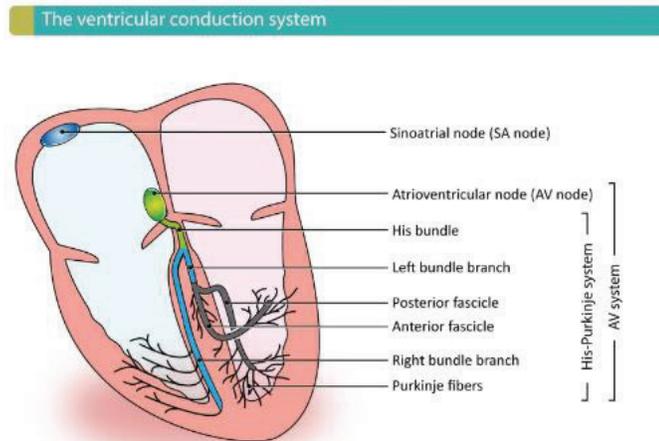


BRADYCARDIA

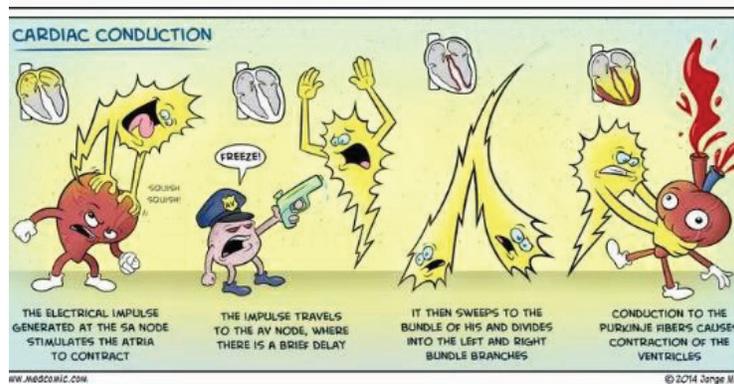
Here's what happens during a normal heartbeat

- Your heart has a natural “pacemaker” called the sinoatrial (SA) node which sends an electrical impulse throughout your heart to cause it to beat (contract).
- That electrical impulse from the SA node first travels through the heart’s upper chambers (the atria).
- It then passes through a small group of cells called the atrioventricular (AV) node. The AV node checks the impulse and sends it along a track called the bundle of His.
- The bundle of His divides into a right bundle branch and a left bundle branch, which lead to your heart’s lower chambers (the ventricles).
- As the signal travels, it triggers nearby parts of the heart to contract in a coordinated manner.



Analogy

- Imagine a picture made up of dominos.
- One domino is pushed over causing a wave of collapsing dominos spreading out across the picture until all dominos are down
- And imagine the bundle branches as motorways, with the Purkinje fibers as A and B roads that spread widely across the ventricles.
- In this way all the cells in the ventricles receive an electrical stimulus causing them to contract.



What is Bradycardia?

- Under normal conditions, the human heart beats 60 to 100 times per minute.

- When the heart beats faster than normal, or more than 100 beats per minute (bpm), this condition is called tachycardia.
- When the heart beats less than 60 bpm, this condition is called bradycardia.
- Bradyarrhythmias are considered a conduction abnormality and occur when electrical signals slow down too much or are blocked from getting to the ventricles.
- Sinus bradycardia is a slow heartbeat that can be due to normal causes and commonly occurs in athletes or during a state of deep relaxation. It can also occur with heart disease or in response to different medications.

What's could be causing my slow heart rate?

- In some patients, who are otherwise healthy, the heartbeat may slow to less than 60 beats per minute while resting or sleeping. This usually causes no symptoms and does not require treatment.
- Heart tissue damage related to aging. Men and women age 65 and older are most likely to develop a slow heart rate that needs treatment.
- Damage to heart tissues from heart disease or heart attack: Heart attacks can weaken the heart muscle or cause problems with its electrical system.
- Heart disorder present at birth (congenital heart defect) Problems with the structure or function of the heart present at birth can cause a slow heart rate.
- Infection of heart tissue (myocarditis): Certain bacteria, viruses and parasites can infect the heart muscle, causing inflammation and damage leading to an irregular heart rate.
- Underactive thyroid gland (hypothyroidism): An abnormally low level of thyroid hormones can cause a slow heart rate.
- Electrolyte imbalance: such as potassium or calcium. Any abnormality in the body's mineral balance – including calcium, chloride, magnesium, phosphate, potassium and sodium – can lead to a slow or irregular heart rate
- Repeated disruption of breathing during sleep (obstructive sleep apnea): results from the combined effect of cessation of breathing plus hypoxemia (low oxygen levels).
- Inflammatory disease, such as rheumatic fever or lupus
- Medications: Some medications for treating high blood pressure or other heart conditions like beta blockers, antiarrhythmics and digoxin (for heart failure) can cause bradycardia.

What are the complications?

If bradycardia causes symptoms, possible complications can include:

- Frequent fainting spells
- Inability of the heart to pump enough blood (heart failure)
- Sudden cardiac arrest or sudden death



How will I know if bradycardia is affecting my heart's ability to pump enough blood to my body?

- If I feel your symptoms and clinical picture indicate further workup, then heart rhythm monitoring or maybe an echocardiogram will be considered or reviewed if already done.

How is bradycardia treated?

The good news is that bradycardia can be treated and even cured!

- Treatment of any underlying conditions (such as hypothyroidism or obstructive sleep apnea)
- Changing medications or lowering dosages might correct problems with a slow heart rate.
- Even if the condition can't be reversed, I can still treat it with a pacemaker which delivers regular electrical pulses through thin, highly durable wires attached to the heart

What symptoms should I watch out for? If I notice them, when and whom should I call?

Some symptoms are more obvious of a significant problem such

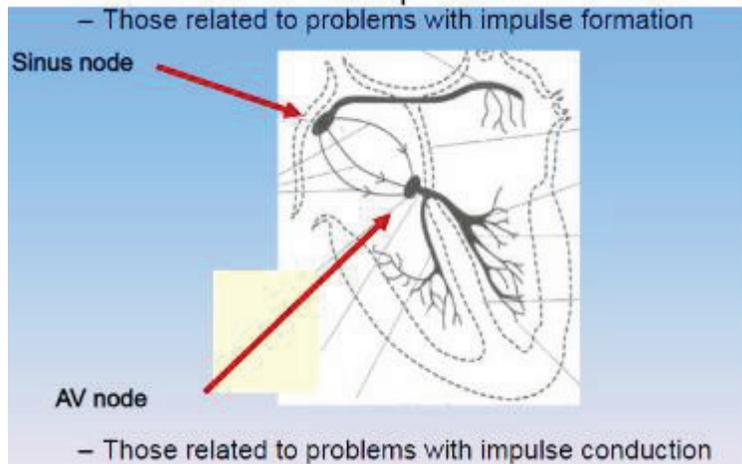
- as unexplained lightheadedness, fainting and new extreme fatigue.

Others are more subtle such as generalized tiredness, activity intolerance

- Non-urgent matters can be brought to our attention during normal working hours. There are support staff available to take phone calls
- More urgent matters (fall with injury, fainting, chest pain) should prompt a call to office regardless of the time of day.

There are two types of Bradyarrhythmia (Slow Heart Rate) that the result is a slower heartbeat or pulse.

- If impulses are sent from the sinus node at a slow rate
- If the impulses are delayed as they travel through the conduction system



Sinus Node Problems (*problem with impulse formation*)

Bradycardia often starts in the sinus node.

- Sinus node dysfunction or sinus node disease is also known as sick sinus syndrome (SSS).
- This is the name of a cluster of heart rhythm problems known as arrhythmias in which the natural pacemaker of the heart known as sinus node does not work to the mark.

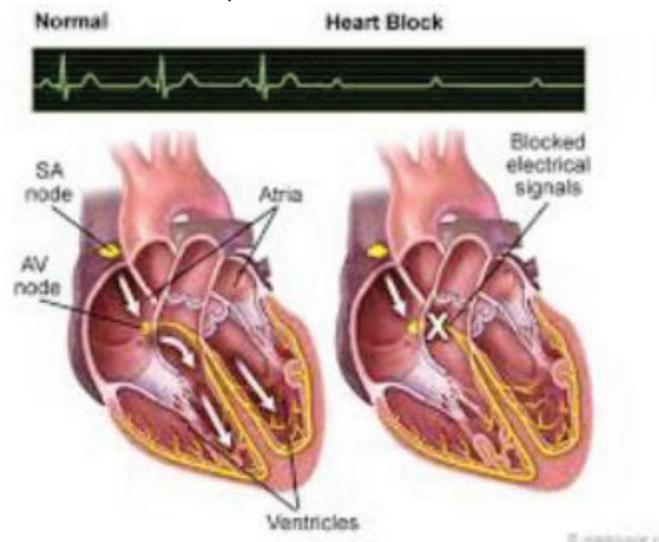
A slow heart rate might occur because the sinus node:

- Discharges electrical impulses slower than is normal (called sinus bradycardia)
- The heartbeat pauses or stops (called sinus pauses or sinus arrest) This may be episodic as in vasovagal syncope (your body overreacts to certain triggers) or carotid sinus hypersensitivity
- Discharges an electrical impulse that's blocked before causing the atria to contract (called sinus exit block)
- In some people, the sinus node problems result in alternating slow and fast heart rates (called bradycardia-tachycardia syndrome).
- Chronotropic Incompetence (the inability of the heart to increase its rate) with increased activity or demand, produces exercise intolerance

Heart block (atrioventricular block) (*problem with impulse conduction*)

When a person has a heart block, there is a “block” in one of these electrical pathways.

- This blocks electricity from travelling normally through the heart.
- This makes the heartbeat more slowly.



Heart Block Classification

Heart blocks are classified based on the degree to which signals from the atria reach your heart's main pumping chambers (ventricles).

Heart Block Analogy

Think of the AV node like a boom gate in the middle of a road that controls traffic.

When working normally, it will allow each car to pass through from point A to point V...pun intended!

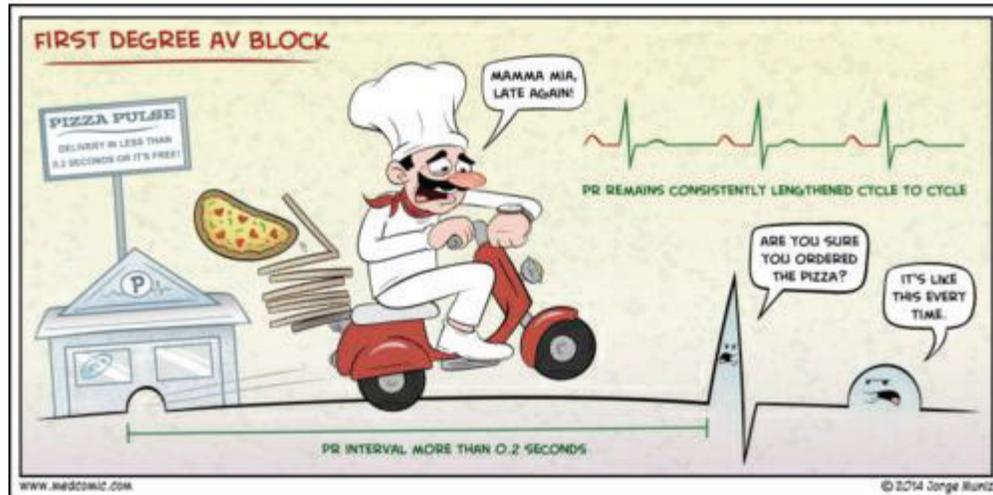
However, an issue with the boom gate will result in a road block. The same applies for the AV node not allowing the electrical impulse to pass through normally.

The severity of this road block determines the degree of the heart block.

It could range from merely causing some delayed traffic through the boom gate (first degree), to some traffic getting through and some traffic getting blocked (second degree), or no traffic getting through at all (third degree).

First-degree heart block

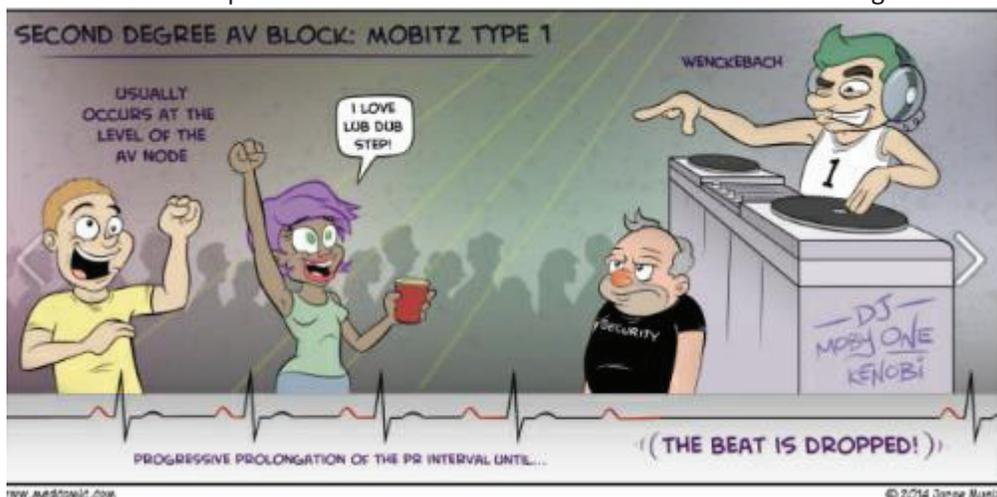
- All electrical signals from the atria reach the ventricles, (the impulse is not actually blocked so the name is a misnomer) but the signal is slowed.
- First-degree heart block rarely causes symptoms
- Causes of First Degree AV Block can include: Drug therapy (digoxin, beta-adrenergic blockers or calcium channel blockers, or antiarrhythmic drugs such as amiodarone), Post-MI (heart attack), Chronic degenerative disease of the atrial conduction system (seen with aging), Hypo- or hyperkalemia (potassium imbalance), Increased vagal tone (activity of the vagus nerve)
- Treatment typically aims to correct the underlying cause. If it is caused from drug therapy, then I will adjust or remove the medication. If it is a potassium imbalance, then it needs to be corrected.



Second-degree heart block

This is the most complex form of heart block and is the most diagnostically challenging.

- There are four categories of second-degree heart block. Type I, often referred to as Wenckebach, Type II, 2-to-1 heart block and high-grade heart block.
 - All of these are EKG descriptions that may or may not be diagnostic of a specific site of electrical block in the heart.
 - The site of electrical block is what needs to be considered, along with presence or absence of symptoms, when determining the best treatment.
- In all types, the impulse originates in the sinus node, but is conducted through the AV node in an intermittent fashion
- Not all electrical signals reach the ventricles. Some beats are "dropped," resulting in a slower and sometimes irregular rhythm.
- This can lead to a skip in the heartbeat. This can cause dizziness and fainting.



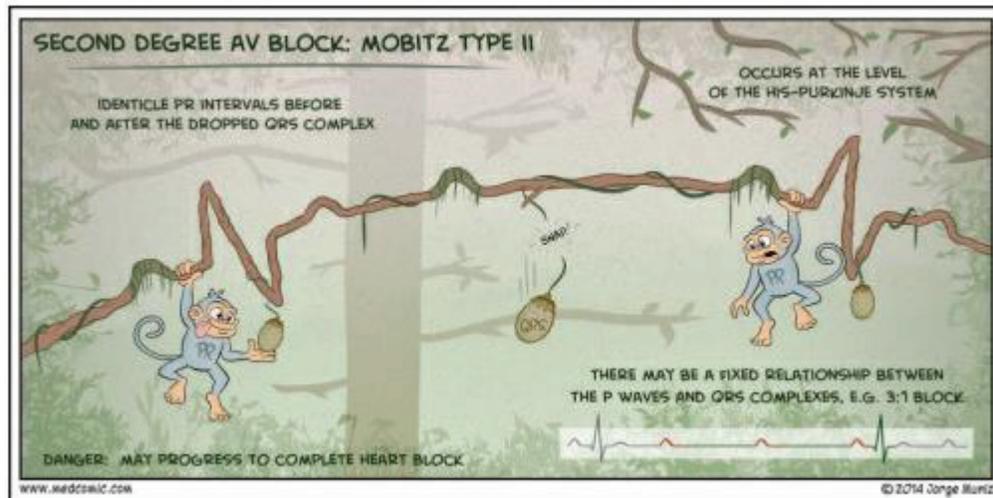
Second Degree AV Block Type I - Wenckebach

- Causes can include: Drug therapy (digoxin, beta-adrenergic blockers, calcium channel blockers, amiodarone), Coronary artery disease, New MI (seen more commonly with acute inferior wall infarctions, or heart attacks), Rheumatic fever, Increased vagal tone, Hyperkalemia, Myocarditis
- Treatment is not typically required. Wenckebach phenomenon in setting of bundle branch disease may require investigation to see if a pacemaker would be appropriate.

Second Degree AV Block: Type II

Type II is associated with a poorer prognosis, and complete heart block may develop.

- Causes can include: Age related degenerative changes in the conduction system, New MI- seen more commonly with acute anterior wall infarctions, Post cardiac surgery or complication arising with cardiac catheterization.
- Note: Type II is not typically a result of increased vagal tone or drug effects
- Potential Treatments: Pacemaker treatment is always recommended due to the poorer prognosis for developing complete heart block.



2-to-1 heart block

- In 2-to-1 heart block, every other sinus beat does not conduct to the ventricle.
- This is most often given its own classification because it is not specific to one site or the other in the heart
- The causes are similar to the above types of second degree heart block
- Treatment: Depends on symptoms, presence of reversible causes and the site of electrical block (needs to be determined)

High grade heart block

This is defined as 2 or more consecutively non-conducted sinus beats.

Causes are similar to those listed above

Treatment: Depends on symptoms, presence of reversible causes and the site of electrical block (needs to be determined)

Third-degree (complete) heart block

This is the most serious type of heart block. It is also called a complete heart block.

- None of the electrical impulses from the atria reaches the ventricles.

- When this happens, a natural, subsidiary (escape) pacemaker takes over, but this results in slow and sometimes unreliable electrical impulses to control the beat of the ventricles.
- Most often people with complete heart block require a pacemaker due to the unreliable nature of the escape pacemaker.

