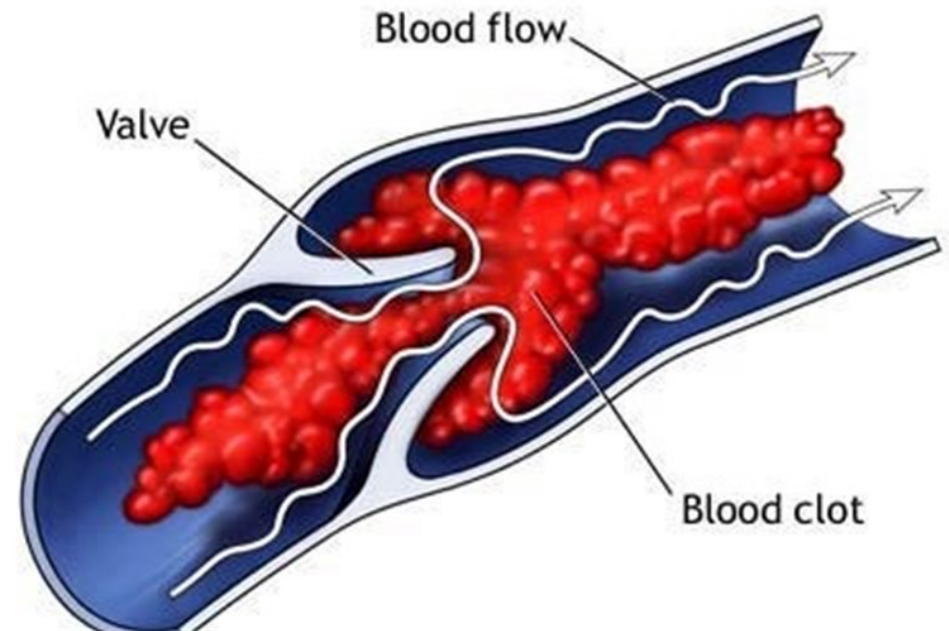


Vascular Disease – Blood Clots

Arterial thrombosis:



Venous Thrombosis:



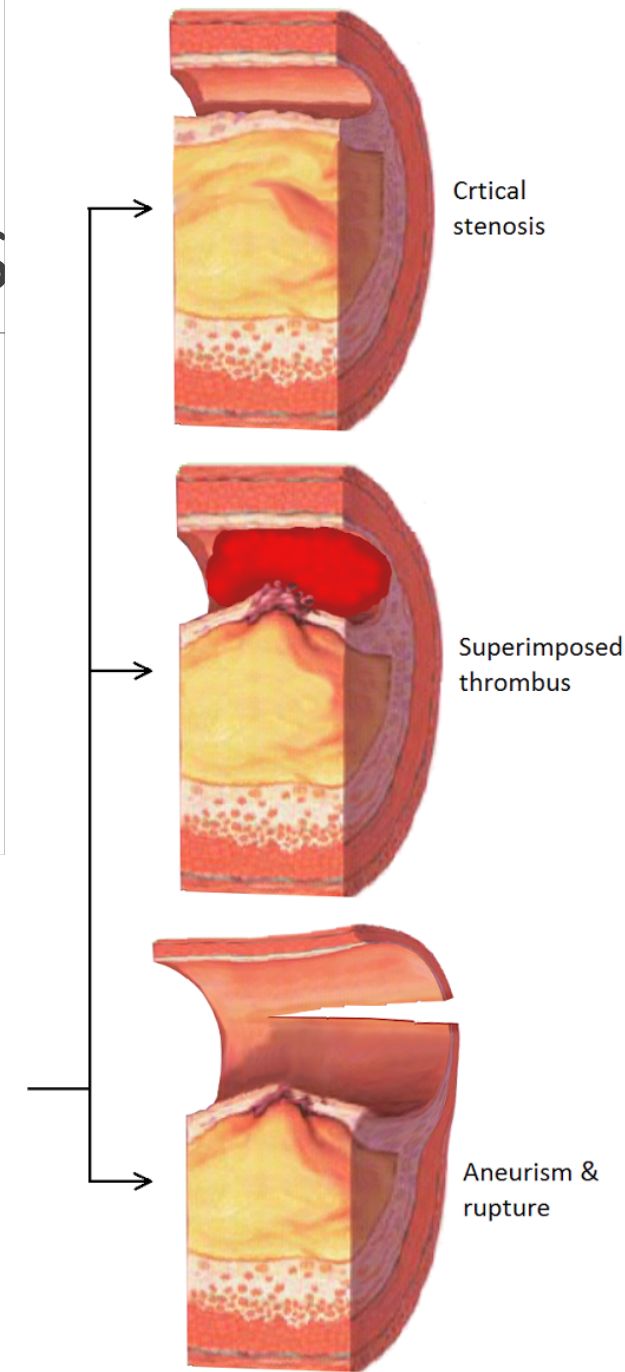
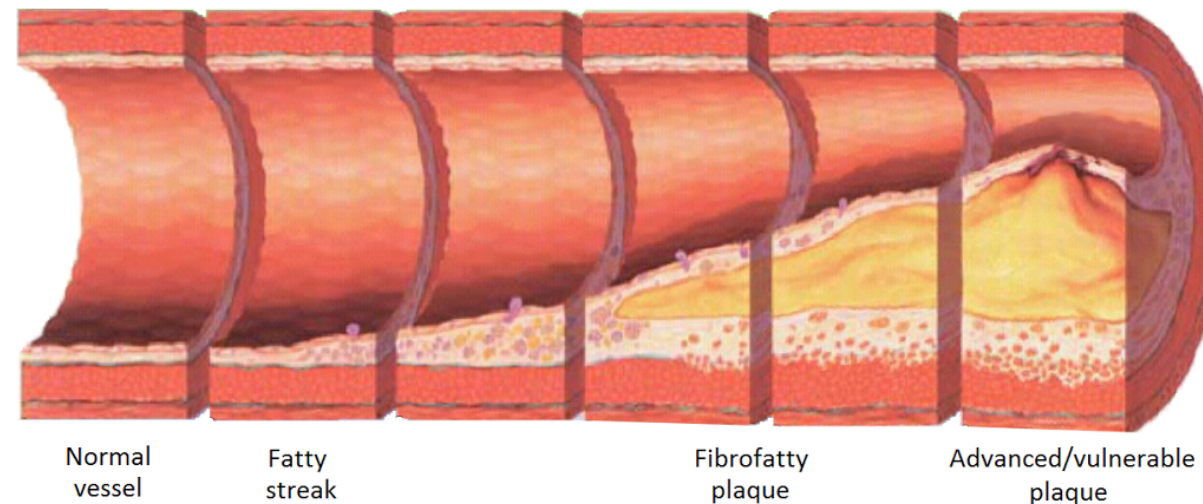
Vascular Disease – Blood Clots

- Blood clots are often treated with “blood thinners” (anti-coagulants and anti-platelets)
 - Prevent clot from growing and new ones from forming – gives your body time to break up the clot
- Blood clots can also be treated with “clot-busting” medication to help your body break down the clot
- Sometimes surgical intervention is needed to remove the clot

athero = plaque
sclerosis = hardening

Vascular Disease - Atherosclerosis

- Build up of fats, cholesterol, and other substances within an artery, forming a plaque that narrows and hardens the artery
- Formation:
 1. Endothelial cell (inner layer of blood vessel wall) injury
 2. LDL cholesterol deposit
 3. Immune/inflammatory reaction
 4. Fibrous cap formation (smooth muscle cells)



Poll

Which of these conditions contributes to the formation of atherosclerosis (plaque)?

- High (LDL) Cholesterol
- Diabetes Mellitus
- High Blood Pressure
- Cigarette Smoking
- All of the above

Vascular Disease - Atherosclerosis

Predisposing Conditions:

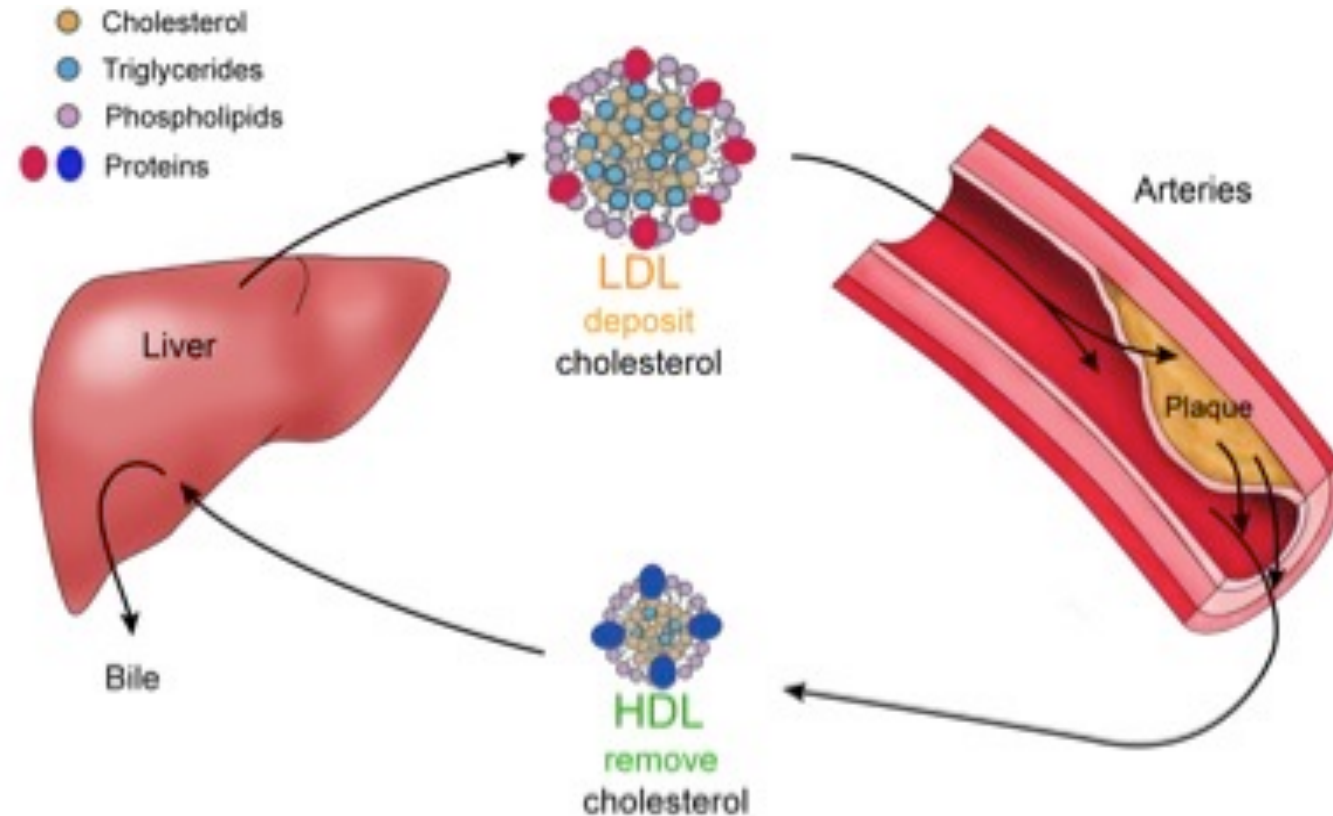
- High cholesterol
- Diabetes
- High blood pressure (hypertension)
- Cigarette smoking

Poll

True or False:

All the cholesterol in our bodies comes from our diet (food)

Atherosclerosis – High Cholesterol



High LDL + Low HDL + high triglycerides → atherosclerosis

Atherosclerosis - Diabetes



- Diabetes is a condition where your body cannot regulate the amount of glucose in the blood, leading to hyperglycemia
- Diabetes can induce atherosclerosis and accelerate its progression
 - Increases LDL and decreases HDL
 - Hyperglycemia damages inner layer of blood vessel wall (endothelial cell injury)
 - Diabetes contributes to inflammation involved in atherosclerosis
 - This process starts early on – is present in pre-diabetes

Atherosclerosis – High Blood Pressure

- High blood pressure can induce atherosclerosis and accelerate its progression
 - Damages inner layer of blood vessel wall (endothelial cell injury)
 - Increases inflammation
 - Promotes smooth muscle cell proliferation
→ hardening and narrowing of the artery



Atherosclerosis - Smoking



- Cigarette smoking impacts all stages of atherosclerosis formation
 - Damages inner layer of blood vessel wall (endothelial cell injury)
 - Lowers HDL
 - Contributes to inflammation
 - Promotes fibrous cap formation → thickened and hardened plaque
 - Promotes blood clot formation

Intermission

- 10-minute break

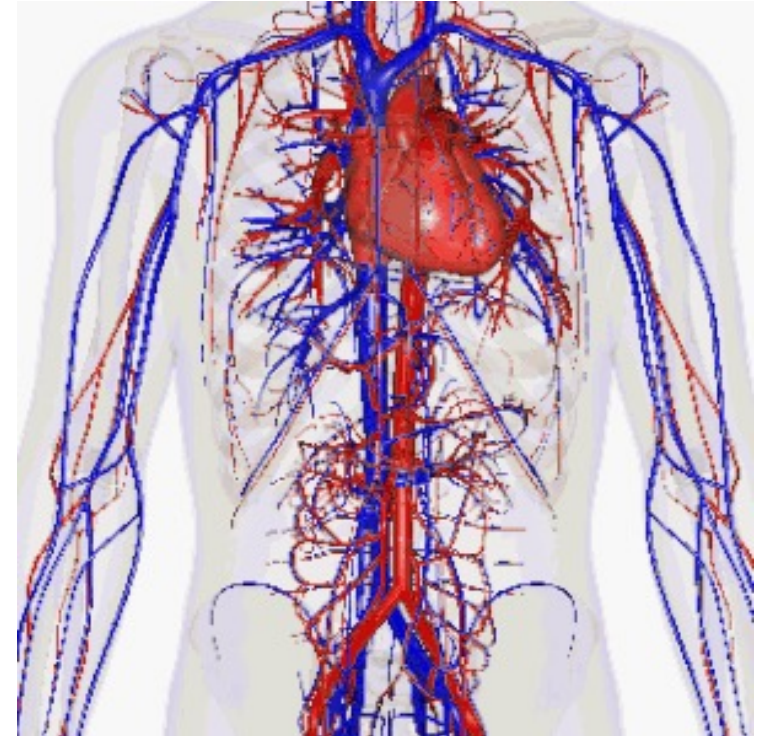


Q&A

- Questions or comments about the talk so far?

Agenda

- Health outcomes
- Treatments
- Prevention
- Suggested Resources
- Q&A



Health Outcomes - Atherosclerosis

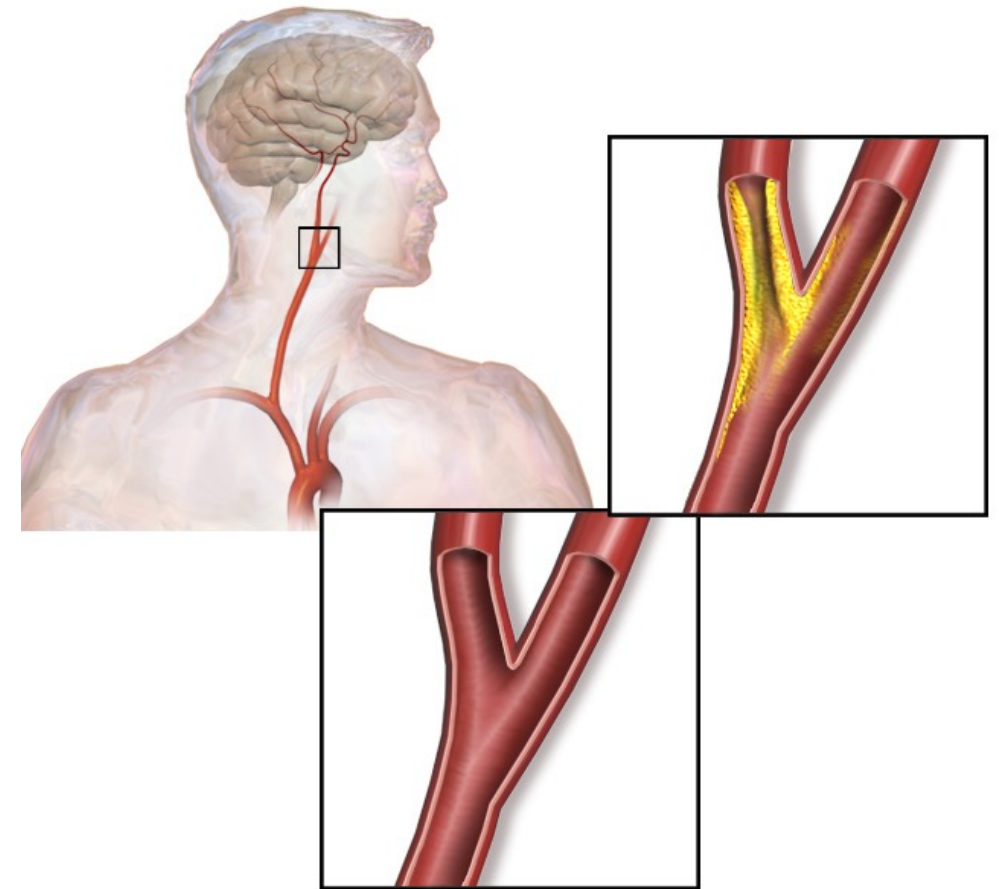
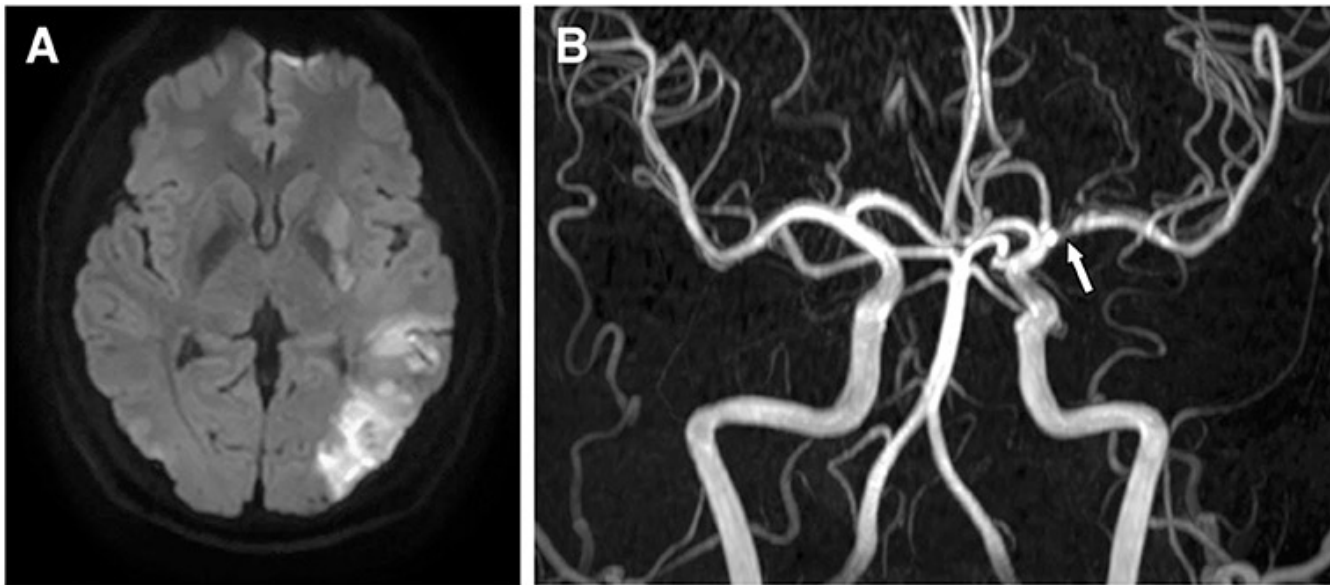
- TIA and Stroke
- Vascular Dementia
- Angina and Heart Attack
- Kidney Damage
- Peripheral Arterial Disease

TIA = Transient Ischemic Attack

Ischemia = restriction of blood flow to tissues

Atherosclerosis - TIA / Stroke

- Atherosclerosis can cause the blockage of blood flow to the brain due to plaque and blood clot formation

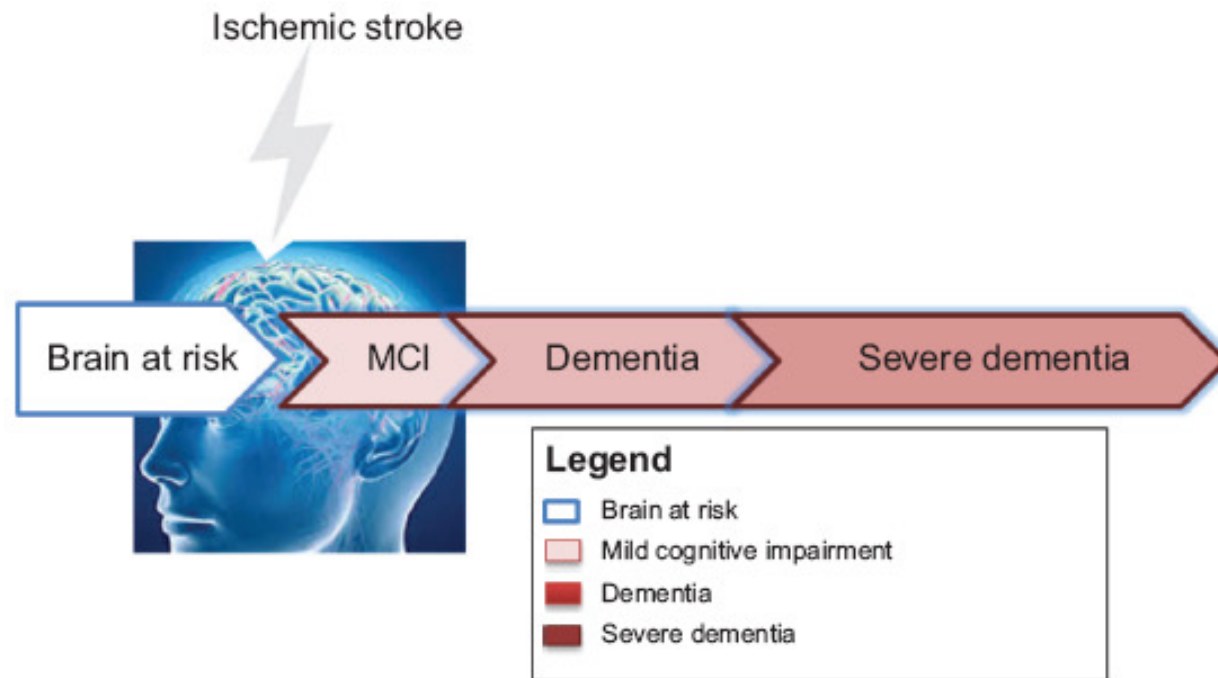




Face is it drooping?
Arms can you raise both?
Speech is it slurred or jumbled?
Time to call 9-1-1 right away.

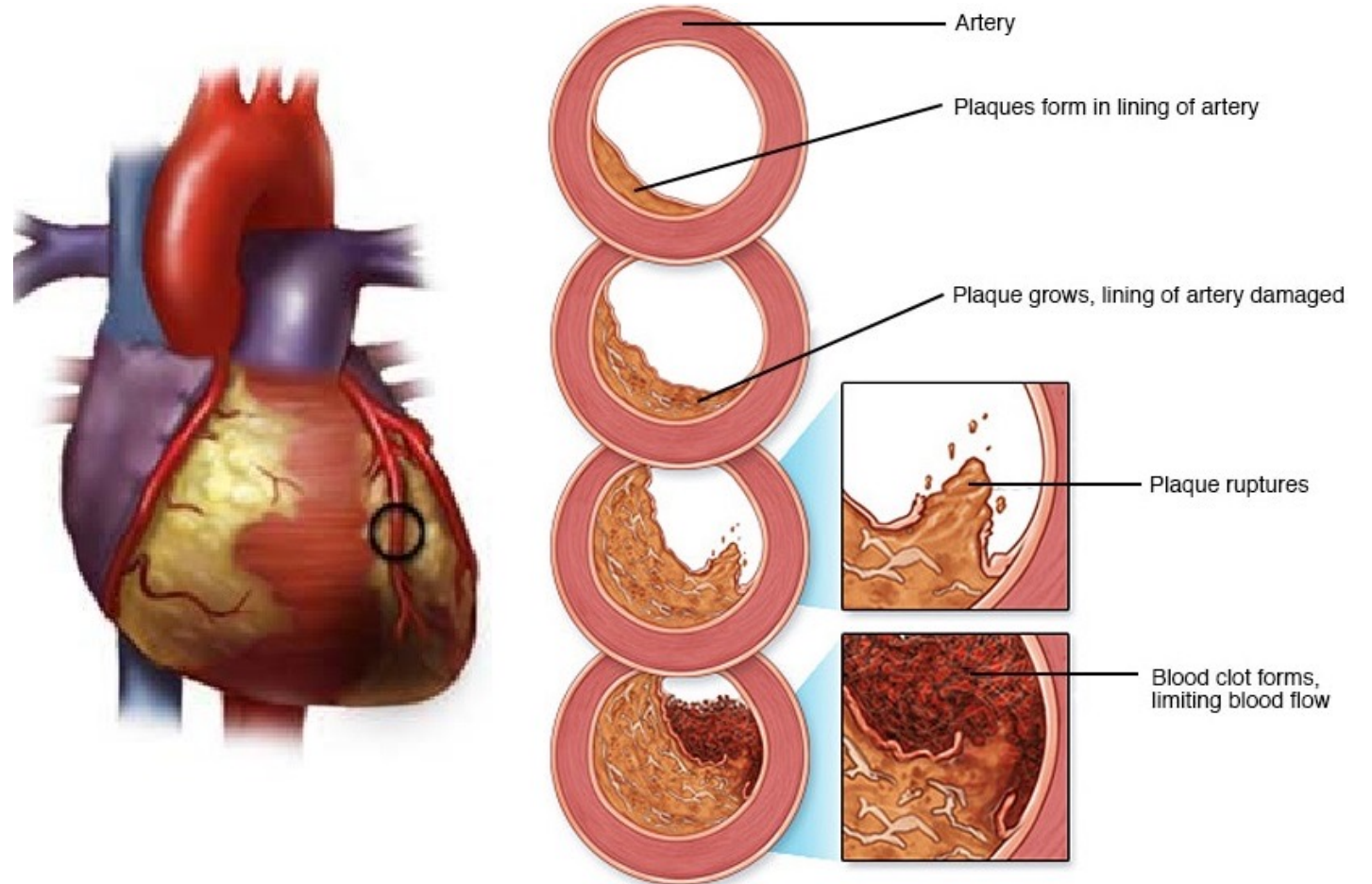
Atherosclerosis – Vascular Dementia

- Decreased blood flow to the brain due to atherosclerosis can lead to dementia



Atherosclerosis – Angina / Heart Attack

- Atherosclerosis is the main cause of Coronary Artery Disease



HEART ATTACK SYMPTOMS: MEN VS. WOMEN

The most common symptom of a heart attack for both men and women is chest pain. But women may experience less obvious warning signs.

MEN

Nausea or vomiting



Jaw, neck or back pain



Squeezing chest pressure or pain



Shortness of breath



WOMEN



Nausea or vomiting



Jaw, neck or **upper** back pain



Chest pain, **but not always**



Pain or pressure in the **lower chest** or **upper abdomen**



Shortness of breath



Fainting



Indigestion



Extreme fatigue

American Heart Association.

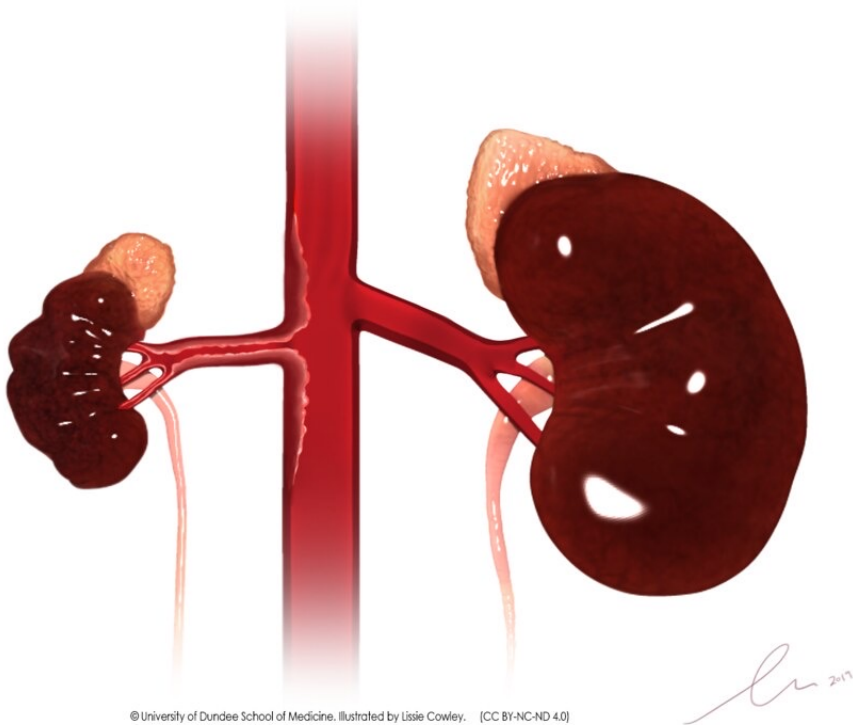


Go Red for Women is a registered trademark of AHA.
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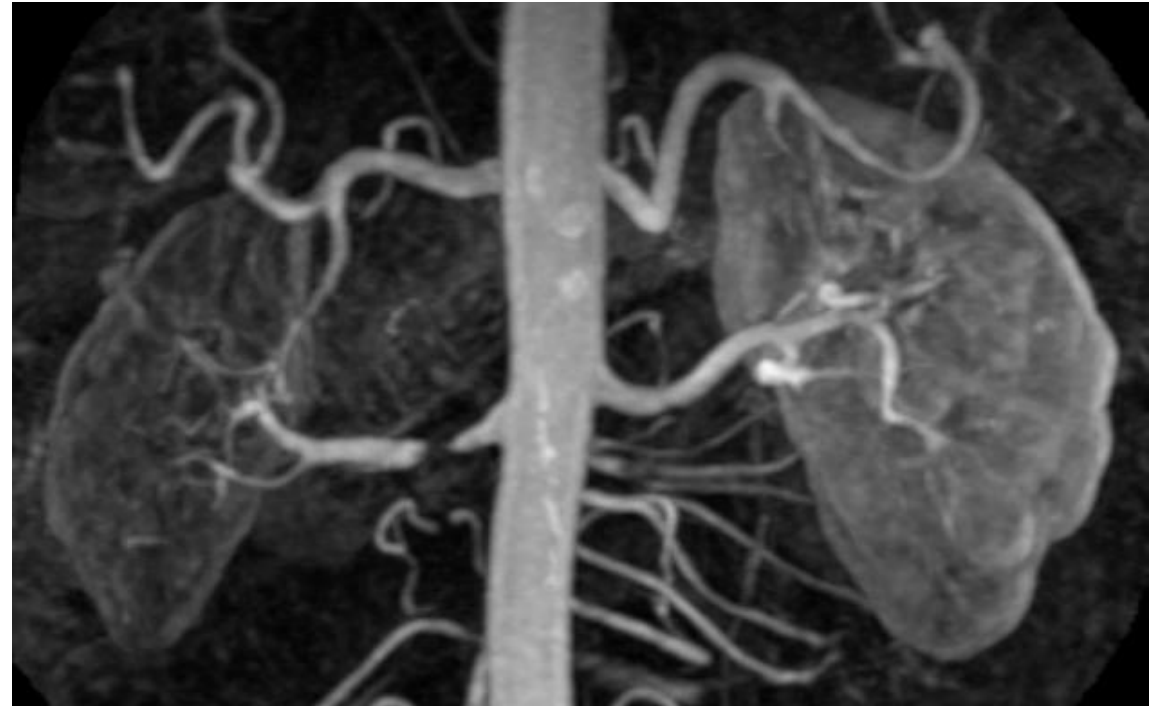
Source: American Heart Association's journal, Circulation
Published April 4, 2019 | © Copyright 2020 American Heart Association, Inc.
By American Heart Association News

Atherosclerosis – Kidney Damage

- Atherosclerosis can cause narrowing of the renal arteries (renal artery stenosis), leading to kidney damage and high blood pressure

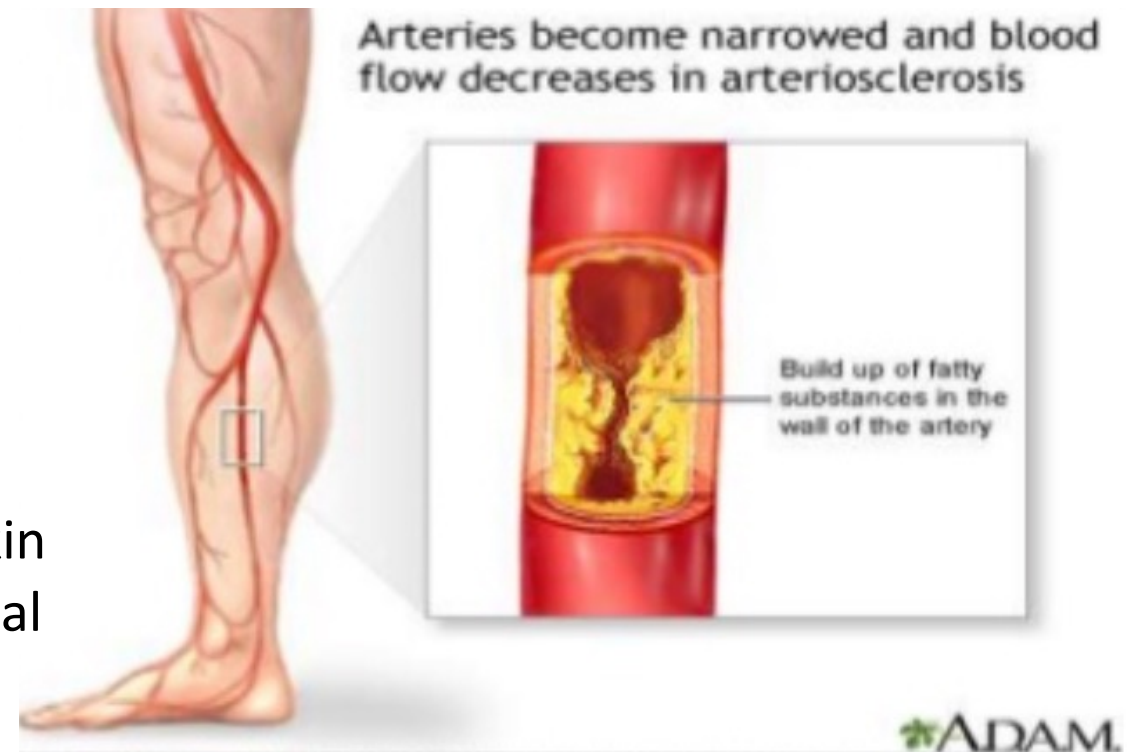


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Atherosclerosis – Peripheral Arterial Disease

- Atherosclerosis can decrease blood flow to the legs and feet
 - Leg muscle pain/cramping (claudication vs rest pain)
 - Leg/foot numbness or weakness
 - Leg hair loss
 - Change in appearance of leg/foot skin
 - Sores on legs and feet that won't heal



Treatment - Atherosclerosis

- Medications
 - Statins
 - Antiplatelets and Anticoagulants (blood thinners)
- Surgery
 - Bypass surgery
 - Angioplasty
 - Carotid Endarterectomy

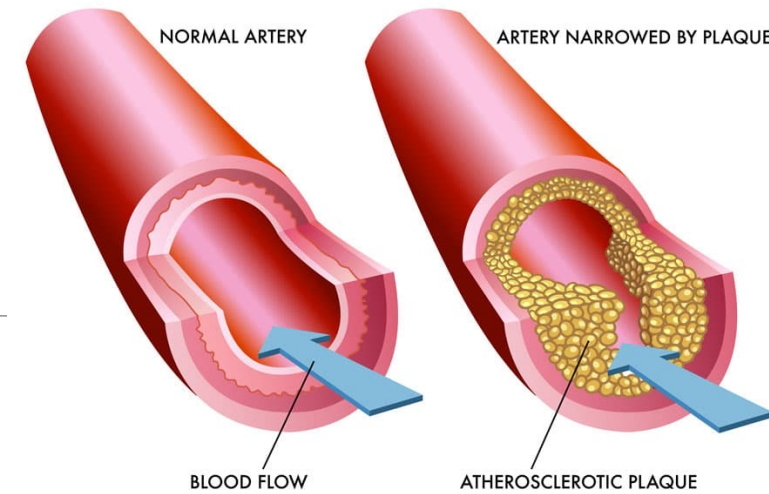


Poll

Have you, or anyone you know, taken medication or undergone surgery for atherosclerosis/cardiovascular disease?

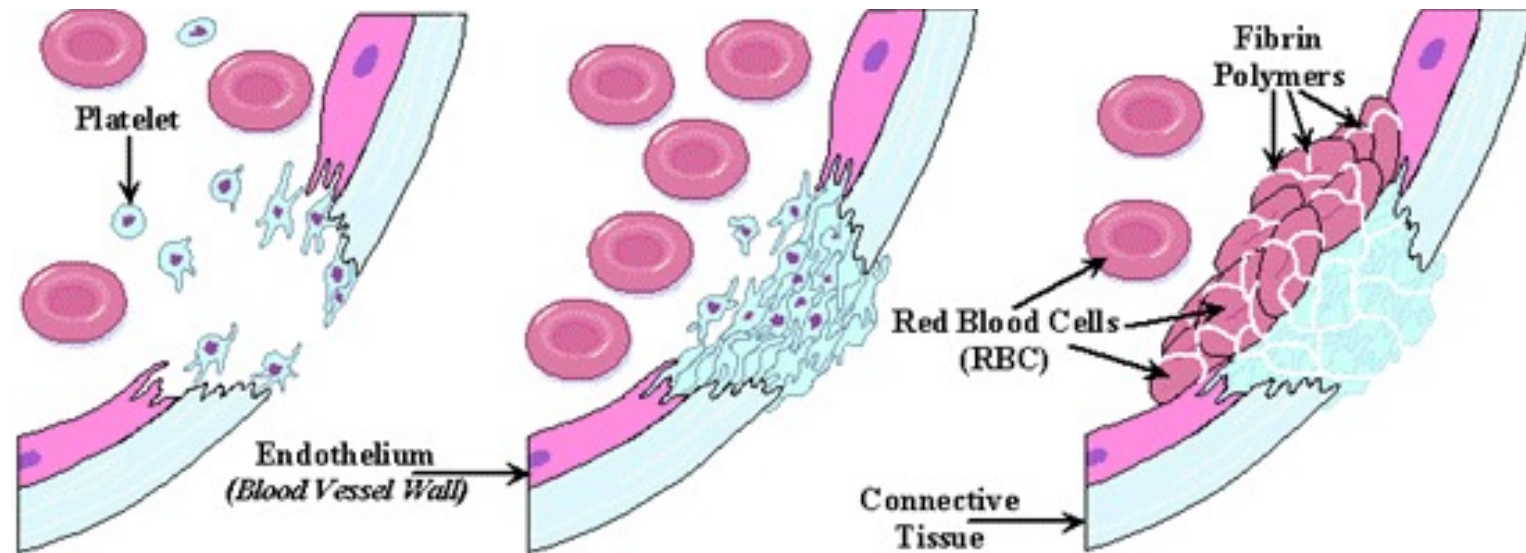
Treatment - Statins

- Statins help lower cholesterol and protect arteries
 - Disrupt production of cholesterol by blocking an enzyme in your liver that is needed to make it
 - Reduce inflammation in the blood vessel wall caused by cholesterol → less atherosclerosis formed → stable plaque
- Statin medications have the convenient name “-statin”
 - Eg. Rosuvastatin, Atorvastatin

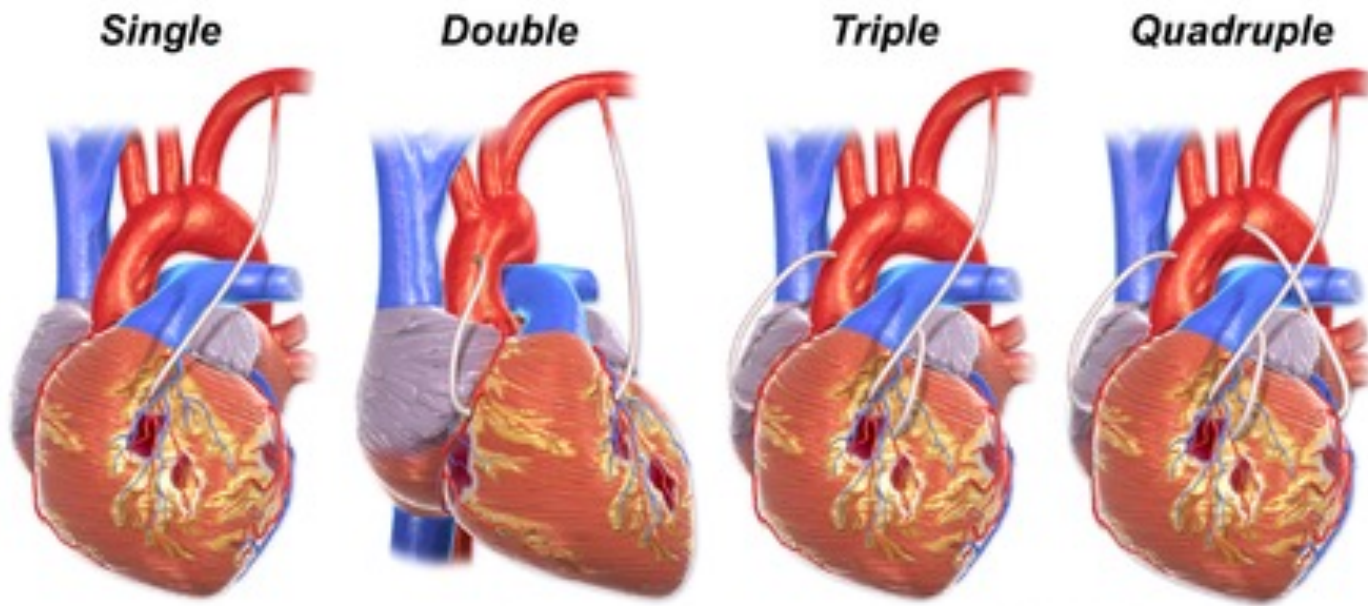


Treatment – Blood Thinners

- Antiplatelets reduce the ‘stickiness’ of platelets
 - Eg. Aspirin, Clopidogrel
- Anticoagulants (blood thinners) inhibit proteins needed for clotting to occur
 - Eg. Warfarin, Apixaban



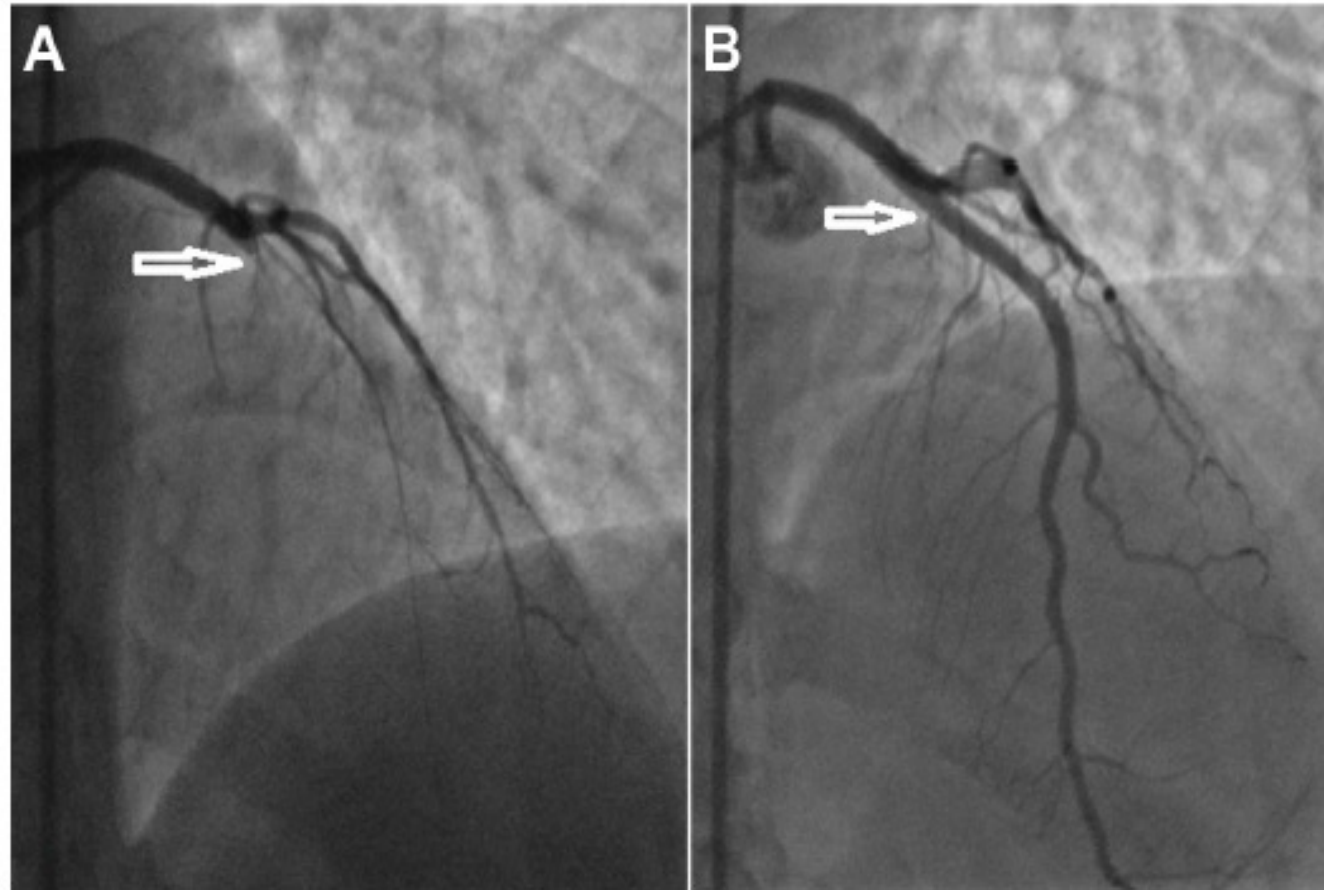
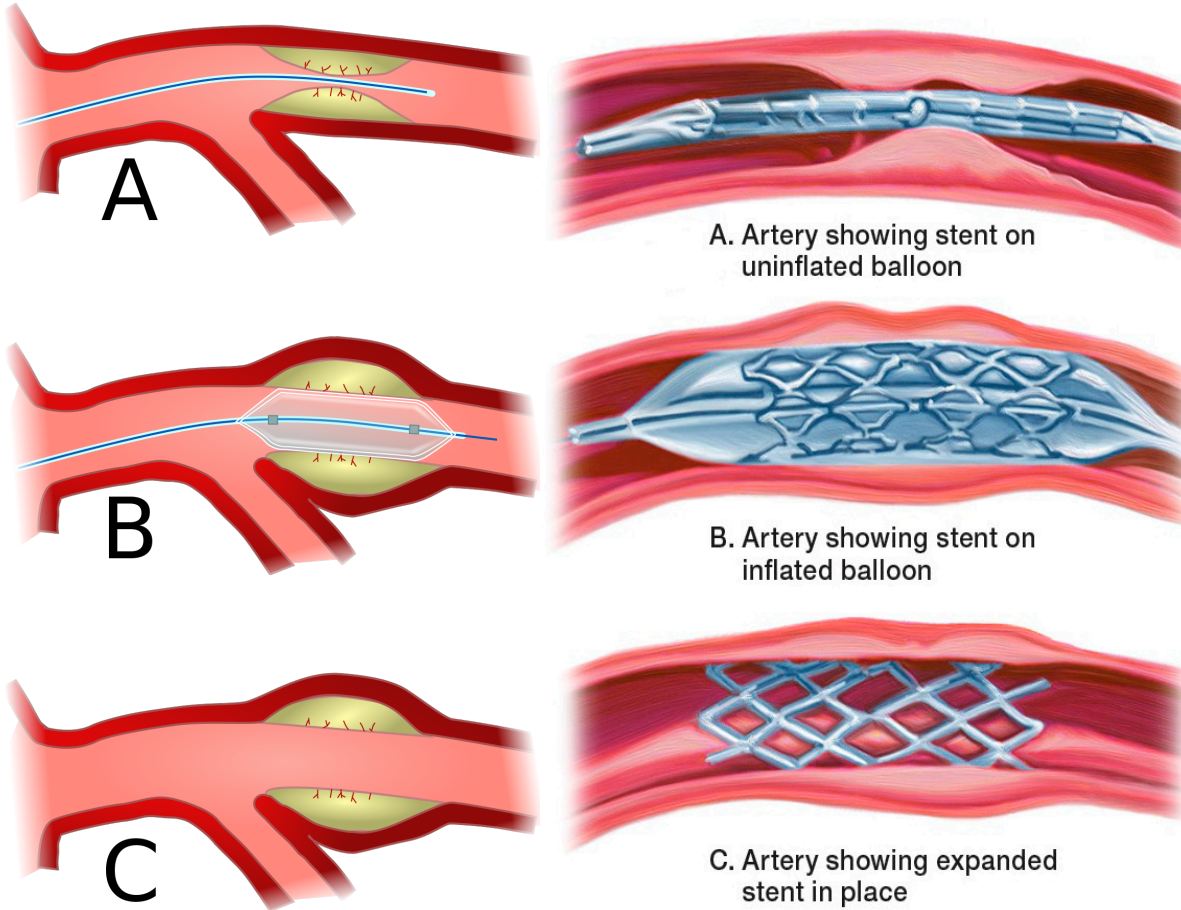
Treatment – Bypass surgery



Coronary Artery Bypass Graft (CABG)

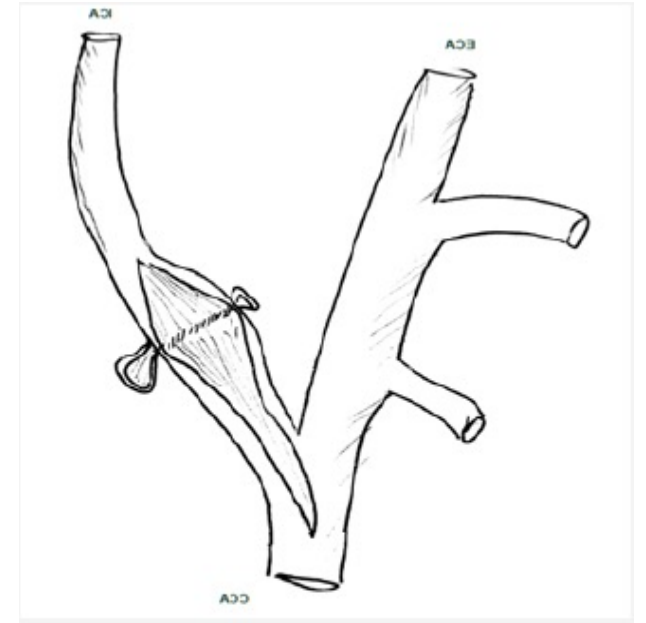
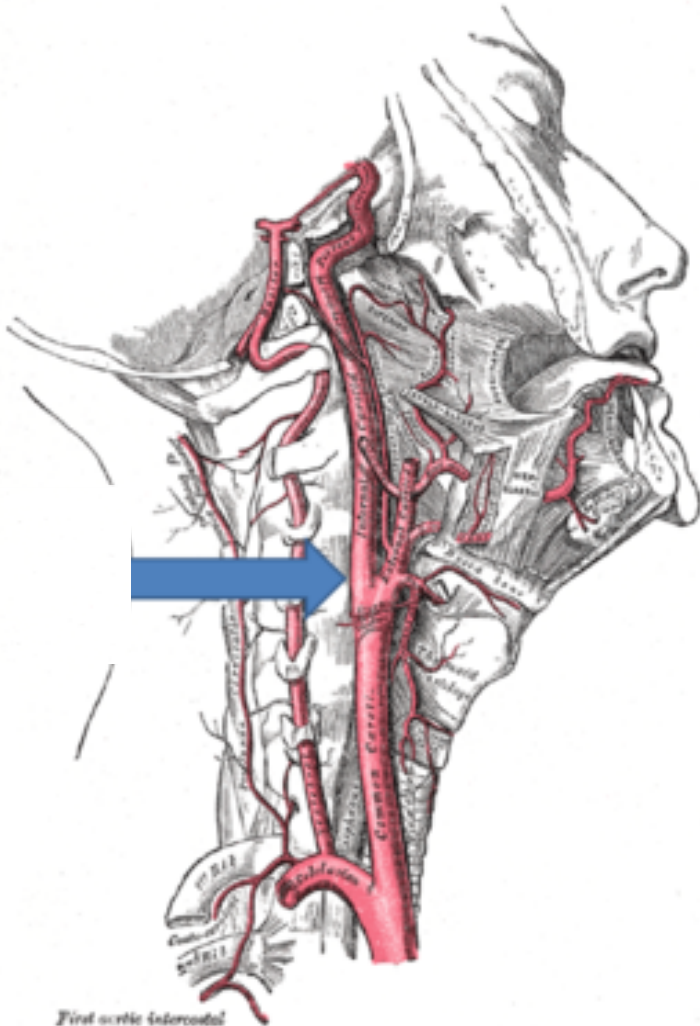


Treatment - Angioplasty



Treatment – Carotid Endarterectomy

- Plaque is physically removed from the carotid artery



Prevention - Atherosclerosis

- Treatment for predisposing conditions
 - High blood pressure
 - Diabetes
 - High cholesterol
- Smoking cessation
- Diet
- Exercise



Prevention – Predisposing Conditions

- Good management and control of conditions like high blood pressure, diabetes, and high cholesterol is important for prevention of atherosclerosis and cardiovascular events
 - Work as a team with your healthcare practitioner to build a plan that fits your life

Prevention – Predisposing Conditions

High blood pressure:

- 10 mmHg reduction in systolic blood pressure lowers risk of cardiovascular disease events by 20%, coronary artery disease by 17% and stroke by 27%



Prevention – Predisposing Conditions

Diabetes:

- Good control of blood sugar can reduce risk of heart attack and coronary artery disease
- Even greater benefits when combined with good control of cholesterol and blood pressure



Prevention – Predisposing Conditions

High cholesterol:

- Each 38.7 mg/dL reduction in LDL cholesterol is associated with 23% relative reduction in risk of major vascular events
 - Normal LDL range: < 200 mg/dL
- The lower the LDL the better



Prevention – Smoking Cessation

- Relative to never smokers, current cigarette smoking has 50% increase in progression of atherosclerosis, while those who have since quit only have a 25% increase
- Lower risk of Peripheral Arterial Disease, Coronary Artery Disease, and Stroke starting within 1-5 years of smoking cessation
 - Longer period of cessation is related to even lower risks – the earlier you quit the better



Howard G, Wagenknecht LE, Burke GL, et al. Cigarette Smoking and Progression of Atherosclerosis: The Atherosclerosis Risk in Communities (ARIC) Study. *JAMA*. 1998;279(2):119–124. doi:10.1001/jama.279.2.119

Ning Ding, Yingying Sang, et al. Cigarette Smoking, Smoking Cessation, and Long-Term Risk of 3 Major Atherosclerotic Diseases, *Journal of the American College of Cardiology*, Volume 74, Issue 4, 2019, Pages 498-507, ISSN 0735-1097, <https://doi.org/10.1016/j.jacc.2019.05.049>.

Prevention - Diet

- Increased consumption of whole grains, vegetables, fruits, legumes and nuts, and decreased consumption of red and processed meats and sugar-sweetened beverages is beneficial to health
 - Associated with a 14% - 21% lower risk of cardiovascular disease (high blood pressure, coronary artery disease, stroke, peripheral arterial disease)
- Antioxidant-rich food may be helpful in treating atherosclerosis
 - Broccoli, carrots, potatoes, berries, spinach, etc.



<https://www.hsph.harvard.edu/news/press-releases/following-a-variety-of-healthy-eating-patterns-associated-with-lower-heart-disease-risk/>

Prevention - Exercise

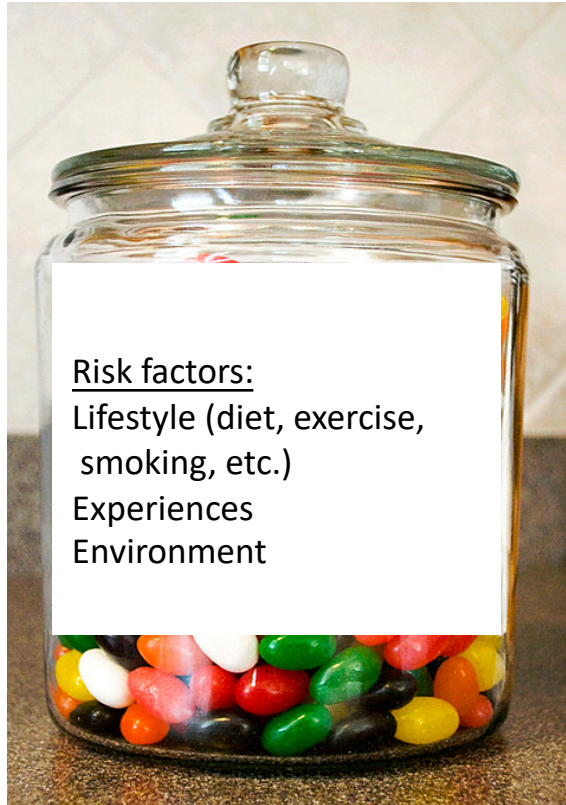
- Regular exercise protects arteries from atherosclerosis
 - Reduces (maybe even reverses) endothelial cell damage
 - Boosts nitric oxide production → relaxes the artery (vasodilation) → increased blood flow → prevents inflammation and damage of artery
 - Increases level of HDL (good) cholesterol
 - Duration of exercise session is most important factor



<https://www.health.harvard.edu/heart-health/exercise-and-your-arteries>

Kodama S, Tanaka S, et al. Effect of aerobic exercise training on serum levels of high-density lipoprotein cholesterol: a meta-analysis. Arch Intern Med. 2007 May 28;167(10):999-1008. doi: 10.1001/archinte.167.10.999. PMID: 17533202.

Prevention – Jellybean Jar Analogy



Person 1 genetic predisposition



Person 2 genetic predisposition



Disease

Suggested Resources

- Heart and Stroke Foundation: <https://www.heartandstroke.ca/>
- Canadian Society for Vascular Surgery: <https://canadianvascular.ca/Patients>
- HealthLinkBC:
 - Healthy eating for heart health: <https://www.healthlinkbc.ca/healthy-eating/your-condition/heart-health>
 - Physical activity: <https://www.healthlinkbc.ca/physical-activity>
 - Heart and circulation information: <https://www.healthlinkbc.ca/health-topics/center1021>
- QuitNow (smoking cessation): <https://quitnow.ca/>
- Telephone 8-1-1 (7-1-1 for the hearing impaired)
 - Speak to a Registered Nurse, Registered Dietician, exercise professional, or Pharmacist

Q&A

- Questions or comments about the talk?

Closing Remarks

- Thank you to Dr. Jane Gair, our supervisor for this activity, and to my classmates, Julia De Pieri and Alexandra Jamieson, who will be delivering several of the talks in this series

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- Thank you to Dr. Jane Gair, our supervisor for this activity, and to my classmates, Julia De Pieri and Alexandra Jamieson, who will be delivering several of the talks in this series
- Thank you for attending today!