

Cardiovascular

The four concepts related to oxygenation and perfusion are:

1. Hypoxemia: Decreased oxygen concentration of arterial blood
2. Hypoxia: Oxygen deficiency in body tissues
3. Ischemia: Tissue not getting enough oxygen
4. Necrosis: The tissue dies

Overview

CV disease is the leading cause of death in the US. One death occurs every 33 seconds, and 25% of the population has CV disease. It's bad.

Technology

Various diagnostic procedures are used to detect disease and various procedures/surgery are used to treat disease:

- *Ultrasound* (ECHO) is used to evaluate the structure and function of the heart. It's not really do-able in pts with COPD (due to a lot of air between heart and chest cavity) and pts who are obese.
- *EKG* uses monitoring electrodes to create a graphic representation of the electrical impulses that the heart generates during the cardiac cycle. Interfering factors are electrolyte imbalances and certain drugs such as digitalis, quinidine and barbiturates.
- *Angiography* is cardiac catheterization, and it is used to visualize the heart chambers, arteries and great vessels. It is used most often to evaluate pts with chest pain. Pts with a positive stress test also undergo this test to locate the region of coronary occlusion. It is also used to determine the effects of valvular heart disease. Right heart catheterization is used to calculate cardiac output and measure right heart pressures (also used to identify pulmonary emboli).
- *Radioisotope studies* (couldn't find anything about this online that was understandable)
- *Clot prevention drugs and lysis drugs*
- *Angioplasty* involves placing a balloon is placed at the stenotic area to widen a narrowed or obstructed blood vessel.
- *Endarterectomy* is a surgical procedure to remove plaque material or blockage in the lining of an artery.
- *Stent placement* holds an artery open
- *CABG and Peripheral Bypass* are surgical procedures. CABG is coronary artery bypass, in which arteries or veins from elsewhere in the body are grafted to the coronary arteries to bypass atherosclerotic narrowings and improve the blood supply to the heart. Peripheral arterial bypass refers to treating blockages in the legs.
- *Amputation* is often for a vascular reason (if not for diabetes or trauma).

Arterial Disorders

These are disorders that affect arteries...not veins! Try to keep that straight! Examples are:

- Artherosclerosis (CAD and Peripheral): thickening and hardening of arterial walls.
- Hypertension: BP over 140/90
- Aneurysm: localized abnormal dilation of a blood vessel (usually artery)

- Raynaud's: A primary vasospastic disease of small arteries, presents as an exaggerated response of vasomotor controls to cold or emotion.
- Buerger's: a chronic, recurring, inflammatory, vascular occlusive disease, chiefly of the peripheral arteries and veins of the extremities.

Venous Disorders (ex)

- Thrombophlebitis: inflammation of a vein in conjunction with the formation of a thrombus.
- Emboli: masses of undissolved matter present in a blood or lymphatic vessel and brought there by the blood or lymph.
- Venous Stasis Ulcers: ulcers in the lower leg (usually inner part of leg just above ankle). Common in pts who have a history of leg swelling, varicose veins or blood clots.
- Lymphedema: an abnormal accumulation of tissue fluid in the interstitial spaces.

CV Disease

Though CV disease is the leading cause of death in the U.S. the really sad thing is that there are many risk factors associated with this disease that are modifiable:

- Hypertension
- Obesity
- Smoking
- Hyperlipidemia
- Stress
- Lack of Exercise
- Diabetes
- Na Intake
- Alcohol

Hypertension affects about 25% of the US population (50 million folks), and represents any BP above 140/90. However, it is important to note that ANYTHING above 120/80 is considered risky b/c there is a direct relationship to CV...so it's not like if you're 138/84 that you're a-ok.

HTN damages the intima of the vessel wall. This attracts macrophages which come in and cause an increase in inflammation. This creates more work for the heart to pump against (afterload), and can lead to CHF and cardiovascular "events" such as heart attack and stroke. Note that elderly people can have an increase in systolic pressure only...this is b/c arteriosclerosis causes a loss of elasticity in the large arteries and diastolic pressure does not increase as well.

Pathophysiology of HTN:

Kidneys release renin into the bloodstream, which travels to the liver where it converts aniotensinogen to ang I. Ang I goes to the lungs where it is converted to ang II. Ang II then goes to the kidneys which cause aldosterone to be released. Aldosterone causes sodium and water retention. This retained sodium and water increase blood volume. Arteriolar constriction increases peripheral vascular resistance (remember that ang II is a potent vasoconstrictor). Increased blood volume and vascular resistance cause hypertension.

Studies show that the incidence of MI increases proportionately with increases in systolic pressure over 120.

Studies also show that diabetics are less at risk of "CV events" when diastolic pressure is <80.

Treating HTN:

Lifestyle modifications are fantastic, but they won't fix everyone's HTN. Most people need to be on more than one drug (for example, a diuretic would lower BP, as would a beta-blocker and an ACE-inhibitor or vasodilator...lots of ways to drop BP!) If someone is going to implement lifestyle changes, they can drop their BP 5-20 mmHg for every 10kg they lose...this is great IF they can stick to it!

Pre-hypertension: the plan is lifestyle modification (diet, stop smoking, be more active, cut back on Na).

Stage I: thiazide diuretic +/- beta blocker
(also for pre-hypertension diabetic...the treatment is more aggressive)

Stage II: thiazide diuretic + ACEi/ARB/BB/CCB

Obesity

Obesity is associated with increased risk of CV disease. This is especially true for "central obesity". Obesity is also associated with other risk factors...Type 2 DM, HTN, Inactivity and Hyperlipidemia. Note that obesity is an INDEPENDENT risk factor, but it is often combined with others. The dangers are very real...one study followed 1 million Americans for 14 years and found the risk of CV death to be 2x higher in obese individuals. Get off the couch!!!

Some scary statistics:

- 60% of adults are overweight or obese
- the % of young people who are overweight has more than doubled in the past 30 years
- between 10-15% of Americans age 6-17 are overweight
- The annual cost for the US is \$100 billion. Get off the couch!!!

Smoking

24% of adults in the US continue to smoke, but this is down from 42% in 1965. We're doing better, but we're not there yet! Smoking is the strongest promoter for atherosclerosis...a truly horrible disease. How does this happen: Well, smoking increases PVR, increases LDL ("lethal" cholesterol) and decreases HDL ("healthy" cholesterol). The arterial endothelium is damaged, and platelets (which have increased aggregation due to smoking), are thought to adhere to subendothelial connective tissue exposed by endothelial denudation, initiating the smooth muscle proliferation that leads to atherosclerotic plaque formation. What's more, as many as 30% of CHD deaths in the US each year are attributed to smoking and the risk is strongly dose-related. It also nearly doubles the risk of ischemic stroke because the carbon monoxide more readily binds to hemoglobin than does oxygen and tissues suffer from lack of oxygen.

Environmental smoke has about 34% of the impact on atherosclerotic progression that occurs with active smoking.

Smokers who have had an MI:

- If you quit smoking, there is a 50% reduction in the risk of reinfarction, sudden cardiac death and total mortality
- This group is highly receptive to teaching, so teach!
- When MI pts are given information about quitting, there is a 50% long-term cessation rate...this is awesome!
- Modest telephone-based counseling can increase this percentage to 70% and is cheap!

Quitting:

- ~1.3 million quit each year
- After 1 year off cigarettes, the excess risk of heart disease is reduced by half.
- After 15 years of abstinence, the risk is similar to that of people who never smoked.
- In 5-15 years, the risk of stroke returns to the level of those who've never smoked.
- Only 50% of smokers seen in primary care were spoken to about smoking.
- It is better to have a "quit day" than to taper.
- Hypnosis is not supported by sufficient evidence
- There is a vaccine in clinical trials
- Counseling works!
- Drugs work! Nicotine patch or gum, bupropion, varenicline
- Chart all smoking cessation teaching!
- Smoking is the cause of more than 10% of CV deaths
- Smoking costs the US \$90 billion year

Lipids

LDL = lethal. Each 1% drop in LDL confers to a 2% reduction in CV events. Yay for oatmeal!

HDL = healthy

Treatment for hyperlipidemia depends on lipid profile/levels, other CV risks and the cost of therapy. Generally, pts should change their diet (low-fat, low cholesterol), adopt lifestyle changes, and take drugs (statins, resins, fibrates, niacin).

Stress

Perceived high stress DOUBLES the risk of CV morbidity. So RELAX!

Lack of Exercise

Sadly, 60% of Americans are sedentary! Physical inactivity is another one of those independent risk factors for CVD. Improving activity reduces weight, improves lipid profiles and reduces BP... yay for exercise!

A 1996 statement from the NIH recommends that adults accumulate at least 30 mins of moderate activity on most days (and yes, walking to class counts so park far far away!), and more vigorous activity 3-4x a week for 30-60 minutes. Your heart and lungs will thank you!

Diabetes

The more I learn about diabetes the more I am convinced it is a truly horrible disease. Interestingly, the goal is not to keep pts at "the right level" for their blood glucose...this is because there were too many incidents of hypoglycemia. Instead, the goal is to keep pts within a healthy range and all I know about that is that <200 is the goal for wound healing so maybe that's it? One of the problems diabetics have is with arterial perfusion, which leads to necrotic tissues in the periphery. And yes, there is a definite parallel between obesity and diabetes. Once more folks, "get off the couch!"

Na intake

In obesity, each 2g increase in sodium intake is associated with a 61% increase in CV mortality.

Alcohol Intake

And now for some good news! Moderate alcohol consumption (identified as 1 glass of wine for women and 2 glasses for men) increases HDL, may decrease coagulation and lower BP! Yippee! However, moderation is the key. Large alcohol intake increases BP, risk of stroke, cardiomyopathy and non-cardiac disorders. So, do the benefits outweigh the risks? In the US, 100k excess deaths can be attributed to alcohol-related deaths each year. On the other hand, if current alcohol consumers abstained from drinking, approximately 80,000 of them would die from CV disease.

Binge drinking is a real problem, especially among college aged males.

Homocysteine, Folic Acid and CVD

Homocysteine is an amino acid, and high levels of this are associated with CAD, CVA and PVD in epidemiological studies. However, folic acid and other B vitamins break down this amino acid in the body. Note that there have been no controlled studies supporting whether taking these vitamins decreases the risk so the AHA does not currently recommend. However, it is important to get lots of fruit and green leafy veggies.