University of Diyala/ College of Medicine
Department of Physiology
Physiology Lab

Vital Signs:

Assessment of Pulse Rate and Respiratory Rate

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Outlines

- Objectives
- Introduction about vital signs ,pulserate,and respiratory rate
- Pulse rate assessment: sites, procedure, characteristics, and some medical implications
- Respiratory rate assessment: definition, procedure, and some medical implications

Objectives

At the end of this lab , student should :

- Have general idea about vital signs assessment (specifically, pulse rate and respiratory rate).
- Know how to do the assessment of pulse rate and respiratory rate correctly.
- Able to discuss the importance of pulse rate and respiratory rate in assessing theindividual's' health status.

Vital Signs

Two weeks ago, we started talking about vital signs assessment and mentioned that :

Vital signs are physical signs that indicate an individual is alive.

They measure the body's most basic functions and **can be observed, measured, and monitored** to assess an individual's level of physical functioning.

Vital signs change with ***age, gender, weight, exercise tolerance, and overall health.***

The main vital signs are:

Body Temperature (Done)

Blood Pressure(Done)

Pulse Rate and Rate of Breathing(Respiratory Rate) (Today'sLab)

***However, depending on the clinical setting, the vital signs may include some other measurements such as *oxygen saturation and pain*.**

Vital Signs

If you have listened and read the last two lectures, I am expecting you to answer the following question easily (Please write the answer down inside the empty box).

Q: When to assess vital signs?

1.

2.

3.

4.

5.

Pulse Assessment

Arterial Pulses

- ***The palpable pulse*** in an artery *reflects the pressure wave generated by the ejection of blood into the circulation from the left ventricle*.**The pulse is an index of the heart's rate and rhythm**. Pulse provides valuable data about person's cardiovascular status.

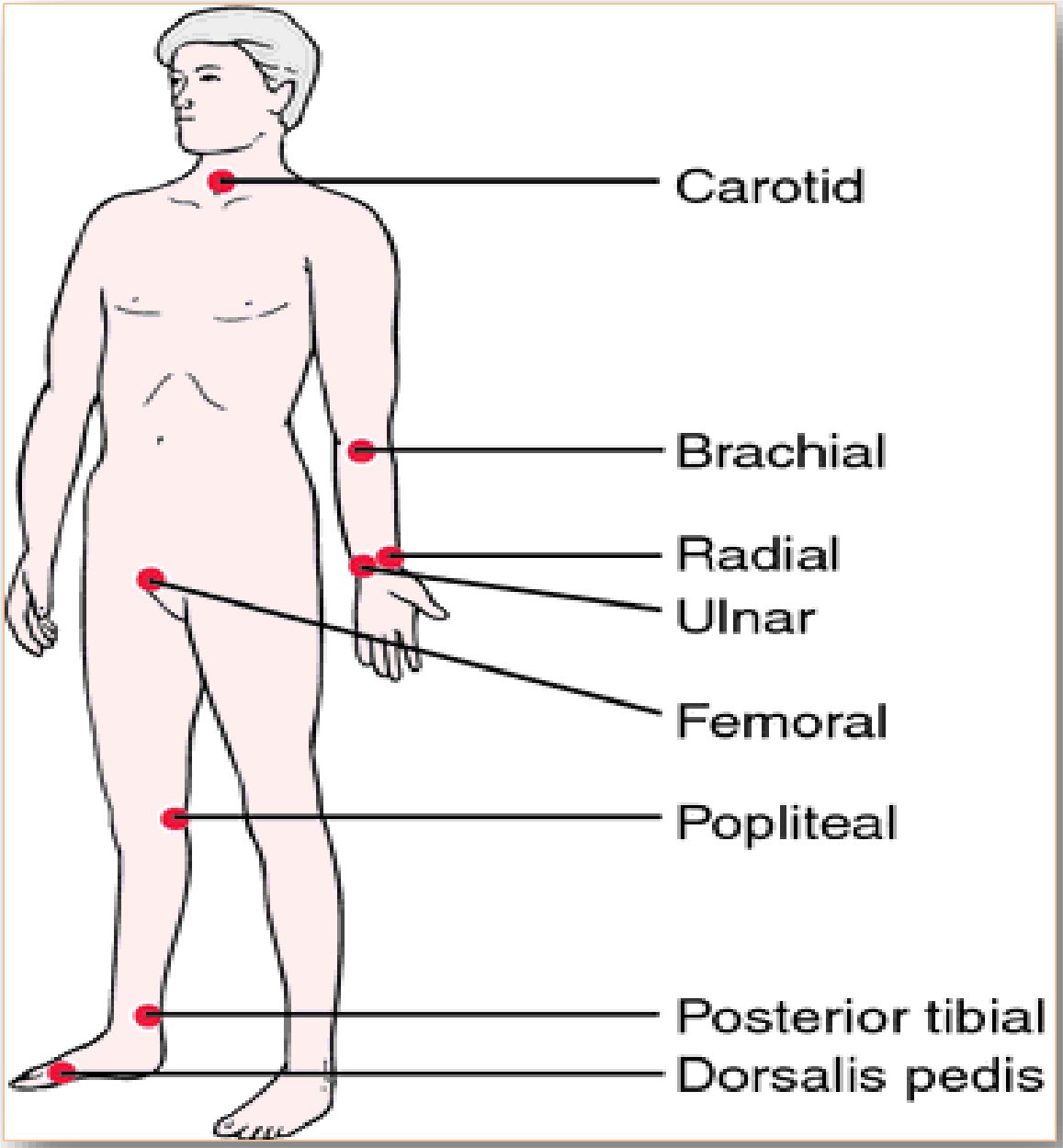
By taking a pulse, you can assess the following parameters:

- ***Rate:*** **the number of pulses occurring per minute.**
- ***Rhythm:*** **the pattern or regularity of pulses.**
- ***Volume:*** **the perceived degree of pulsation.**
- ***Character:*** **an impression of the pulse waveform or shape.**

Keep in mind that:

- ***The rate and rhythm of the pulse are usually determined at the radial artery***; ***use the larger pulses (brachial, carotid or femoral) to assess the pulse volume and character.***

Pulse Sites


Carotid
Brachial
Radial
Ulnar
Femoral
Popliteal
Posterior tibial
Dorsalis pedis

Factors that Can Affect the Pulse:

- Age; as age increases, the pulse rate gradually decreases.
- Gender, male's pulse rate is slightly lower than the female's.
- Exercise; the pulse rate normally increase with activity
- Fever; the pulse rate increases in response to the lowered blood pressure that results from peripheral vasodilatation associated with elevated temperature and because of the increased metabolic rate.
- Medications; some medications decrease the pulse rate, and others increase it such as digitalis decrease the heart rate.

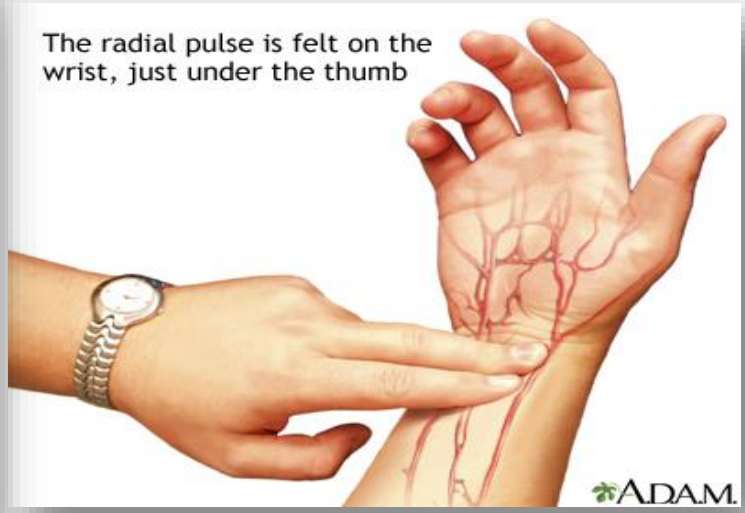
Some Principles in Pulse Examination

- Exercise, emotions, and anxiety cause an increasing in pulse rate so pulse must be taken at rest.
- If you are taking someone else's pulse, do not use your thumb. If you do, you will feel your own pulse along with the other person's pulse.
- Count the pulse rate for one full minute, especially when there is irregularity (you can also count it for 30 sec and multiply it by 2).
- Characteristics of the pulse vary with individuals and indicate the functions of the heart, conditions of the patient, and nature of blood vessels. Thus, you should observe the rate, rhythm, volume, and tension of pulse.
- Clinically it is traditional to ***examine the radial pulse first.***

Pulse Examination

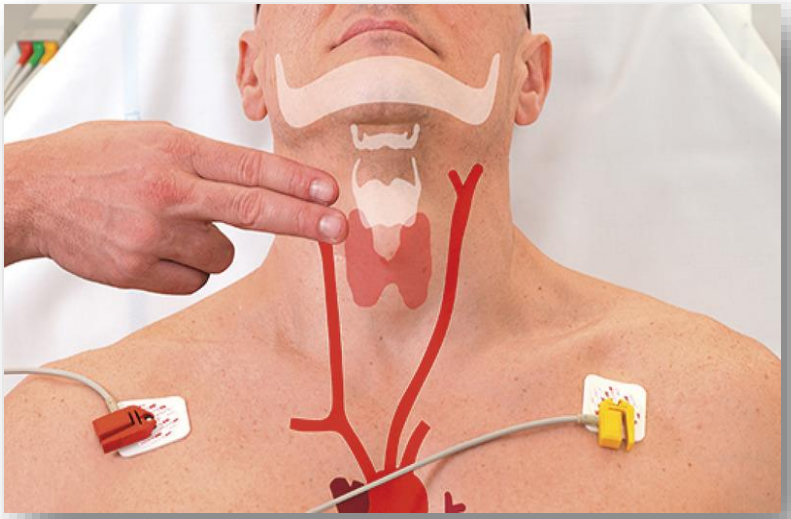
The presence or absence of the main peripheral pulses (radial, brachial, carotid, femoral , popliteal , posterior tibial, and dorsalis pedis pulses) are noted. Pulse equality should be checked on both sides.

1. Radial Pulse: The pulse is usually felt at the **wrist** , just **lateral to the flexor carpi radialis tendon** and over the **radial artery.** It is best felt with the subject's forearm slightly pronated and the wrist flexed. The examiner's three fingers, via the index, middle and ring finger should be over the radial artery (it can be done using two fingers as in the figure below). Both radial arteries are palpated simultaneously to detect the irregularities of the pulse on the two sides.



Pulse Examination

2. Carotid Pulse: Located in the neck between the **anterior border of the sternocleidomastoid muscle**, above the **hyoid bone** and **lateral to the thyroid cartilage**.



Carotid artery should be palpated gently while the patient is sitting or lying down. Stimulating its baroreceptors with deep palpation can provoke severe bradycardia or even stop the heart in some sensitive persons. ***Also, a person's two carotid arteries should not be palpated at the same time. Doing so may limit the flow of blood to the head, possibly leading to fainting or brain ischemia.***

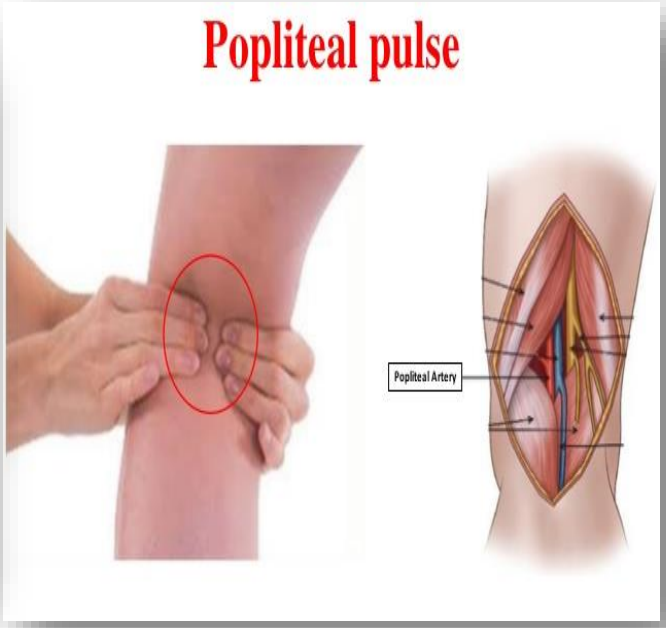
Pulse Examination

3. Brachial Pulse: Use your index and middle fingers to palpate the pulse in the **antecubital fossa**, just **medial to the biceps tendon**.

4. Femoral Pulse: Place your index & middle fingers just **inferior to the mid-inguinal point**, halfway between **the pubic symphysis** and **anterior superior iliac spine (femoral artery).**

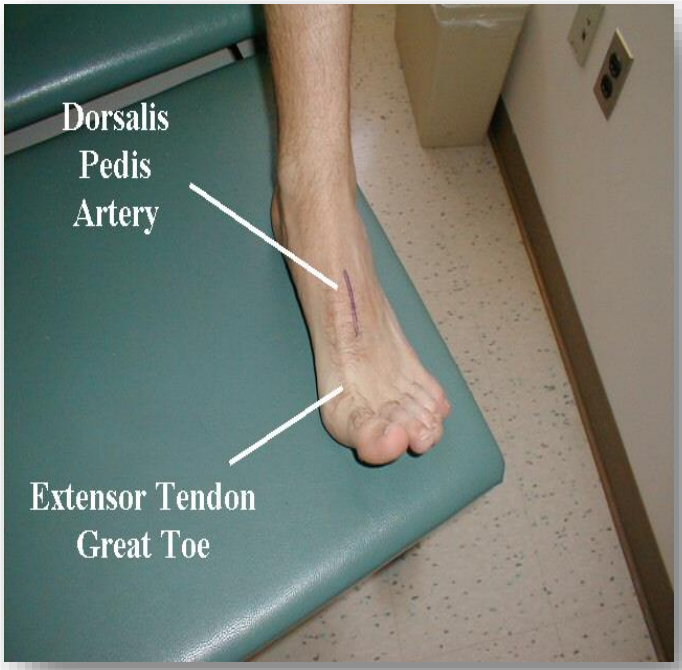
Pulse Examination

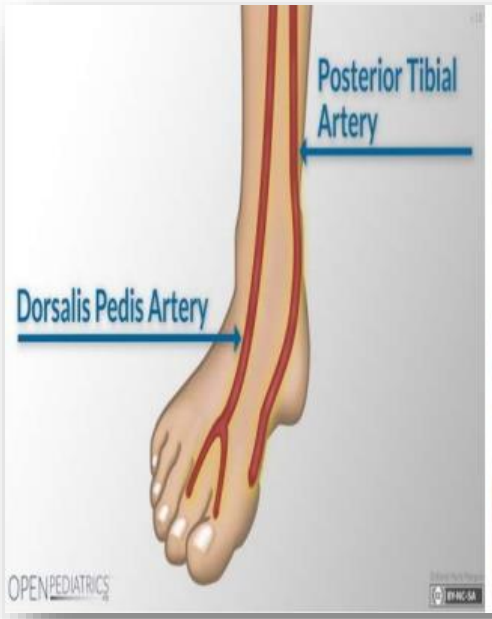
5. Popliteal Pulse: Located behind the knee in the **popliteal fossa**. To detect popliteal pulse, flex knee of the patient to 30 degree. With your thumbs in front of the knee and your fingers behind, press firmly in the midline over the **popliteal artery.** Then slide your fingers 2–3 *cm* below the knee crease and try to compress the artery against the back of the tibia as it passes under the soleus arch.



Pulse Examination

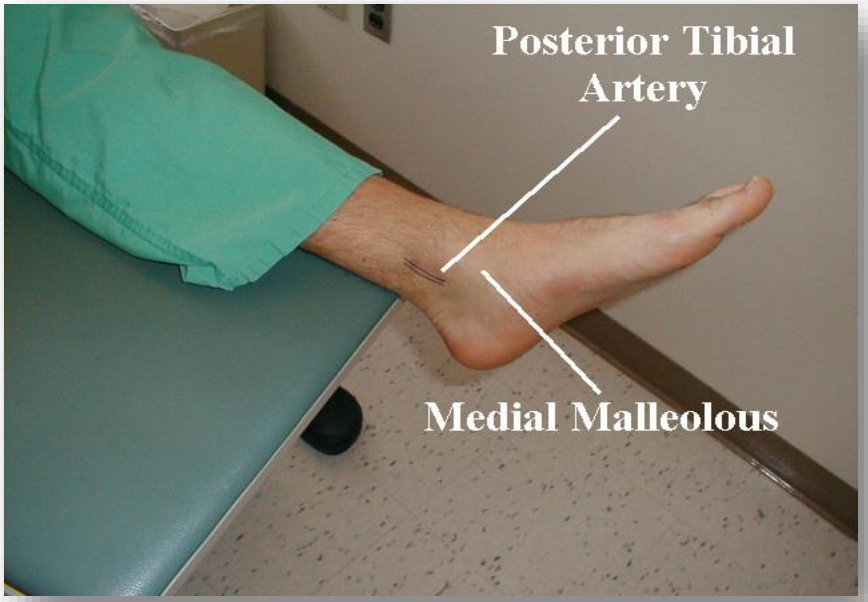
6. Dorsalis Pedis Pulse: Located on top of the foot, immediately **lateral to the extensor of hallucis longus**. Stand at the end of the bed and feel the dorsalis pedis artery of each foot, simultaneously, by placing the pads of middle three fingers of each hand along the line of the artery , with your thumbs beneath the arch of the foot .





Pulse Examination

7. Posterior Tibial Pulse: Located behind and below the **medial malleolus** in the groove between the **Achilles tendon** and **medial malleolus of the ankle joint**. The pads of middle three fingers can then be pulled up against the back of the tibia, trapping the posterior tibial pulse against medial malleolus .



Pulse Rate

Pulse rate *is defined as the total number of arterial pulsations (pulse beats) counted in one minute*.The normal pulse rate for adults is *60-100 bpm* (beats per minute).

Pulse rate is usually assessed using the radial artery, in special circumstances carotid or femoral arteries are used. The pulse rate should be the same as the heart rate.

Pulse rate **decreases with age** as shown below.

Age	Average	Upper limit
0-6 months	140	160
6-12 months	130	150
1-2 years	110	130
2-6 years	100	120
6-10 years	95	110
10-14 years	85	100

Types of Pulse (Based on Pulse Rate)

- **Tachycardia :** When the resting pulse rate increases to more than 100 beats per minute in adults (abnormal rapid heart rate over 100 beats/min).
- **Causes:**

Physiological	Pathological
• Exercise • Increasing body temperature • After food, anger, emotion , and excitement • Infants and children • Pregnancy • High environmental temperature	• Fever • Anemia • Heart failure • hyperthyroidism • Ventricular tachycardia • Supraventricular tachycardia • Shock (hemorrhagic)

Types of Pulse (Based on Pulse Rate)

- **Bradycardia :** A pulse rate of less than 60 beats per minute (An abnormal slow heart rate below 60 beats/min)
- **Causes:**

Physiological	Pathological
• Athletes • Grief • Very old age • Meditation • Sleep	• Hypothyroidism • Obstructive jaundice- toxic effect of bile salts inhibits SA node. • Second degree heart block • Complete heart block • Medication: Beta-blockers, Digoxin, and Verapamil

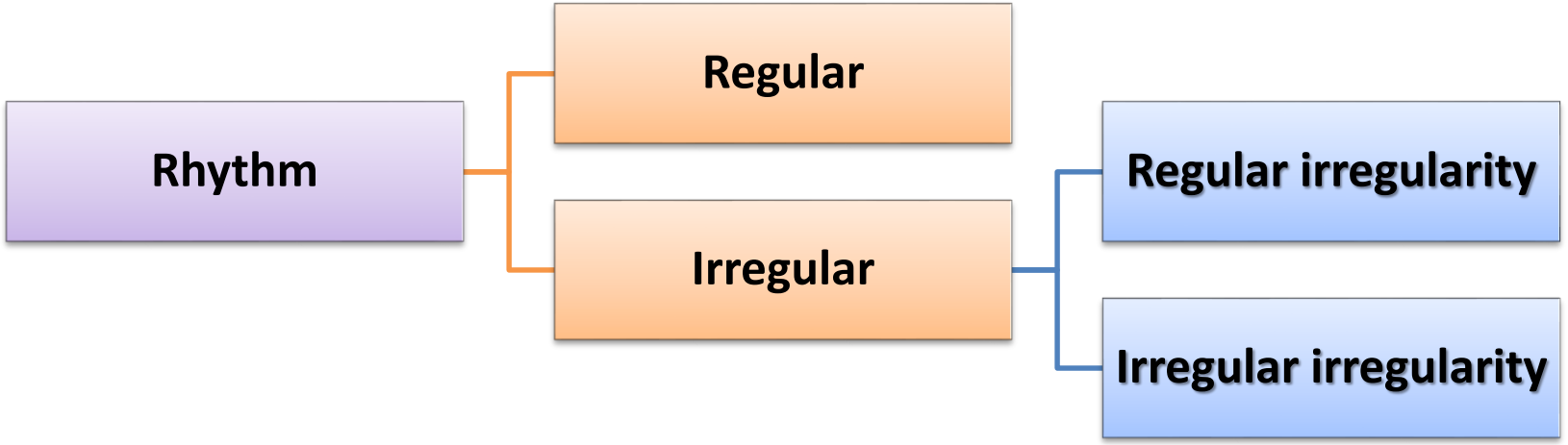
Why do athletes have a bradycardia?

- ✓ **Enlargement of the heart is a natural physical adaptation of the body to deal with the high pressures and large amounts of blood that can affect the heart during these periods of time. *Over time, the body will increase both the chamber size of the left ventricle, and the muscle mass and wall thickness of the heart.***
- ✓ ***Cardiac output*, the amount of blood that leaves the heart in a given time period (i.e. liters per minute), *is proportional to both the chamber sizes of the heart and the rate at which the heart beats.* With a larger left ventricle, the heart rate can decrease and still maintain a level of cardiac output necessary for the body. Therefore, athletes with AHS (Athletic heart syndrome) commonly have lower resting heart rates than non athletes.**

Athletic heart syndrome (AHS) is a non-pathological condition commonly seen in sports medicine in which the human heart is enlarged, and the resting heart rate is lower than normal. **(Not required in the exam)**

Pulse Rhythm

- ***Rhythm*** *refers to the regularity of the pulse or spacing of the beats.*
- The rhythm can be described as either regular or irregular :



Regular Irregularity

- (recurring irregular pattern) as may occur in **bigeminy** (alternating ectopic and normal beat) and **trigemini** (alternating ectopic and two normal beats).

Irregular Irregularity

- (completely irregular pattern) as may occur in **atrial fibrillation.**

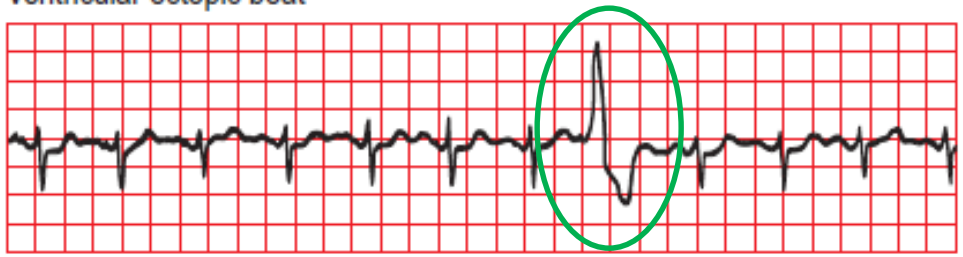
Pulse Rhythm للاطلاع

Note : This slide just to make the types of rhythm clearer so **<u>you do not have to memorize anything here ,just try to understand</u>** (we will go over it's details in ECG lab)

Sinus rhythm

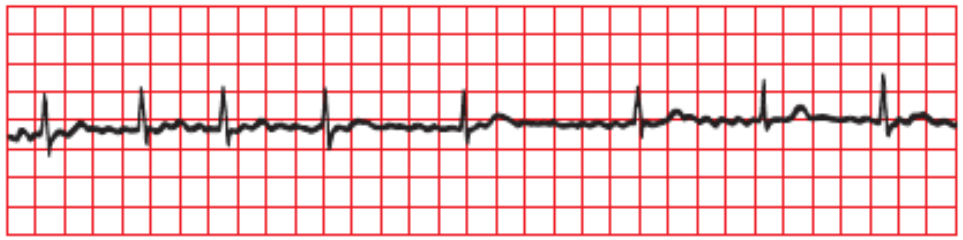
A

Ventricular ectopic beat



B

Atrial fibrillation



C

A. ***Regular Rhythm :*** equal PR intervals (in pulse examination the frequency of the pulsation can be felt by your fingers with equal intervals between pulsations).

B. ***Regularly irregular Rhythm:*** an ectopic beat occurring at a regular intervals.

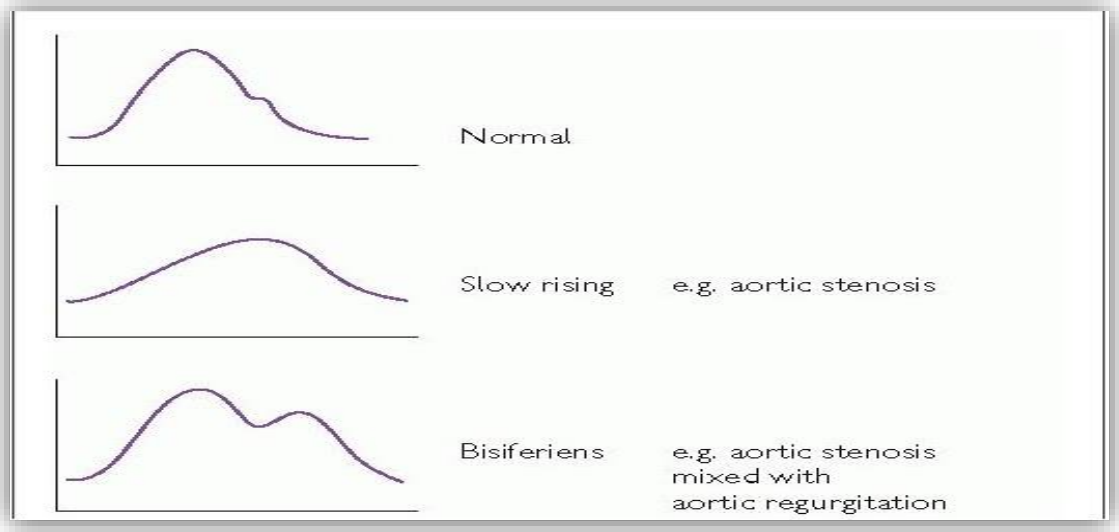
C. ***Irregularly irregular Rhythm:*** Look at the interval between each two QRS complexes , what can you see?

Pulse Character

- **Character:** *it refers to the waveform or shape of the arterial pulse.* The character or form of the pulse wave is studied by palpating the carotid pulse.
- It can be classified into :

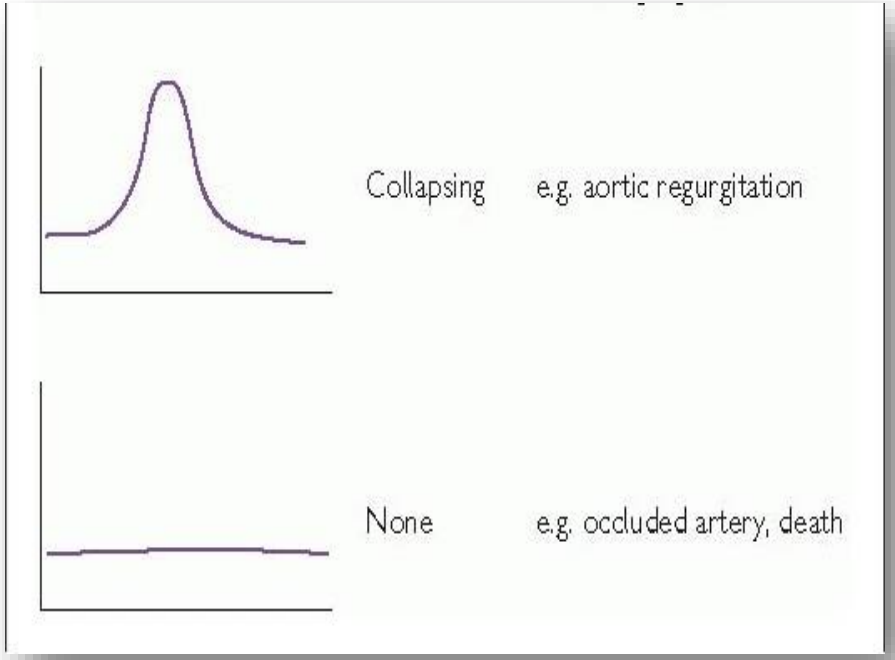
✓ ***A Slow Rising Pulse*** which has gradual upstroke with a reduced peak occurring late in systole, ***<u>it is a feature of aortic stenosis</u>***.

✓ ***A Pulsus Bisferiens*** which has two systolic peaks separated by a dip. ***<u>It occurs in mixed aortic valve stenosis and regurgitation.</u>***



Pulse Character

A Collapsing Pulse occurs when the peak of the pulse arrives early and is followed by rapid descent. It occurs in ***severe aortic regurgitation.*** To detect a collapsing pulse; first, check that the patient has no shoulder or arm pain or restriction on movement. Feel the radial pulse with the base of your fingers, then raise the arm of the patient vertically above the head.



Pulse Volume

- **Volume** *refers to the perceived degree of pulsation and reflects the pulse pressure* which depends upon the stroke volume and the compliance of the arteries. With normal vessels, the pulse volume gives an indication of the stroke volume. ***It is classified to:***

- ✓ ***Grade 0:*** undetectable pulse
- ✓ ***Grade 1:*** weak pulse (small volume)
- ✓ ***Grade 2:*** good volume
- ✓ ***Grade 3:*** large volume (bounding pulse)

Nature of the Vessel's Wall

Checking the condition of the vessel wall is done by rolling the artery under the fingers. *Normally, it is elastic.*

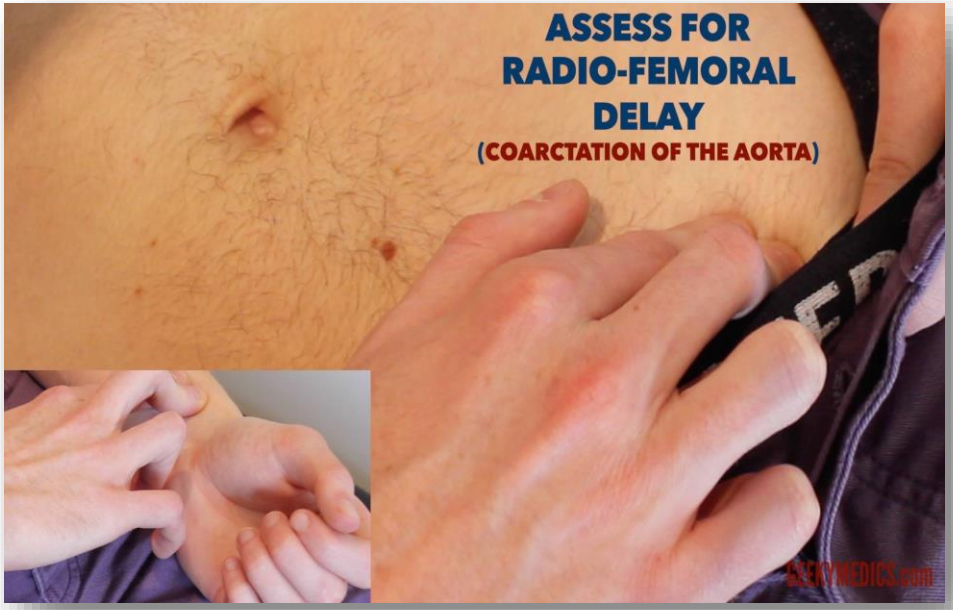
Degenerative changes in arteries that make them less elastic are referred to collectively as ***arteriosclerosis*** *(hardening of the arteries)*

Obesity, high dietary cholesterol and smoking are some of the factors correlated with premature development of ***arteriosclerosis***.

The status can be therefore described as: ***normal elastic state*** or as a ***rigid hard state*** especially in the elderly.

Radio-Femoral Delay

- Simultaneously feel the radial pulse and the femoral pulse .
- If you have found that the radial pulse comes before the femoral pulse ***(femoral delay),*** diagnosis of **coarctation of aorta** will probably be made.
- It is a characteristic of the ***coarctation of the aorta***; in which, there is narrowing of the aorta just beyond the origin of the left subclavian artery.



Radio-Radial Delay and Pulse Deficit

Radio-Radial Delay:*It can also be useful to palpate both radial pulses together to detect radial-radial inequality in timing or volume.* This condition occurs due to arterial occlusion by an *atherosclerotic plaque*, *subclavian artery stenosis*, or due to *thoracic outlet syndrome.*

Pulse Deficit: When the rhythm of the pulse is irregularly irregular (atrial fibrillation),*you have to count the heart rate by auscultation.* ***The difference between heart rate and pulse rate is called pulse deficit.***

PULSE DEFICIT = HEART RATE – PULSE RATE

Why pulse deficit is important ?

If it is > 10 /min:

- **Atrial Fibrillation (AF)**

If it is < 10 /min:

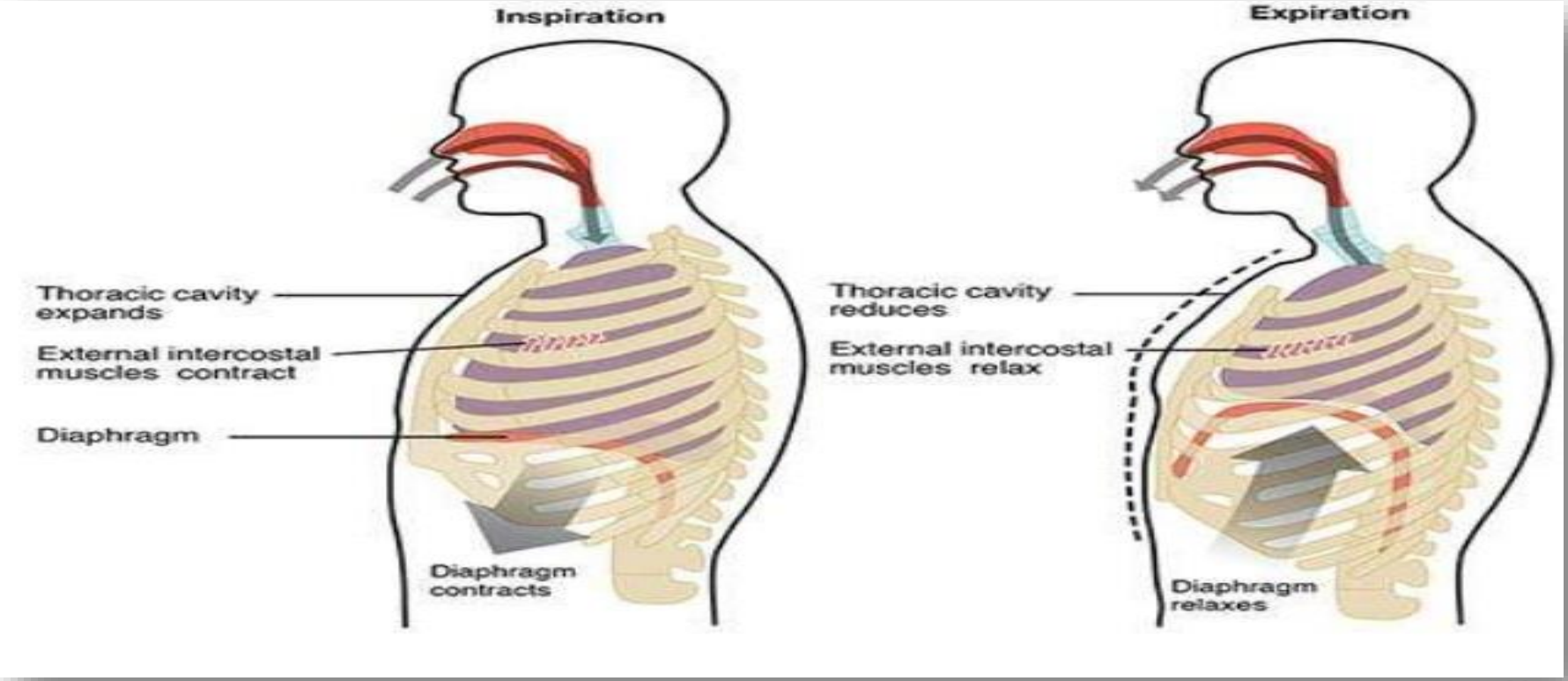
- **Multiple Ectopics**

We done with “Pulse Rate Assessment”, so let’s move to the:

Respiratory Rate Assessment

Respiratory Rate Assessment

Respiration : is the process of bringing oxygen to body tissues and removing carbon dioxide from them. The lungs play a major role in this process.



Respiratory Rate Assessment

- ***Respiratory rate :*** is the **number of breaths** taken within a set amount of time, typically **one minute**.
- The **average respiratory rate** reported in a healthy adult at rest is usually given as ***12–18 breaths per minute***.
- The respiratory rate varies with age; ***being faster in children than in adult:***

Birth to 6 weeks	30–60 breaths per minute
6 months	25–40 breaths per minute
3 years	20–30 breaths per minute
6 years	18–25 breaths per minute
10 years	15–20 breaths per minute
Adult	12–18 breaths per minute

Respiratory Rate Assessment

✓ **How to assess the respiratory rate:**

- The rate of respiration is usually counted at **rest** after taking the pulse rate while still holding the patient's arm to keep him/her **distracted**.

✓ A normal respiratory rate is termed ***Eupnea***, **an increased respiratory rate is termed *Tachypnea* ,** and **a lower than normal respiratory rate is termed *Bradypnea*.**

Reference

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- Pulse Examination: Prof.Dr.R.R.Deshpande (M.D in Ayurvdic Medicine & M.D. in Ayurvedic Physiology)www.ayurvedicfriend.com

An Increased Respiratory Rate