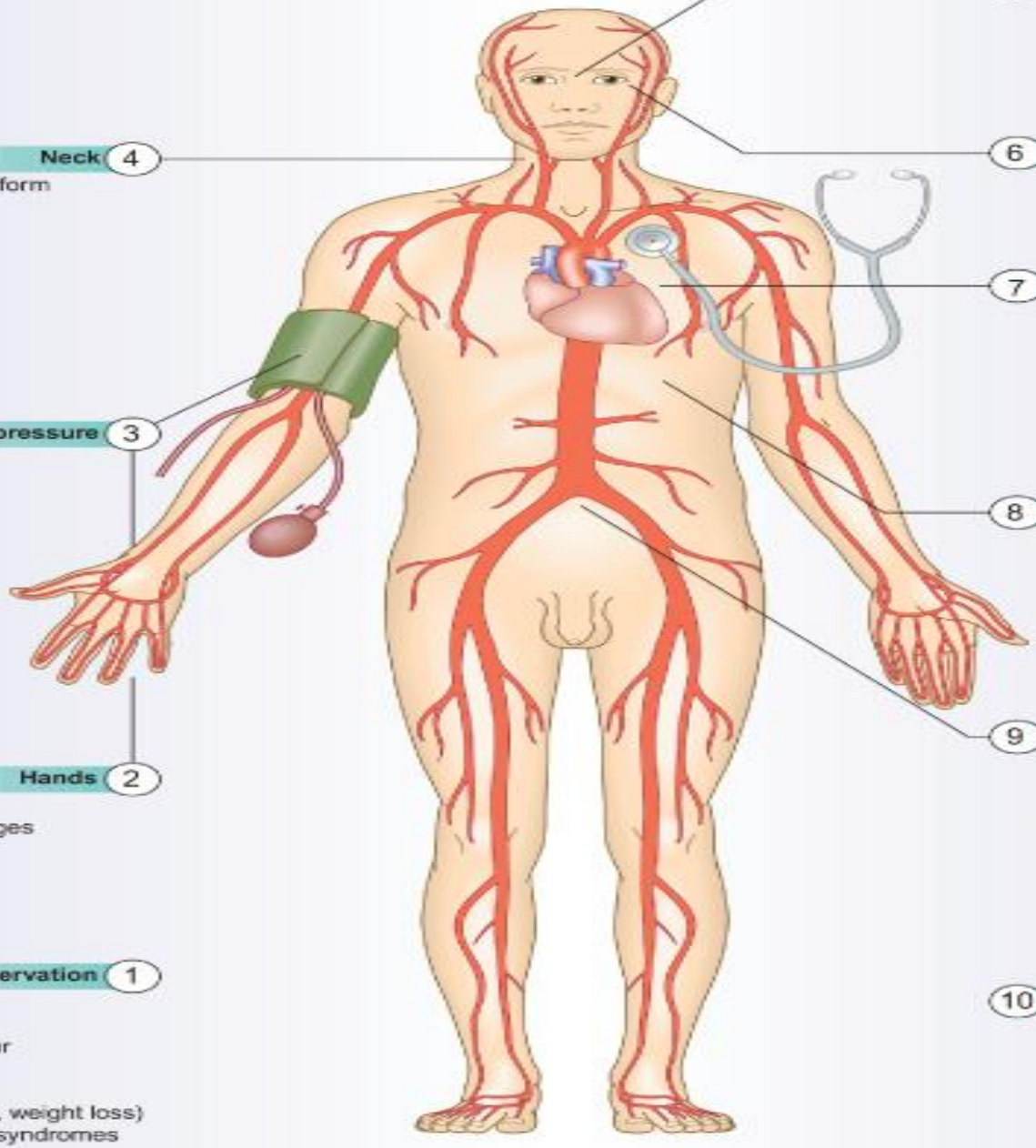
CARDIOVASCULAR SYSTEM

PHYSICAL EXAM



1 General observation
- Cyanosis
- Breathlessness
- Distress, demeanour
- Sweating
- Body habitus
- Body mass (obesity, weight loss)
- Marfan's and other syndromes

2 Hands
- Clubbing
- Splinter haemorrhages
- Skin temperature
- Tremor

3 Pulse and blood pressure

4 Neck
- JVP – height, waveform
- Carotid bruits

5 Face
- Pallor
- Central cyanosis
- Malar flush
- Corneal arcus
- Xanthomata

6 Eyes
- Hypertensive retinopathy
- Diabetic retinopathy

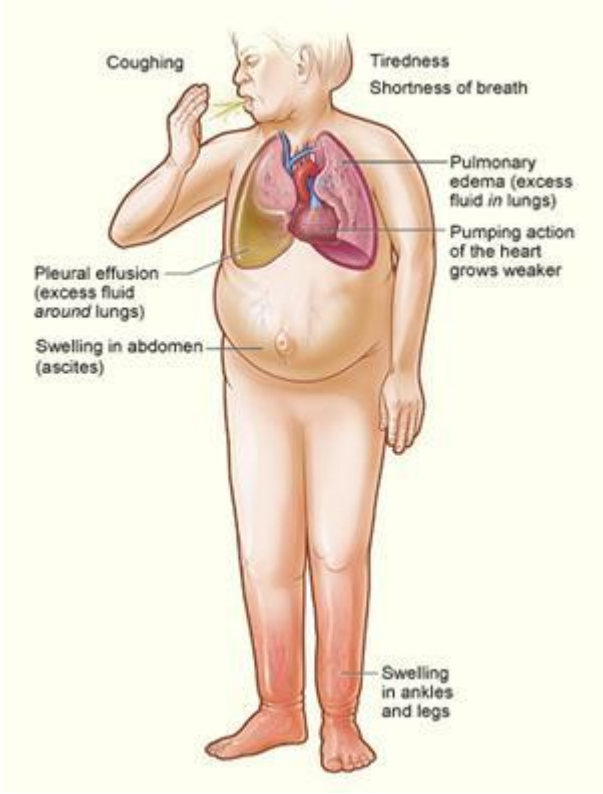
7 Precordium
- Inspect scars, pacemaker sites
- Palpation
  apex beat, heaves, thrills
- Auscultation
  heart sounds
  added sounds
  murmurs

8 Lung bases
- Crackles
- Pleural effusion

9 Abdomen
- Hepatomegaly
- Ascites
- Aortic aneurysm/bruits
- Sacral oedema
- Urine output

10 Legs
- Femoral pulses, bruits, radiofemoral delay
- Popliteal and foot pulses
- Ankle oedema
- Leg ulcers

Heart failure



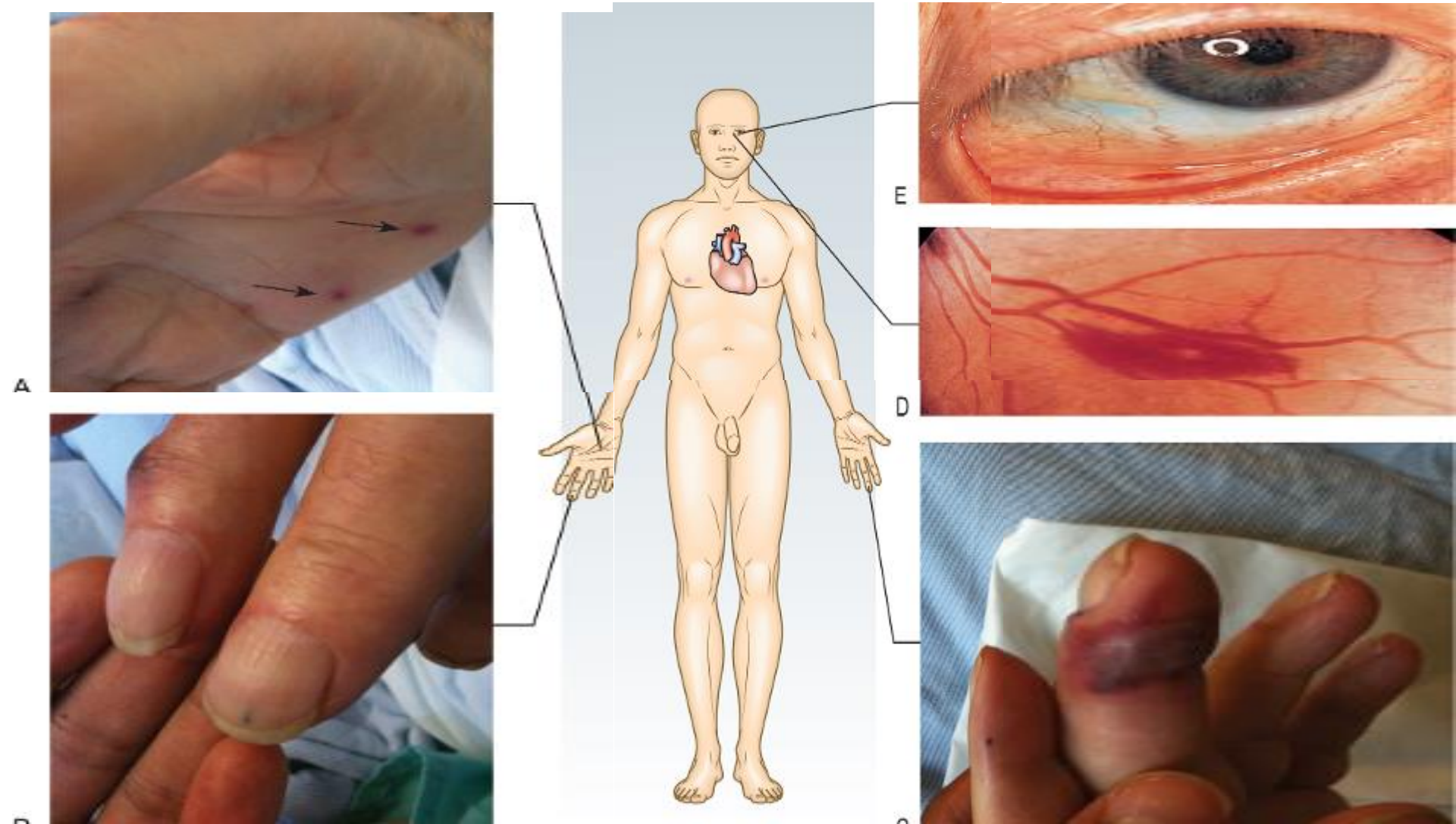
- introduce your self, take permision & explain what u want to do
- privacy
- Good light
- position
- exposure

General impression

- comment on position in bed (lying comfortable , in distress…), connections
- Looks well or ill
- breathless, distressed or frightened
- LOC
- cyanosed , pale , jaundiced

vital signs

Infective endocarditis



Hand examination in cvs

- Inspection

- Cyanosis
- Nails : tobacco staining, clubbing, splinter hemorrhages
- palms : janway spots , osler nodes, xanthomata on palms extensor surfaces,
- Skin : petechial rash

Palpation :

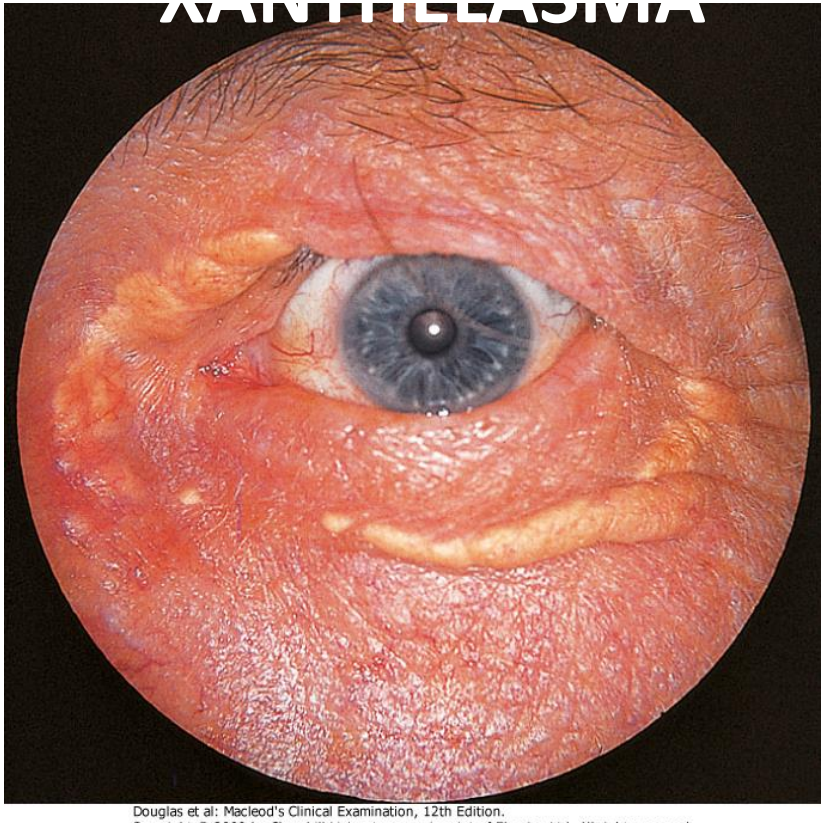
- Wet vs dry, hot vs cold , tremor

Face examination in cvs

- xanthelasma , if present check for xanthomata
- corneal arcus
- conjunctival petechiae
- Fundus : dm & htn, roth spots
- Mouth : cyanosis
- malar flush

Corneal arcus

Dyslipidemia



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.
- When taking a pulse, assess:
• 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.
- compressibility

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.

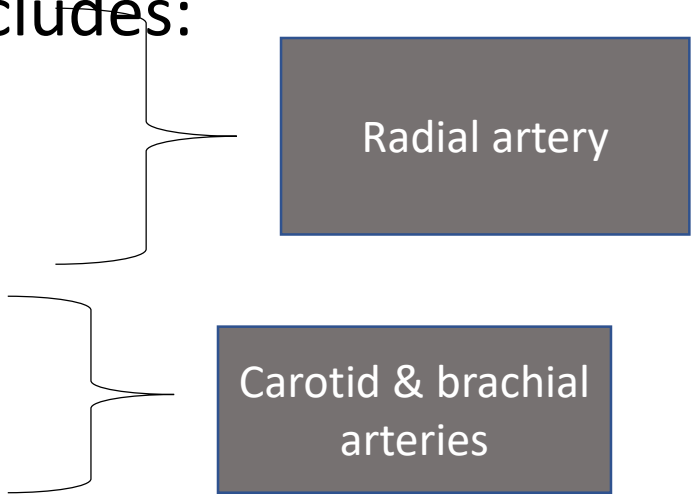
Arterial pulses

>> radial , brachial , carotid, femoral , popliteal, post tibial , dorsalis pedis

>> Identify surface markings of peripheral arteries

>> Examination includes:

- Rate
- Rhythm
- Compressibility
- Volume
- Character



Arterial pulses

Rate

- Normal rate: 60-100 b.p.m

Rhythm

- **Regular pulse-pulse interval**
- **Sinus arrhythmia**
- **Irregular: regular irregular vs. irregular irregular**

Volume

- **Volume refers to the perceived degree of pulsation =pulse pressure**
- **Normal volume**
- **Large or low volume**

Character

- shape/the pulse waveform

4.9 Causes of abnormal pulse rate or rhythm

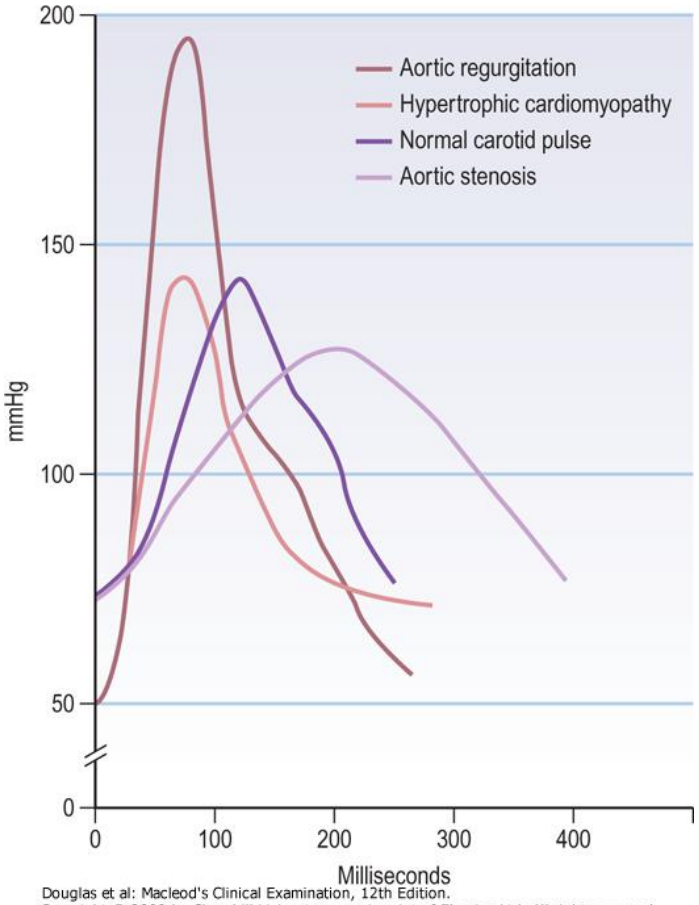
Abnormality	Sinus rhythm	Arrhythmia
Fast rate (tachycardia, >100 bpm)	Exercise Pain Excitement/anxiety Fever Hyperthyroidism Medication: Sympathomimetics, e.g. salbutamol Vasodilators	Atrial fibrillation Atrial flutter Supraventricular tachycardia Ventricular tachycardia
Slow rate (bradycardia, <60 bpm)	Sleep Athletic training Hypothyroidism Medication: Beta-blockers Digoxin Verapamil, diltiazem	Carotid sinus hypersensitivity Sick sinus syndrome Second-degree heart block Complete heart block
Irregular pulse	Sinus arrhythmia Atrial extrasystoles Ventricular extrasystoles	Atrial fibrillation Atrial flutter with variable response Second-degree heart block with variable response

- pulse pressure : systolic bp – diastolic bp
- proportional to stroke volume & cardiac output
- Inversely proportional to compliance of aorta
- Increased pulse volume :

- Excersize , pregnancy , increased environmental temp.
- anemia , fever , thyrotoxicosis , av shunt , paget's disease
- advanced age , htn
- Aortic regurgitation : inc. EDV, inc. aortic sys p , dec. aortic dias p

Abnormal character

- Collapsing pulse: **rapid fall** ..the peak arrives early followed by rapid descend (wide pulse pressure)
- Slow rising pulse: gradual upstroke with a reduced peak occuring late in systole
- Bisferiens pulse: two systolic peaks separated by midsystolic dip (concomitant aortic stenosis & regurg, & HOCM)

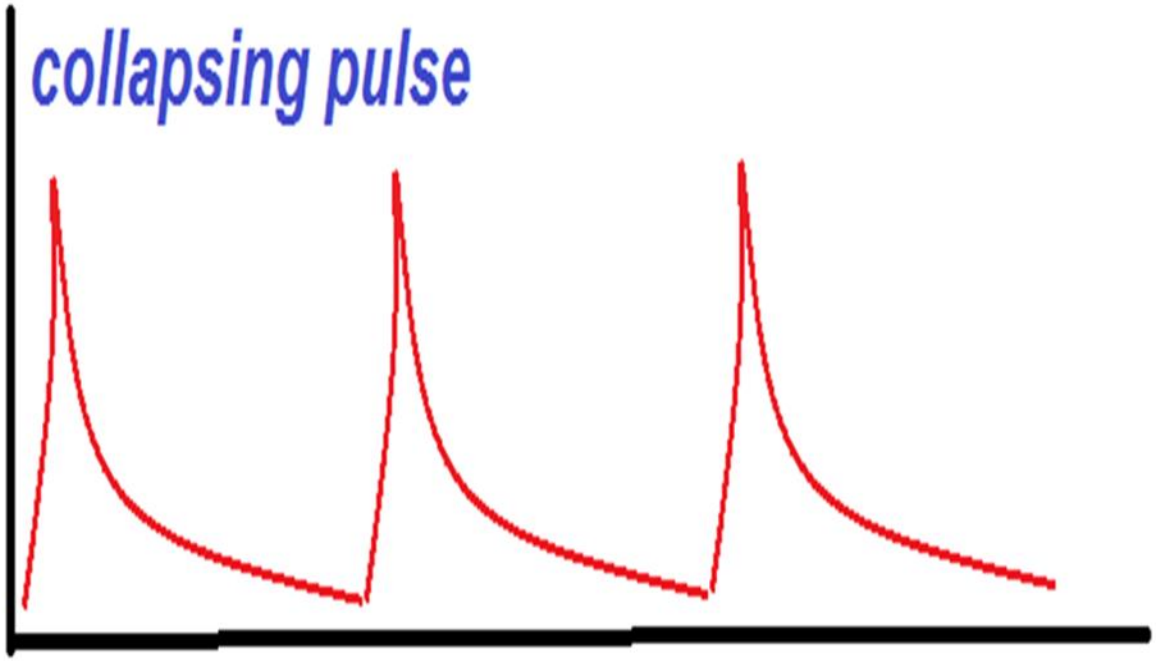


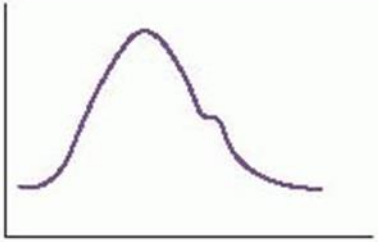
- low pulse volume :

- Left ventricular failure
- hypovolemia
- Aortic stenosis
- Mitral stenosis
- tamponade

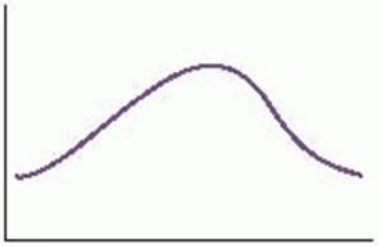
-Asymmetrical pulses on both sides may represent occlusive peripheral arterial disease or stenosis , and rarely , aortic disection

[redacted]





Normal



Slow rising e.g. aortic stenosis

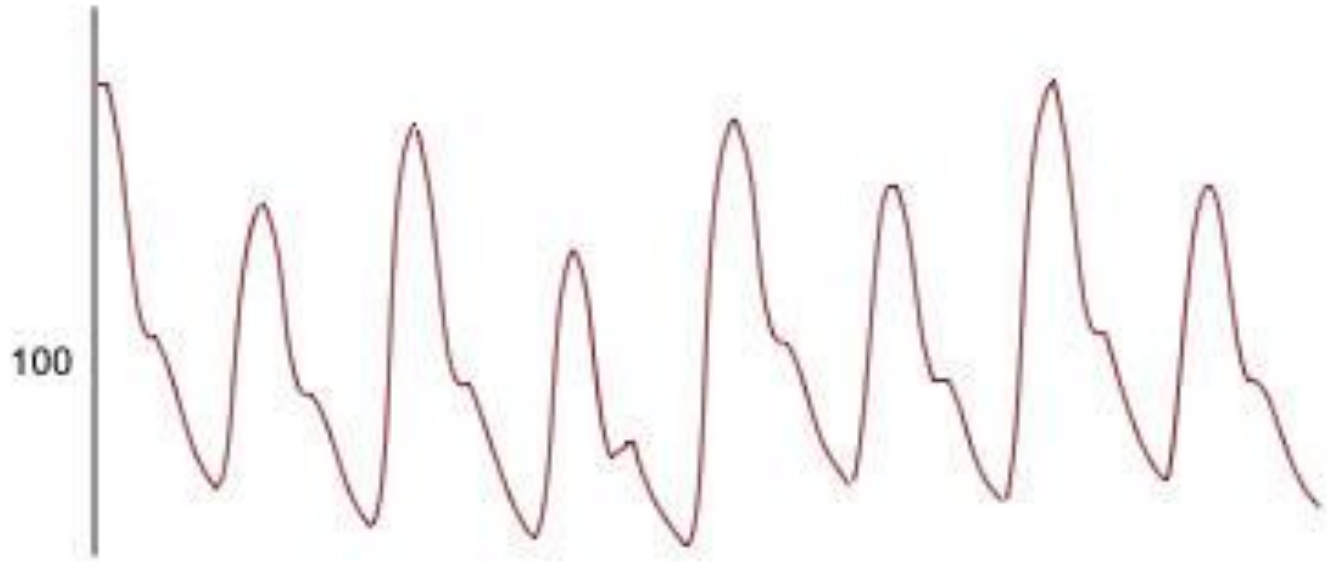
Bisiferiens e.g. aortic stenosis mixed with aortic regurgitation

- pulsus alternans :

>> beat to beat variation in pulse volume with a normal rhythm .

>> occurs in advanced systolic heart failure

>> frank starling low (higher EDV>> more stretch on muscle fibers >> higher stroke volume)


100

Pulsus paradoxus

Hemodynamic effects of respiration

Hemodynamic effects of respiration

	Inspiration	expiration
Heart rate	Accelerates	Slows
Systolic BP	Falls (up to 10 mmHg)	Rises
JVP	Falls	Rises

Intraperi pressure (IPP) tracks- intrathoracic pressure.

Inspiration:

-ve intrathoracic pressure is transmitted to the pericardial space

↓ IPP

↑ blood return to the right ventricle

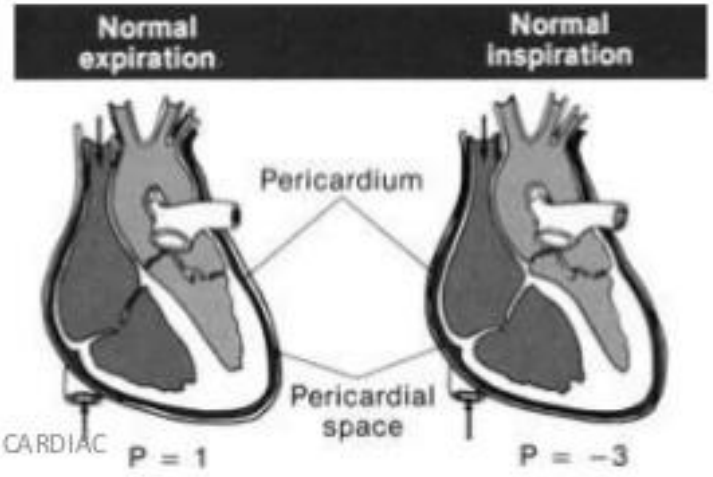
↓ jugular venous and right atrial pressures

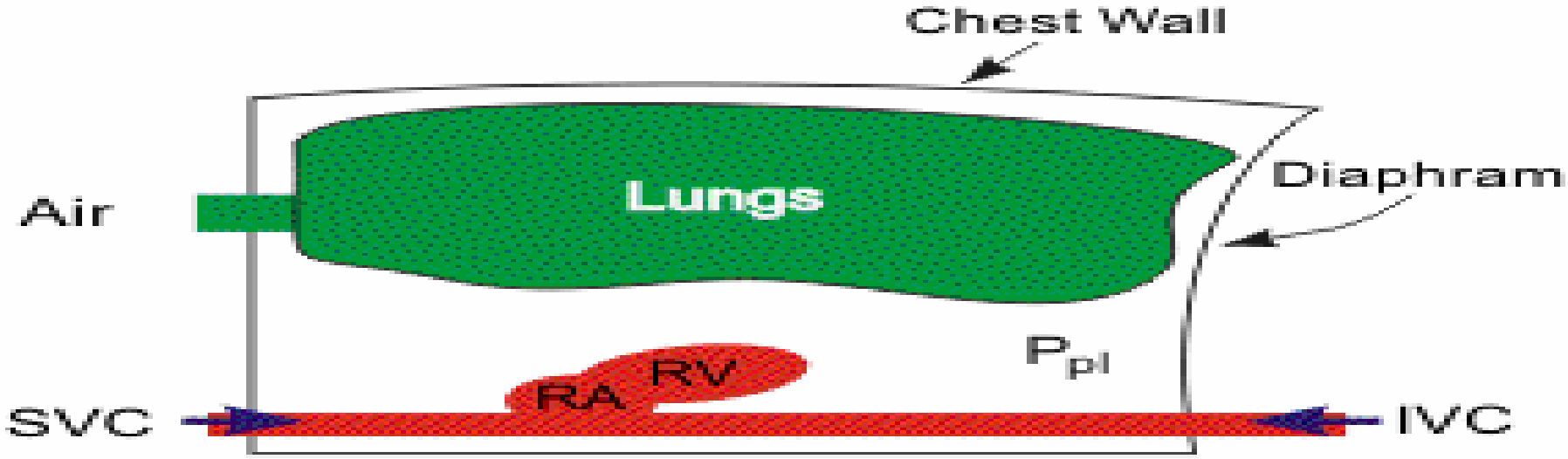
↑ right ventricular volume → IVS shifts towards the left ventricle

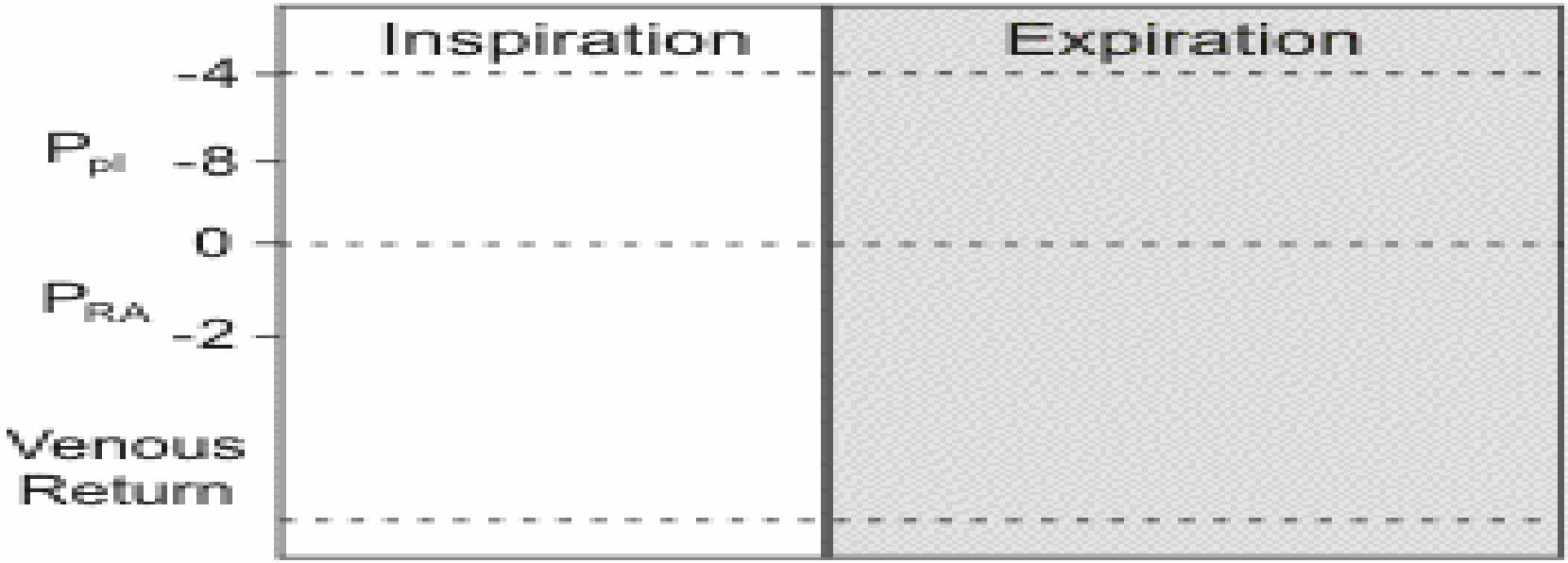
↓ left ventricular volume

↓ LV stroke volume

⇒ ↓ blood pressure (<10mmHg is normal) during inspiration



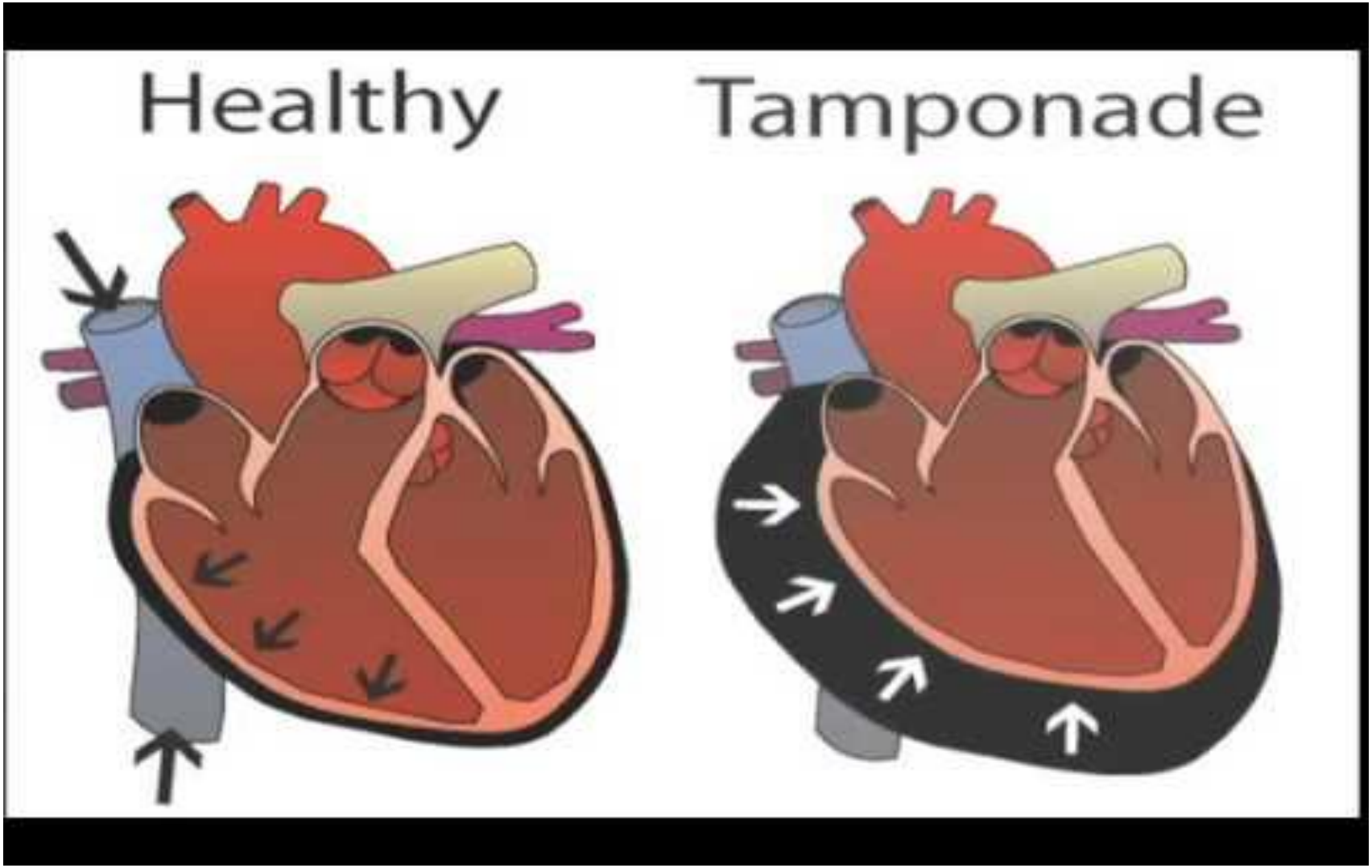




End-Expiration

Pulsus paradoxus :

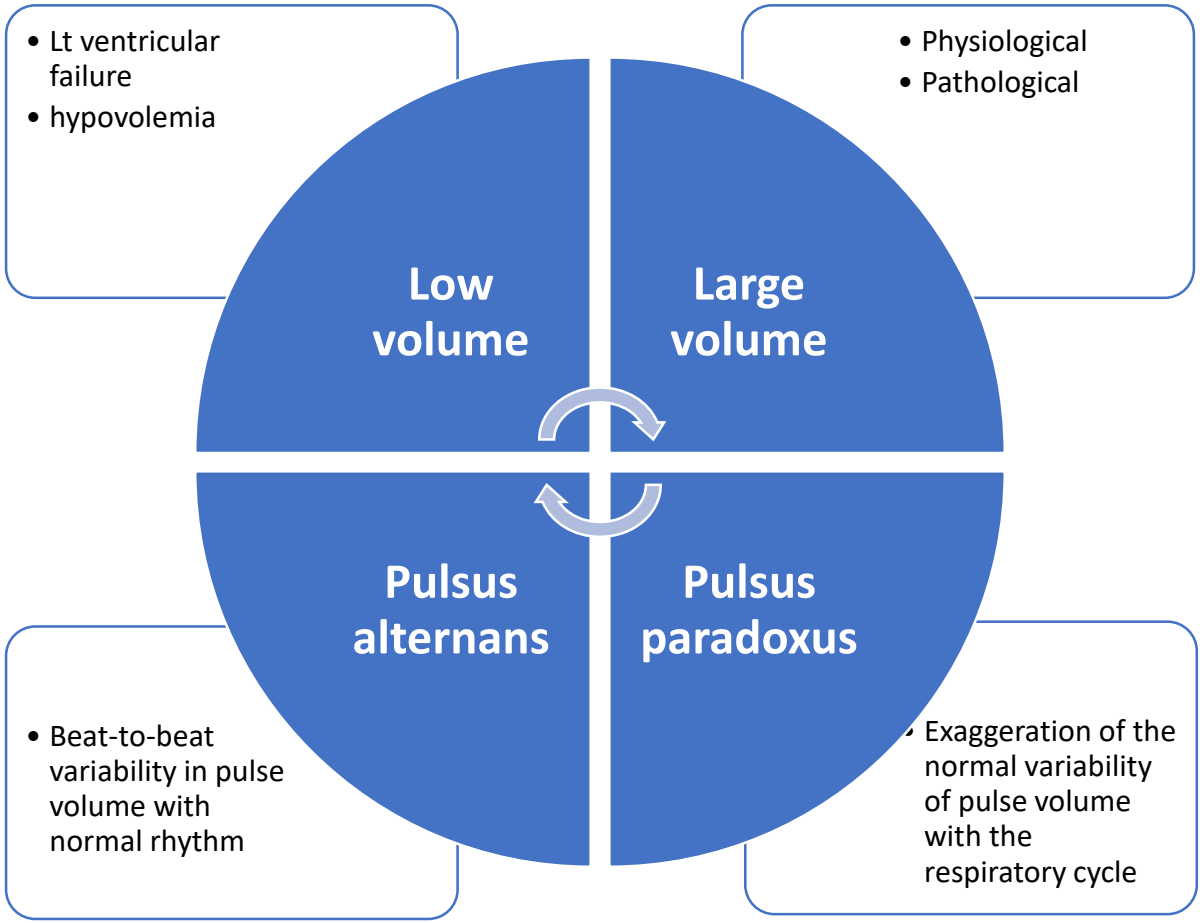
PULSUS PARADOXUS



- causes :

- Cardiac tamponade
- Constrictive pericarditis
- Severe obstructive lung diseases

Abnormal volume



Examination of the Radial pulse

1. Calculate the pulse rate for 1 minute, comment on rate, rhythm , volume , character and compressibility, feel with pads of **THREE FINGERS**.
2. AFTER ENSURING NO ARM PAIN OR LIMITATION IN MOVEMENT , Examine for collapsing pulse with the base of fingers, then raise the pt hand above his head
3. Palpate the radial pulse from both sides simultaneously to assess for any delay or difference in volume.
4. Palpate the radial and femoral pulse simultaneously looking for radiofemoral delay
5. Calculate the pulse deficit if the pulse was irregular

RADIAL PULSE

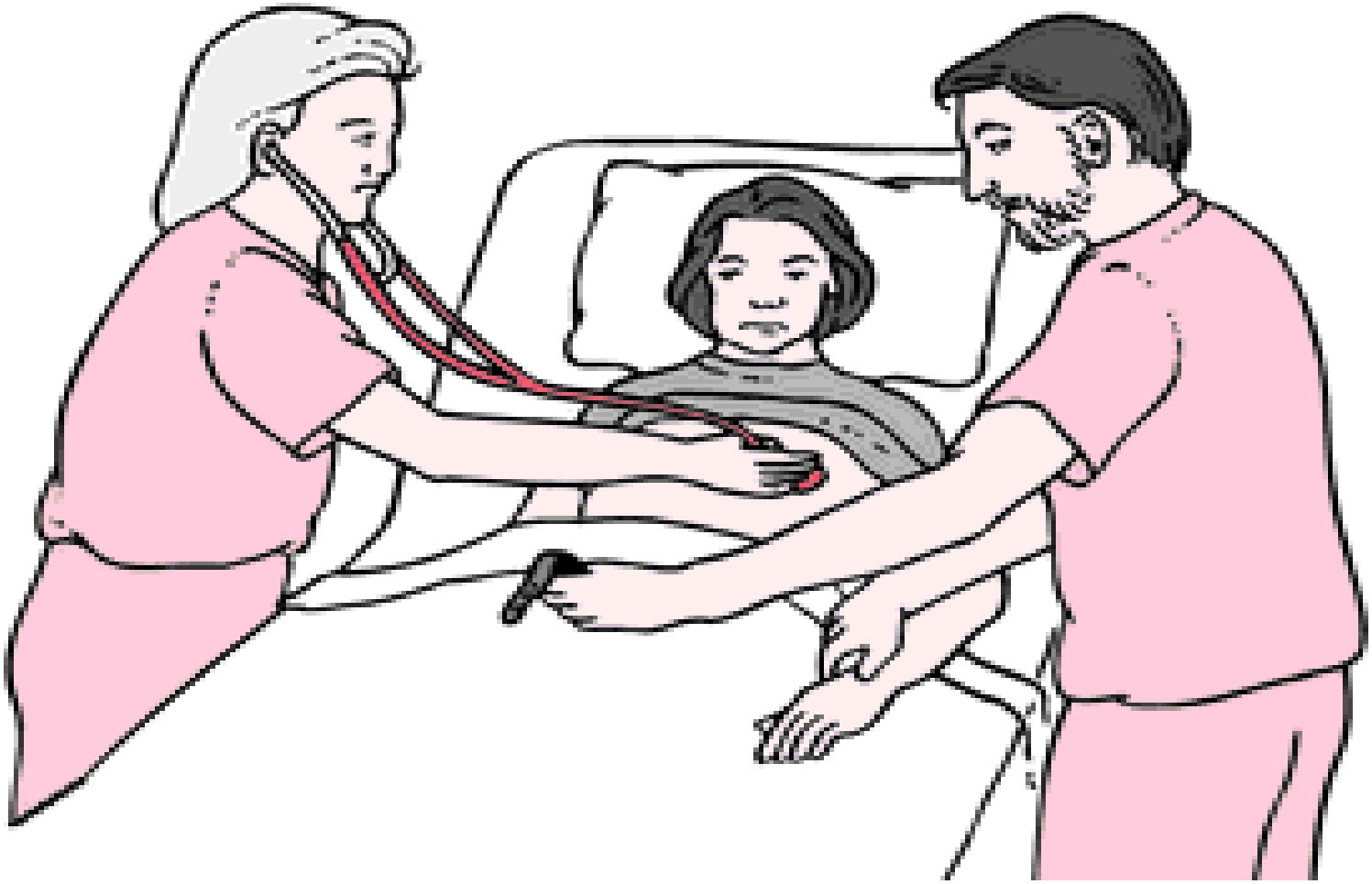
- lateral to the flexor carpi radialis tendon

RADIAL BILATERAL

COLLAPSING PULSE

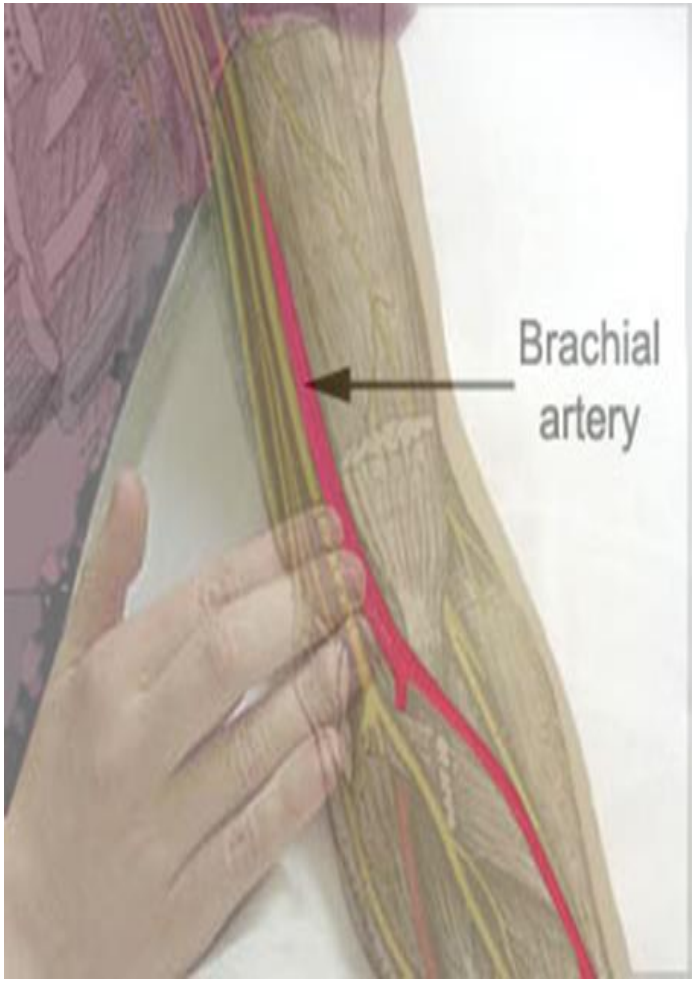
Any shoulder pain?

Pulse deficit

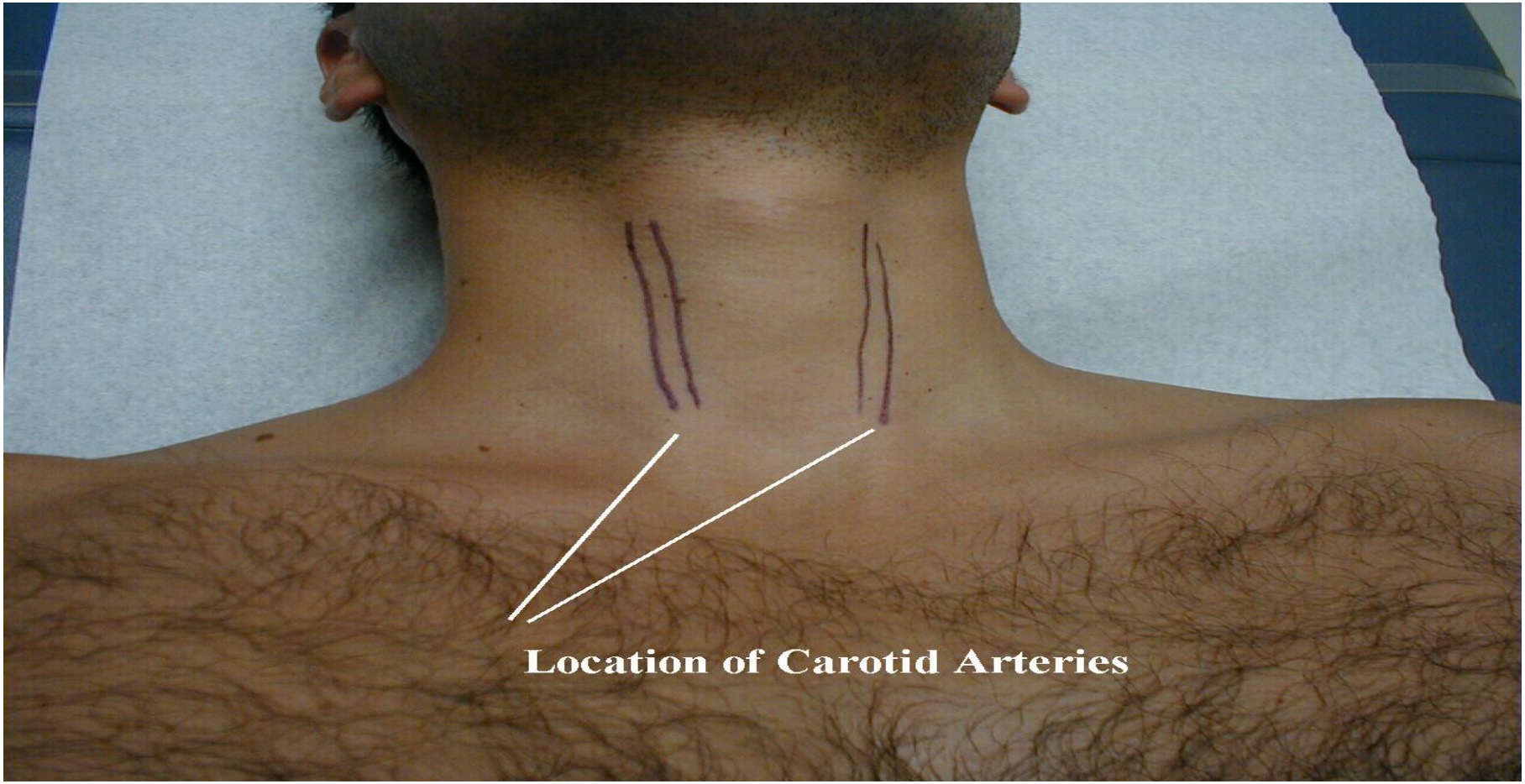


RADIO FEMORAL DELAY

BRACHIAL PULSE



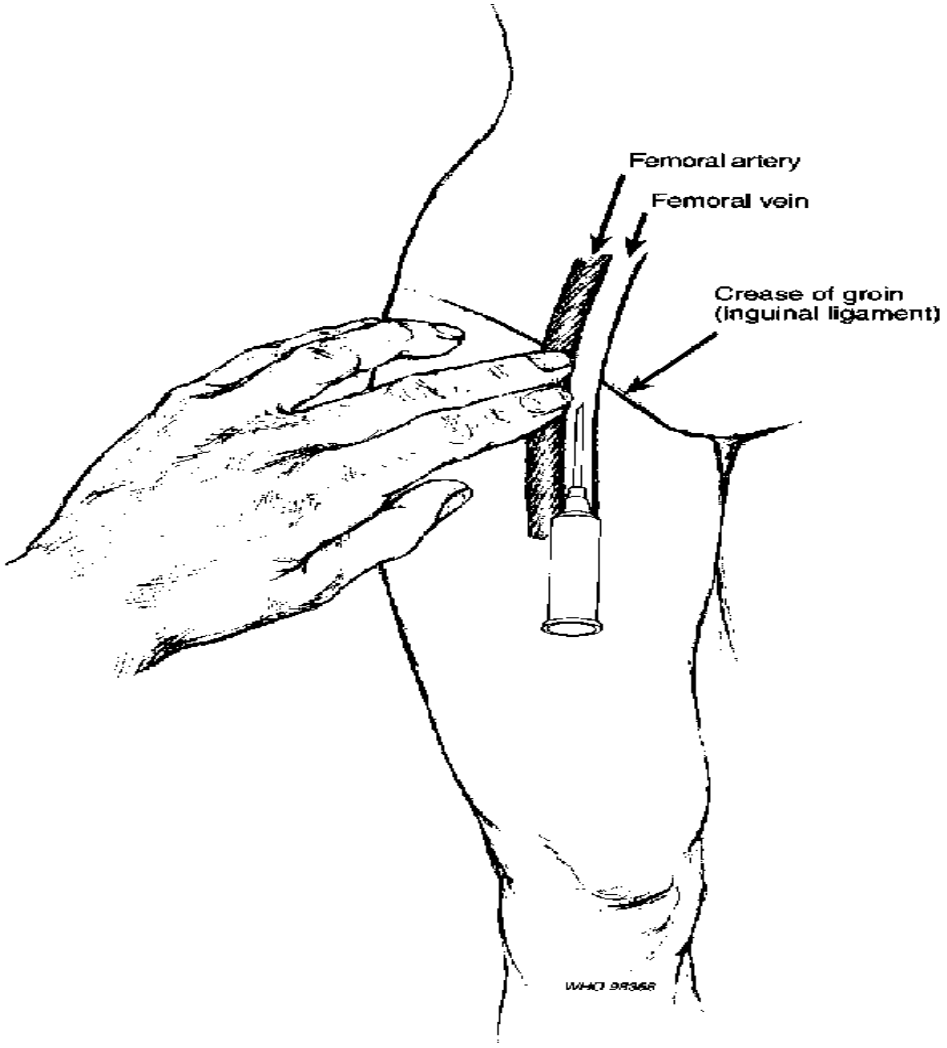
CAROTID PULSE



Comment on volume and character

- Never bilateral simultaneously
- Gently press the tip of TWO fingers between the larynx and the anterior border of the sternocleidomastoid
- Auscultate for bruits using the **diaphragm** with holding the breath

Femoral artery




AUSCULTATE
FEMORAL
ARTERY
(BRUIT)
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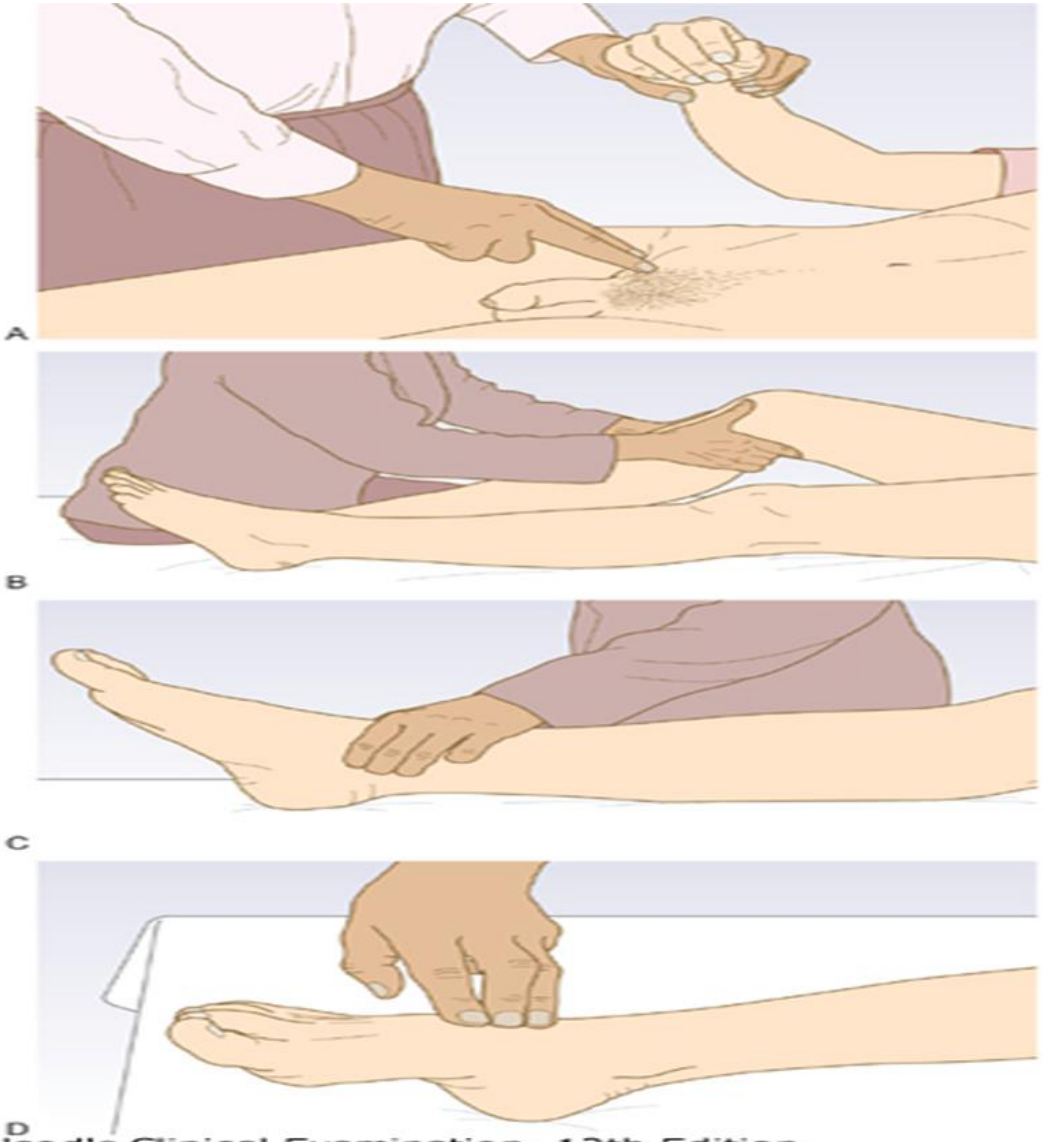
Lower limb pulses

- femoral artery : midinguinal point
- popliteal : popliteal fossa
- post tibial : 2 cm below & posterior to medial malleolus , it passes beneath the flexor retinaculum between flexor digitorum longus & flexor hallucis longus
- dorsalis pedis : lateral to tendon of extensor hallucis longus , at proximal extent of groove between 1^{st} & 2^{nd} metatarsals .



Douglas et al: Macleod's Clinical Examination, 12th Edition.

Blood pressure

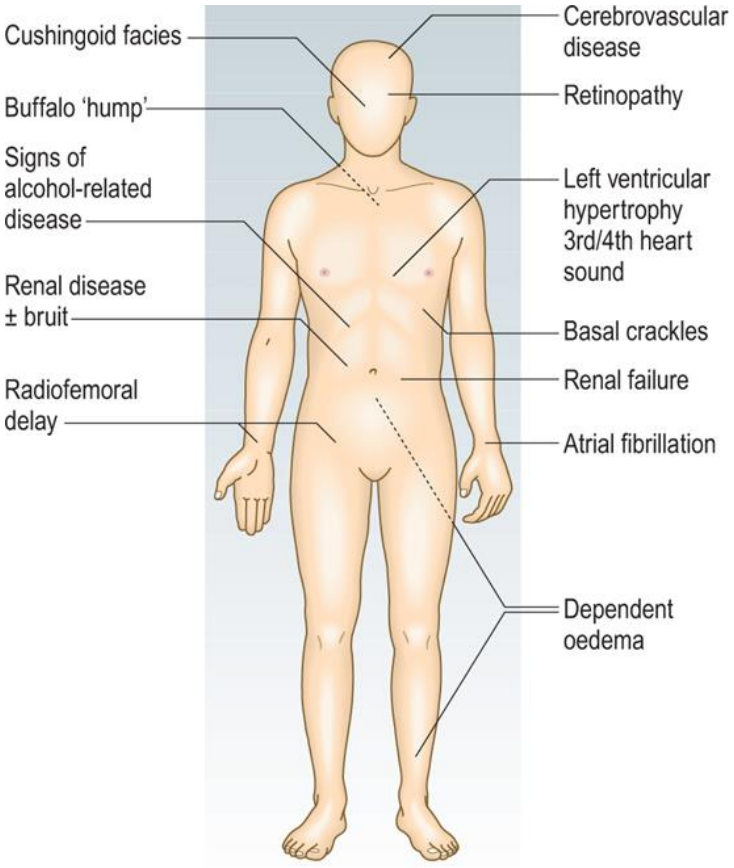
Blood pressure

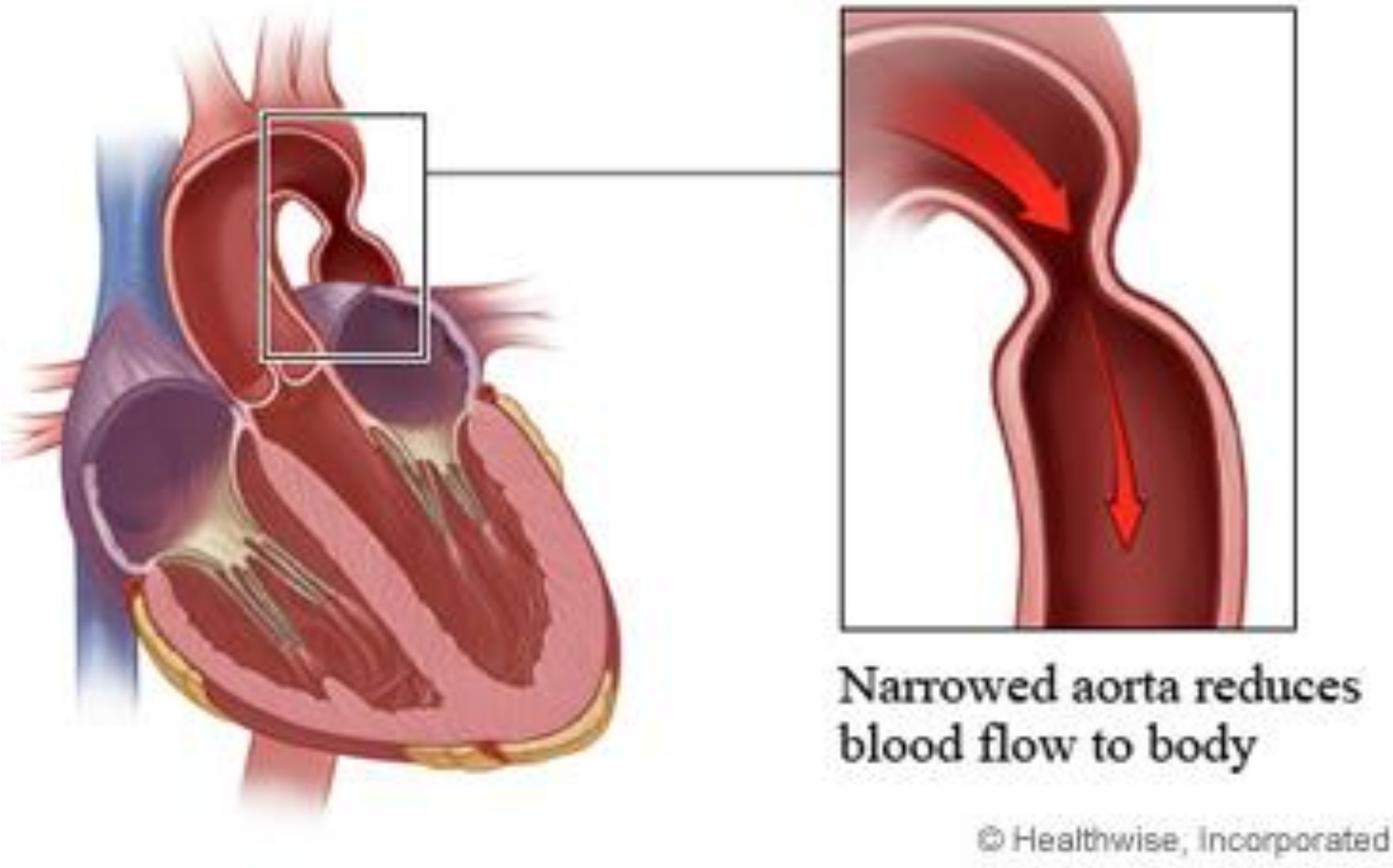
- Blood pressure (BP) is a measure of the force that the circulating blood exerts against the arterial wall
- Systolic BP is the maximal pressure that occurs during ventricular contraction (systole)
- Diastolic blood pressure is BP during ventricular filling (diastole), it is maintained by the elasticity and compliance of the vessel wall
- **Hypertension** is abnormal elevation of BP that places the patient at an increased risk for end organ damage

- Invasive vs non-invasive BP measuring
- BP is measured in *mmHg* and recorded as *systolic pressure/diastolic pressure*, together with where, and how the reading was taken
- 'White-coat hypertension‘
- Ambulatory BP monitoring

- **Essential hypertension** : in which there is no readily identifiable cause, occurs in >90% of patients with hypertension.
- **Secondary hypertension :** is rare, occurring in <1% of the hypertensive population, causes of secondary HTN include:
  - Renal artery stenosis
  - Conn's syndrome
  - Cushing's disease
  - Coarctation of the aorta
  - Polycystic kidney disease
  - pheochromocytoma

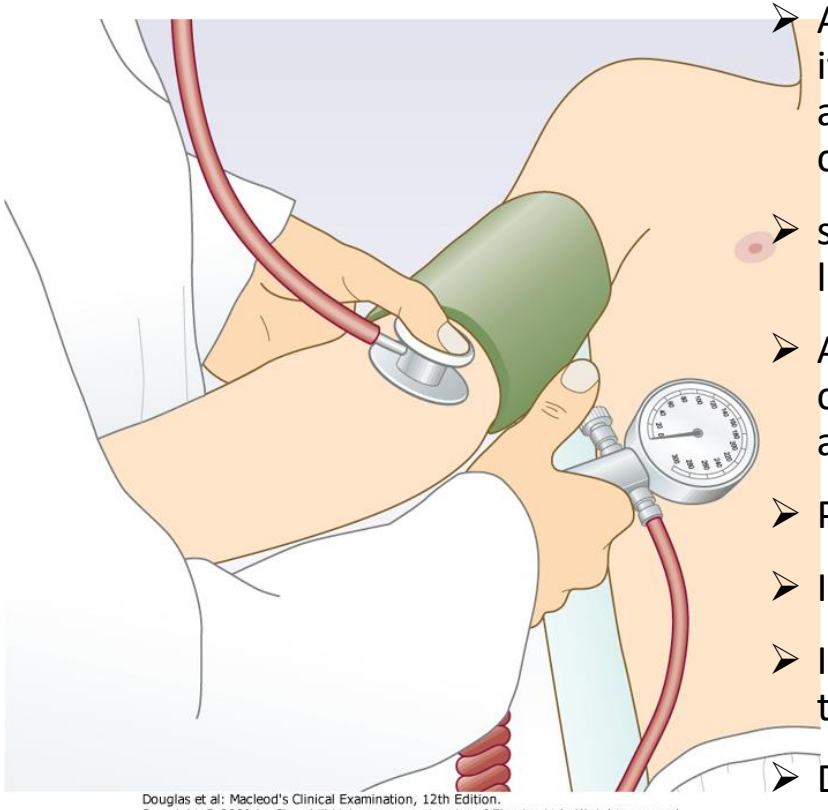
Examination of the hypertensive patient



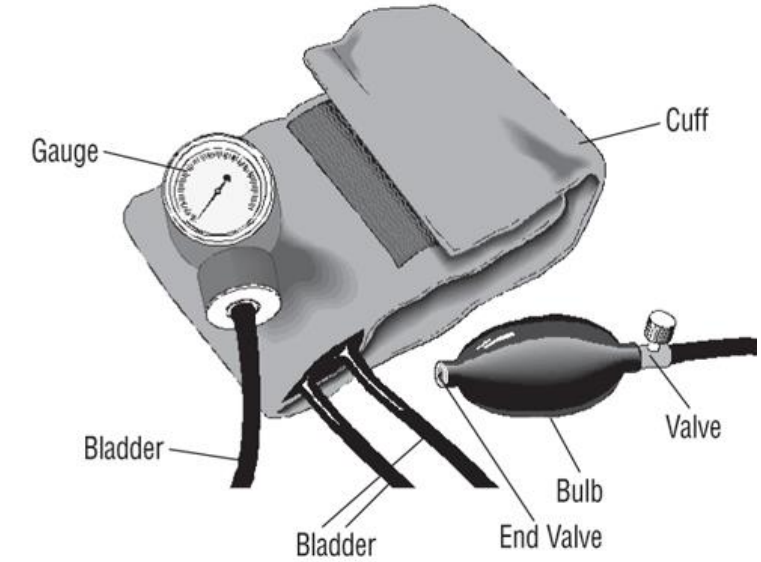


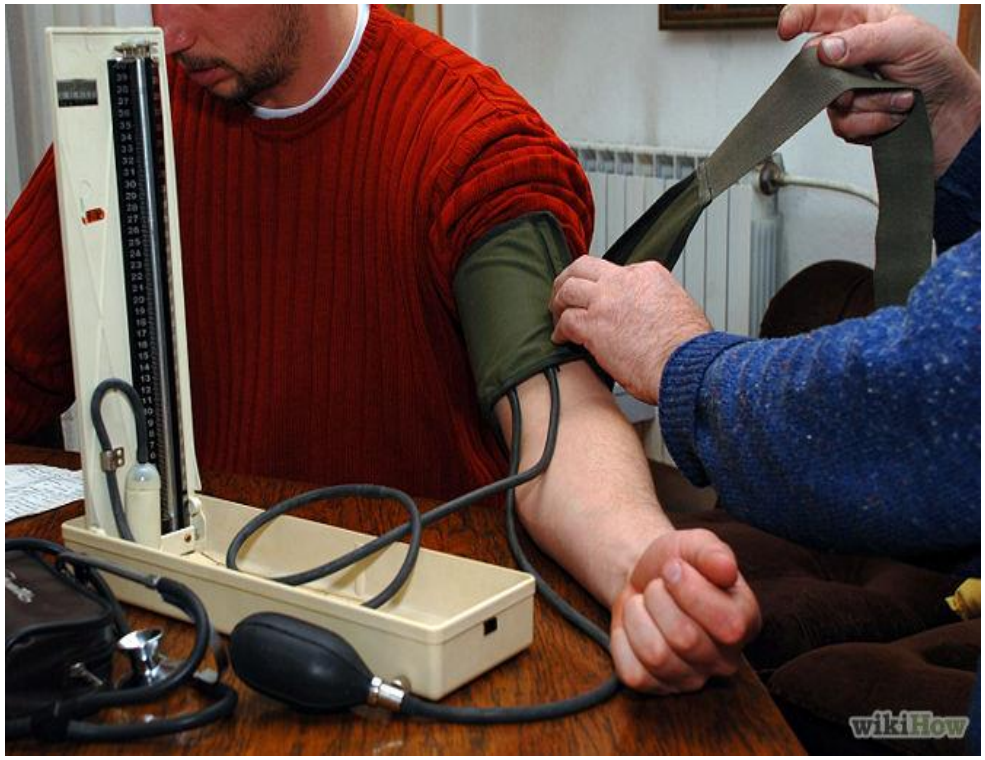
Narrowed aorta reduces blood flow to body

Measuring blood pressure

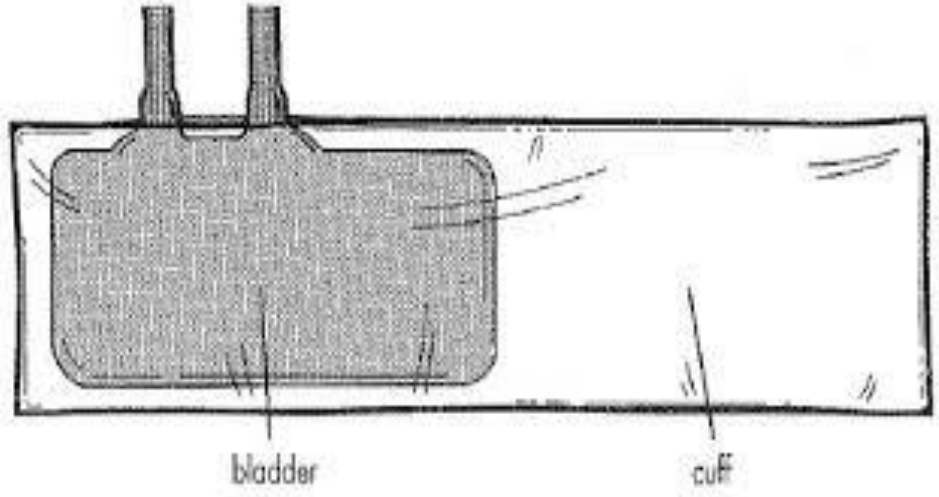


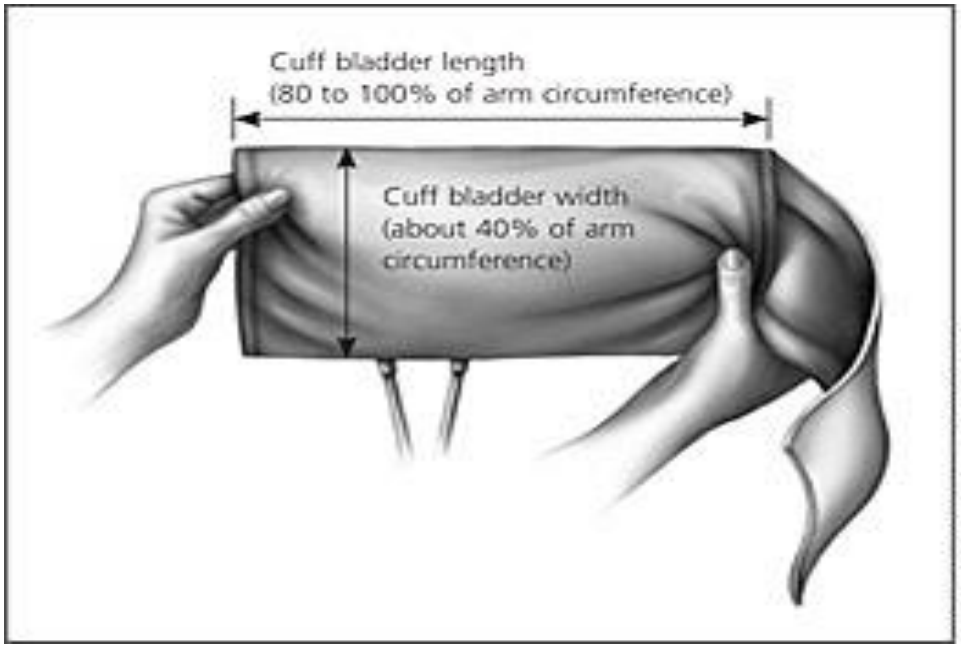
- Rest the patient for 5 minutes.
- Always measure BP **in both arms** & measure it **sitting & standing** with at least 2 min apart ..the higher reading is the closest to central aortic pressure.
- support his arm comfortably at about heart level
- Apply the cuff to the upper arm, with the centre of the bladder over the brachial artery
- Palpate the brachial pulse.
- Inflate the cuff until the pulse is impalpable
- Inflate the cuff another 30 mmHg and listen through the diaphragm of the stethoscope
- Deflate the cuff slowly (2-3 mmHg/s) until you hear a regular tapping sound (phase 1 Korotkoff sounds)
- Continue to deflate the cuff slowly until the sounds disappear.

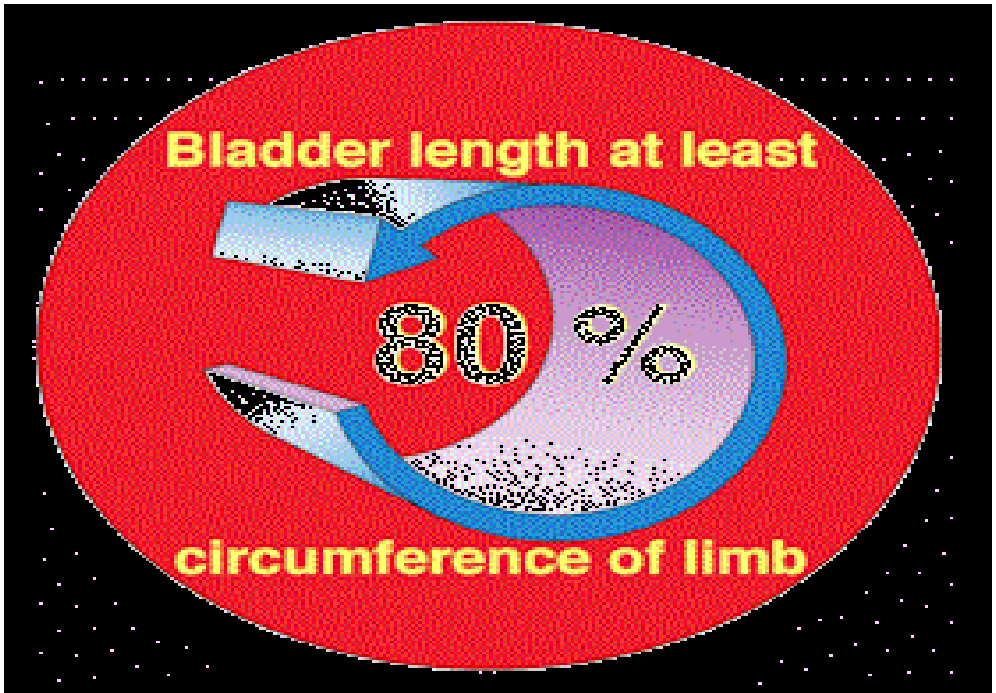

Gauge
Cuff
Valve
Bladder
Bulb
Bladder
End Valve

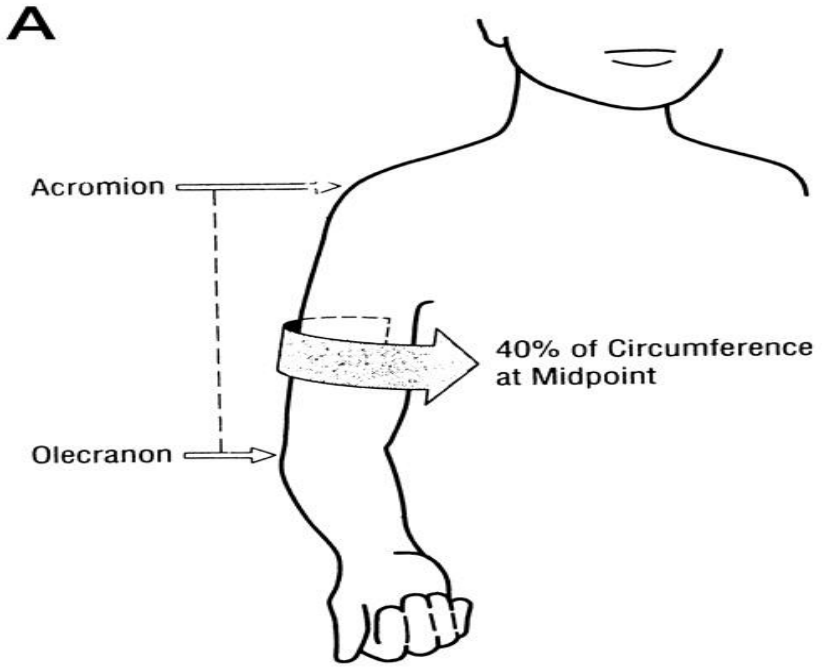

wikiHow

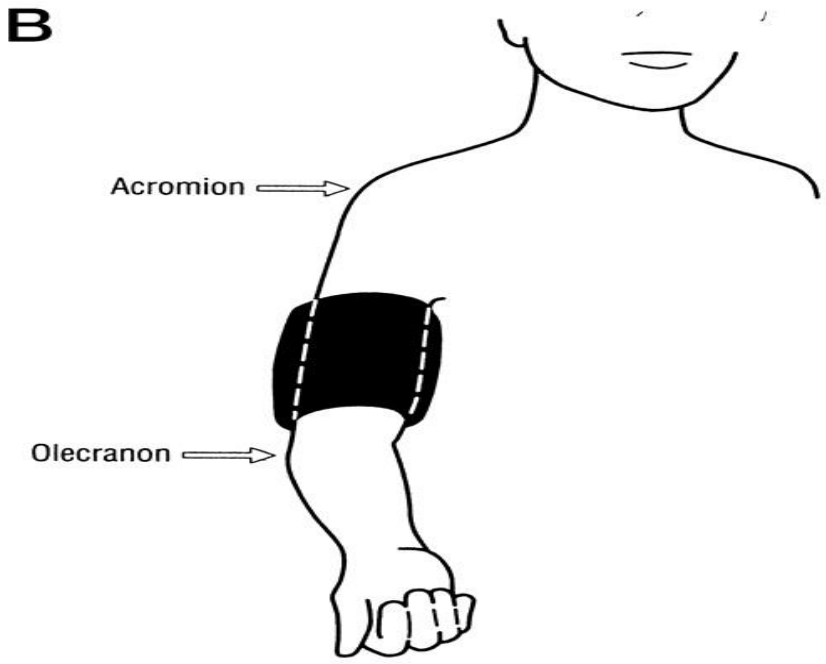

ABN


bladder
cuff

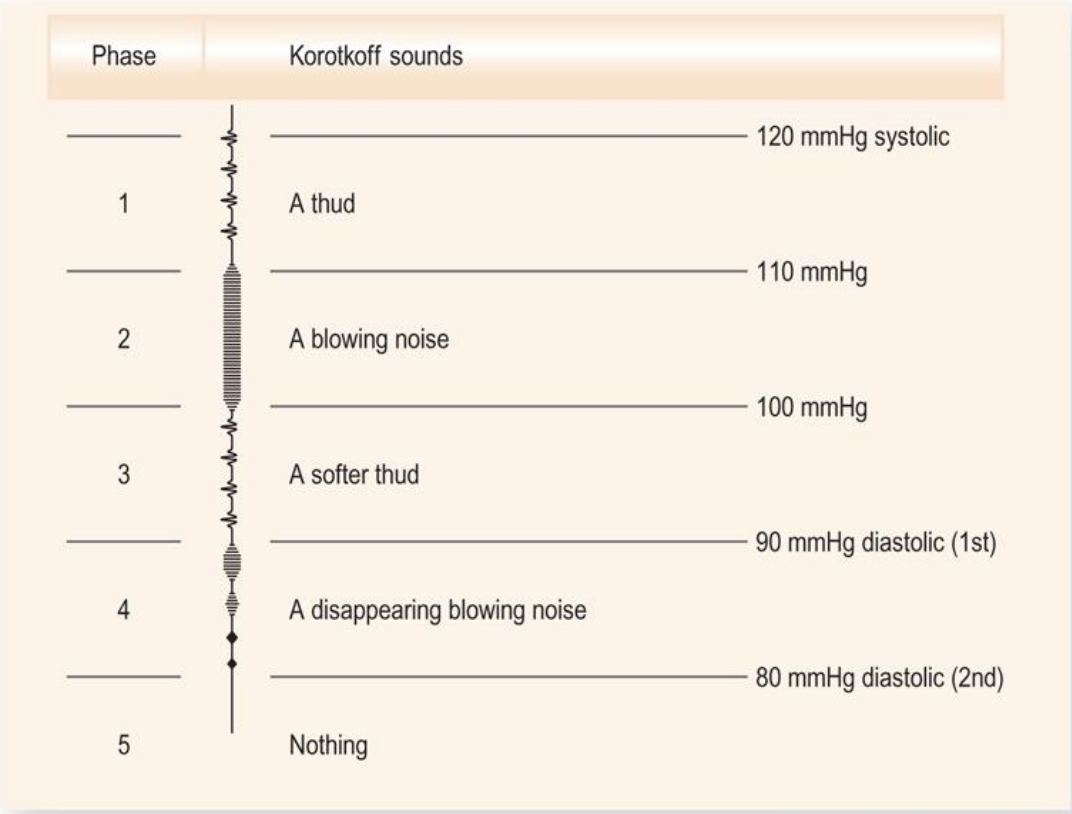

Cuff bladder length
(80 to 100% of arm circumference)
Cuff bladder width
(about 40% of arm
circumference)
© 2006 RENEE CANNON


Bladder length at least
80 %
circumference of limb


A
Acromion
40% of Circumference
at Midpoint
Olecranon


B
Acromion
Olecranon

Korotkoff sounds

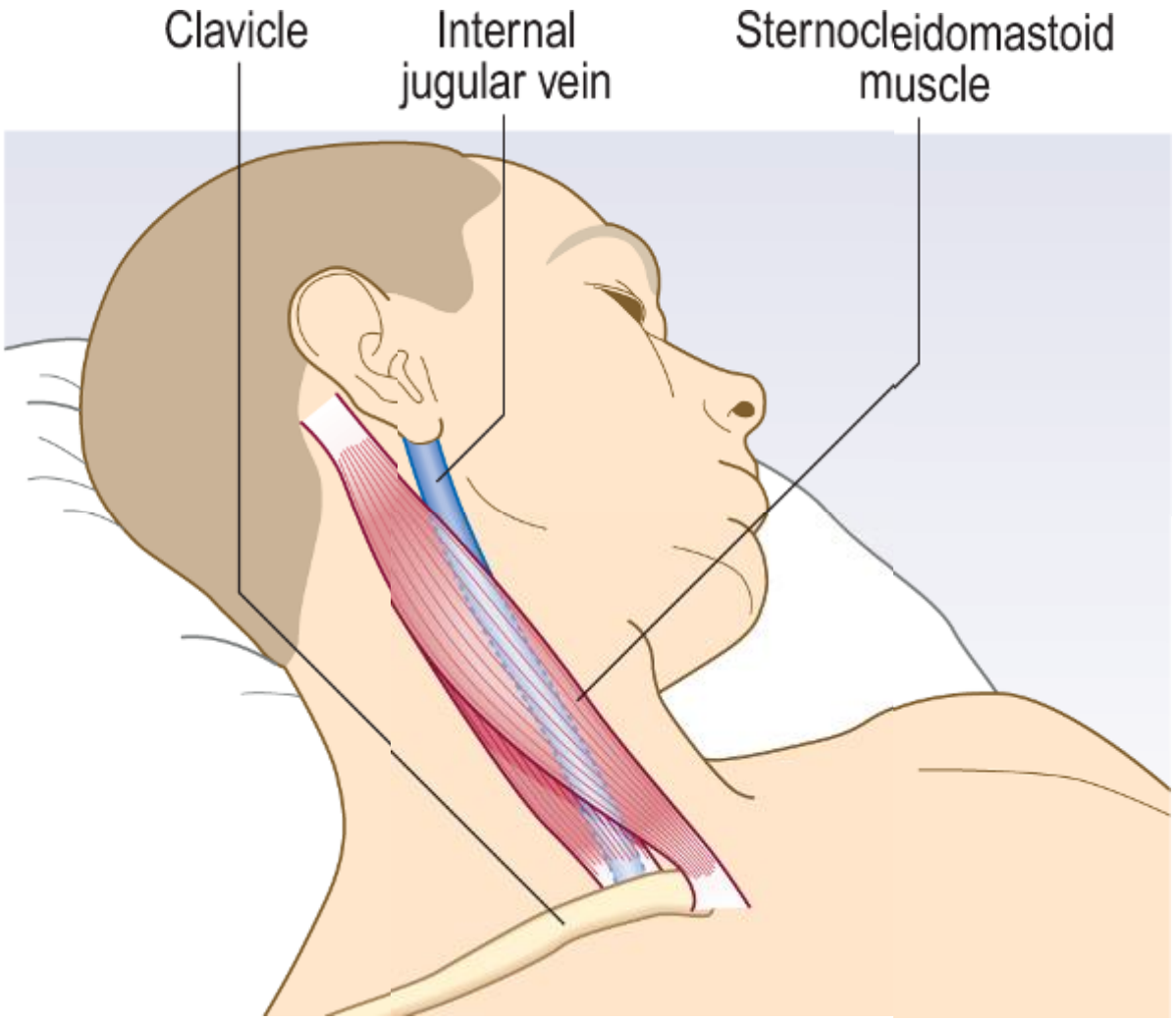


Common problems in blood pressure measurement

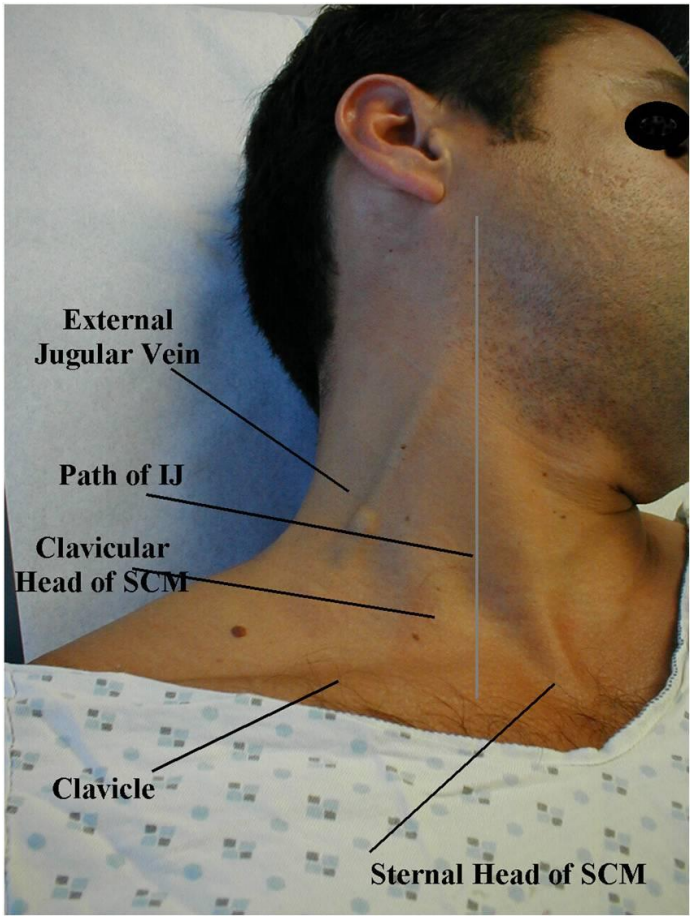
- BP different in each arm
- Wrong cuff size
- Auscultatory gap
- Postural hypotension
- Abnormal pulse pressure

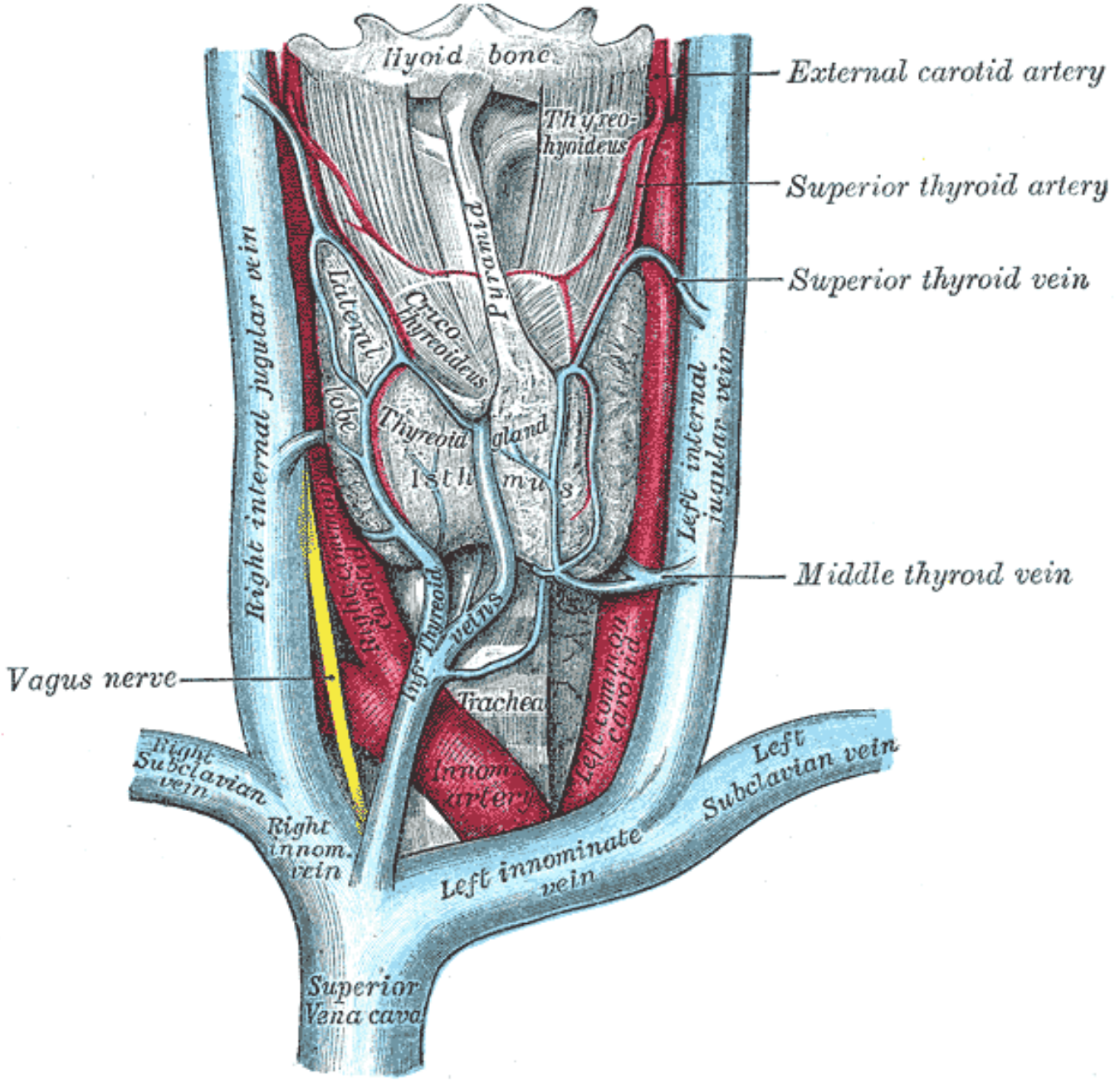
Jugular venous pressure

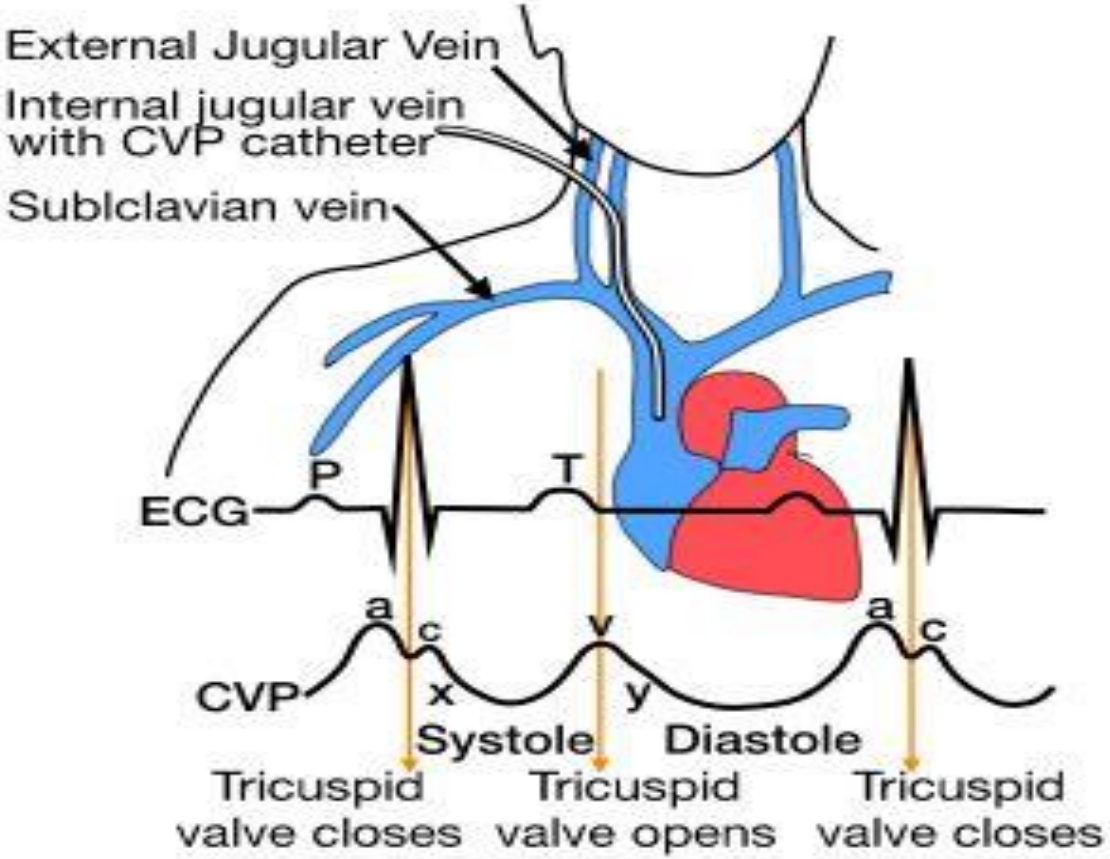
Jugular venous pressure



Anatomical landmarks

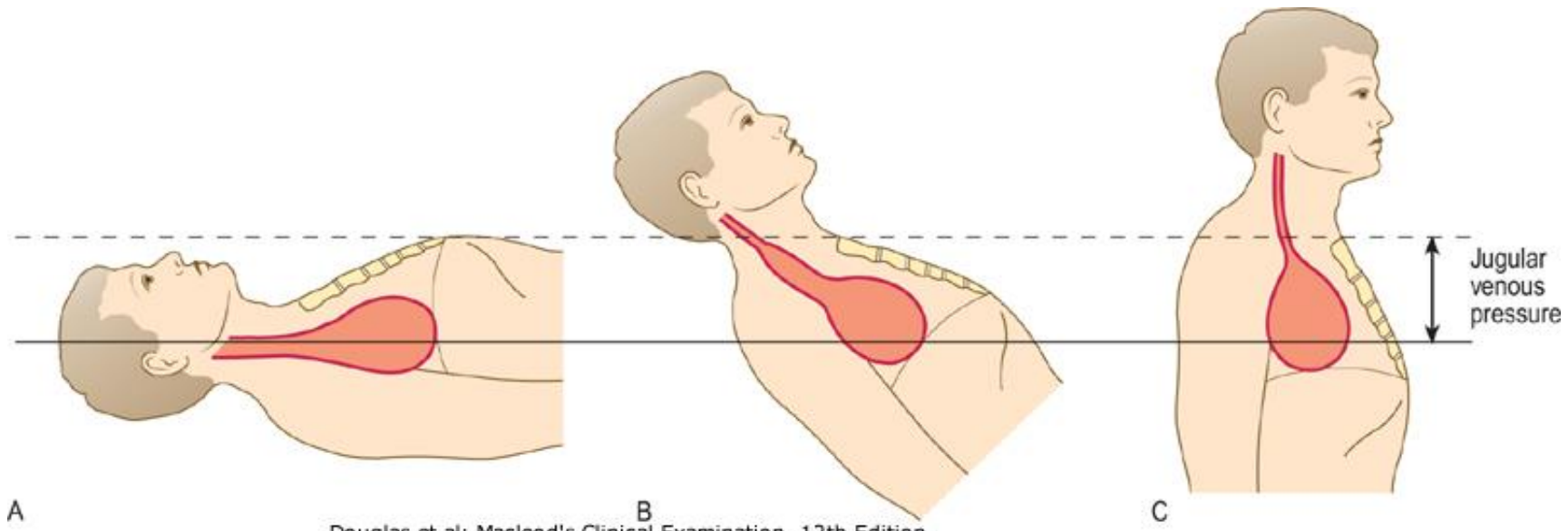



Hyoid bone
External carotid artery
Thyreo-hyoideus
Superior thyroid artery
Pyramid
Superior thyroid vein
Right internal jugular vein
Lateral lobe
Crico-thyreoideus
Thyreoid gland
Isthmus
Left internal jugular vein
Middle thyroid vein
Inf. thyroid veins
Vagus nerve
Trachea
Left common carotid
Innom. artery
Right Subclavian vein
Left Subclavian vein
Right innom. vein
Left innominate vein
Superior Vena cava



a = peak atrial contraction (follows the P wave on ECG)
Tricuspid valve closes, causing dicrotic notch
c = RV contraction, bulging the TC valve into the atria
x descent = atrial pressure declines during atrial relaxation
v = passive atrial filling, against a closed tricuspid valve
Tricuspid valve opens
y descent = passive blood flow from RA to RV
a = peak atrial contraction

JVP



JVP = Central venous pressure = Rt atrial pressure

JVP is normally less than 7 mmHg/ 9 cm H2O

The sternal angle is 5 cm above the right atrium so the normal JVP should be no more than than 4 cm above this angle when the patient lies at 45^0

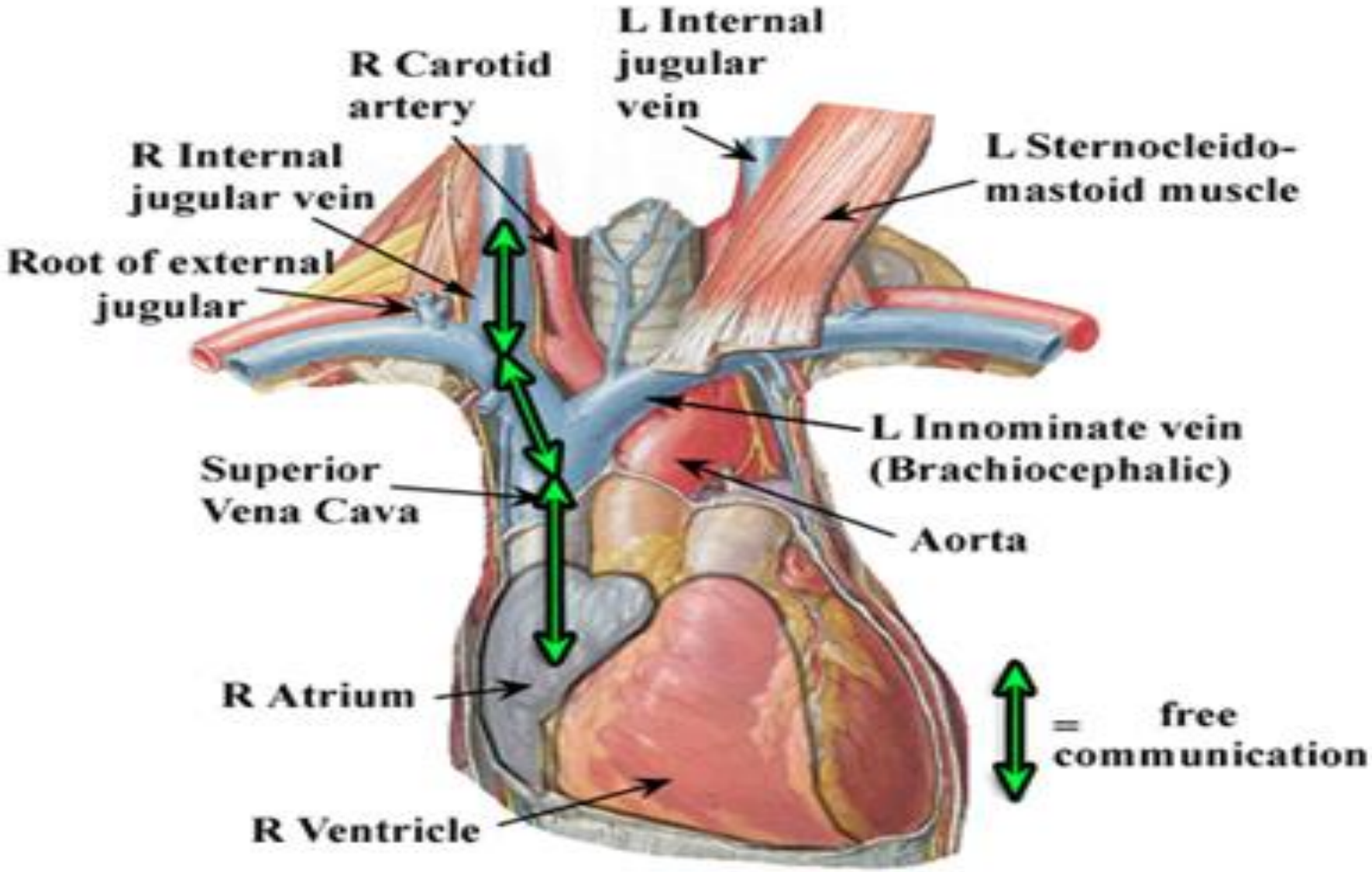
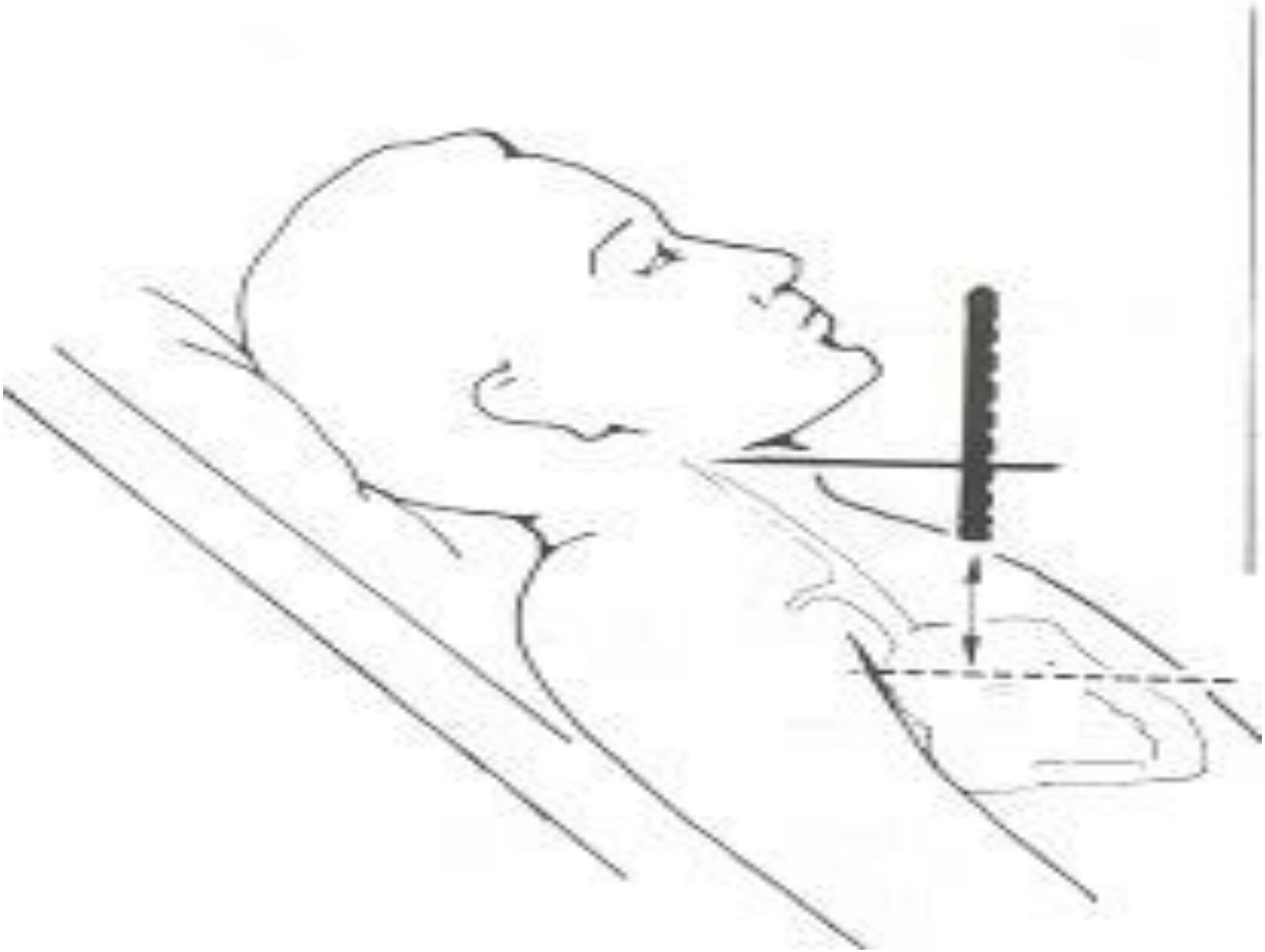
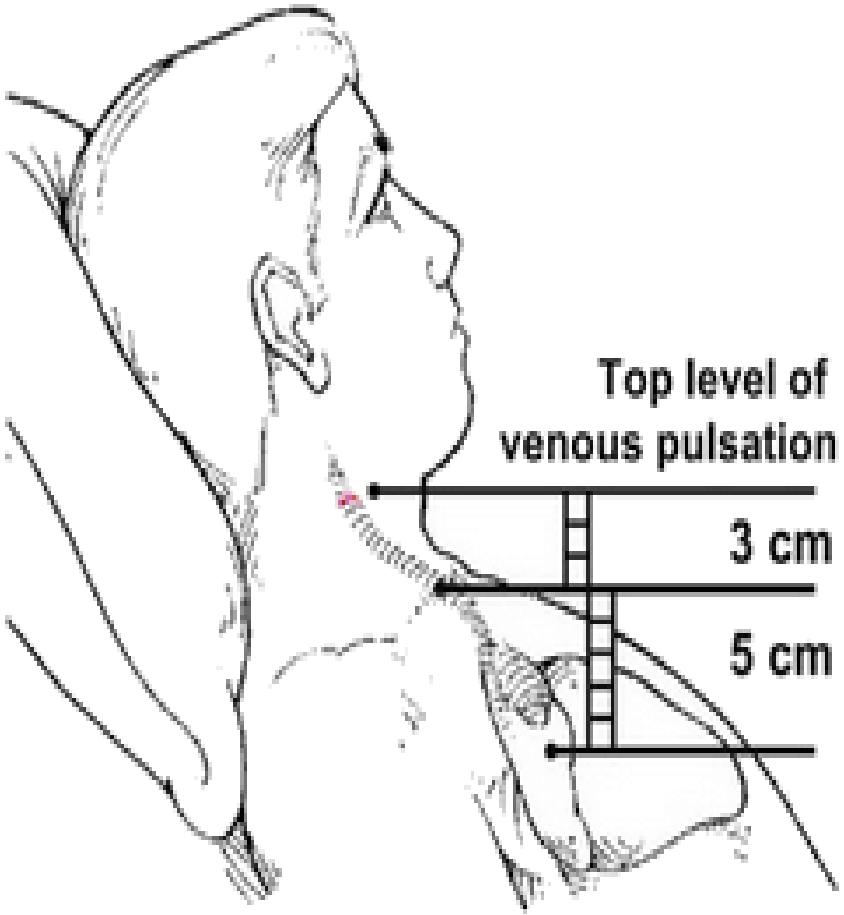
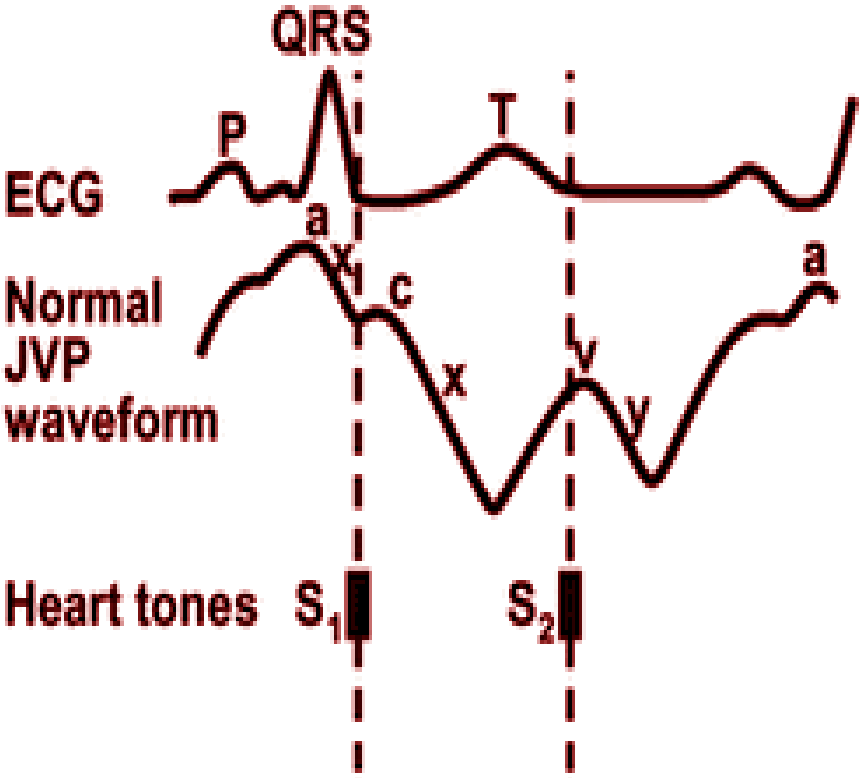


Figure 1. The right internal jugular vein as an extension of the right side of the heart



3 cm (from sternal notch)
+ 5 cm (from right ventricle to sternal notch)
8 cm H_2O jugular venous pressure





EpoMedicine

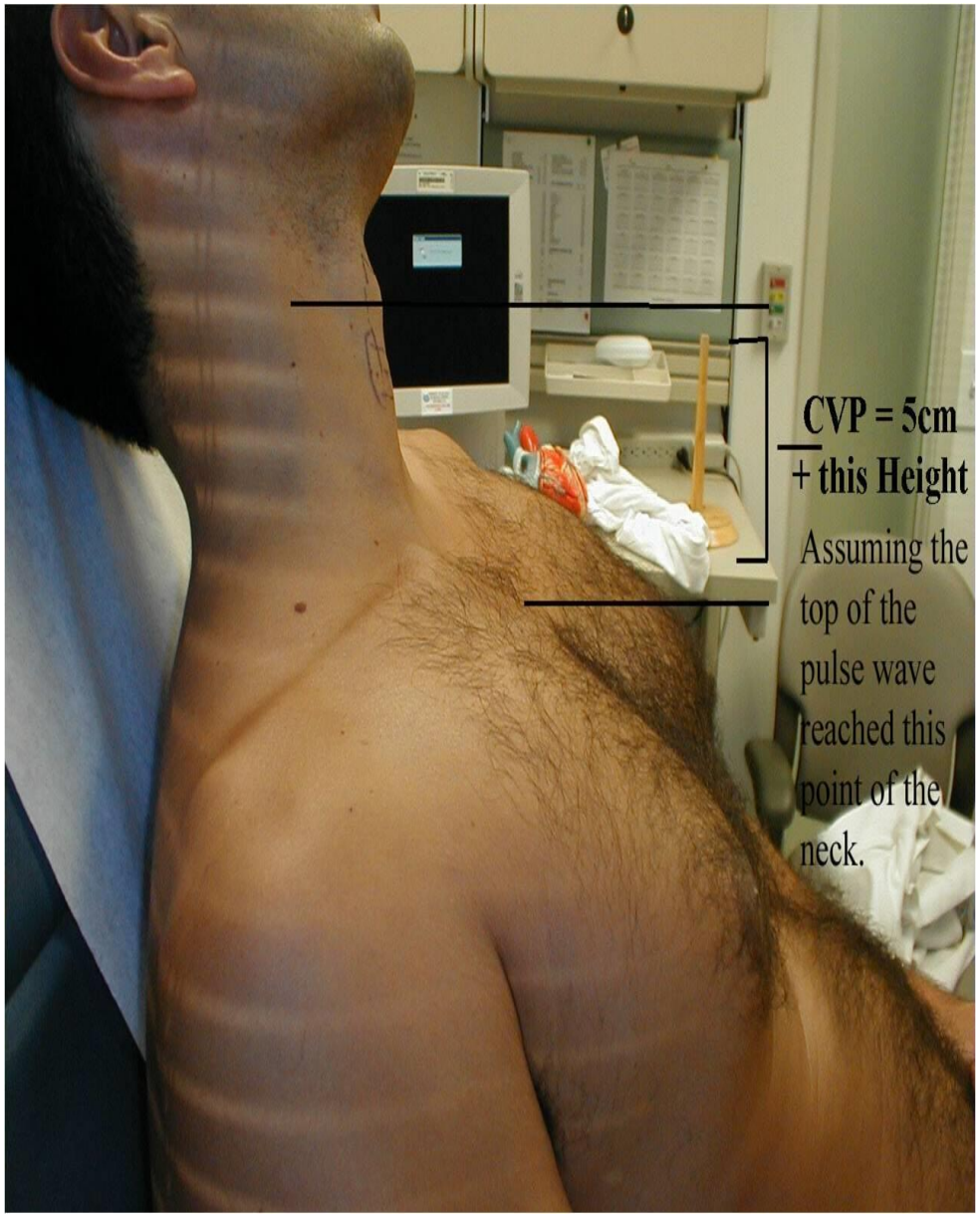
6.23 Differences between carotid artery and jugular venous pulsation

Carotid	Jugular
Rapid outward movement	Rapid inward movement
One peak per heart beat	Two peaks per heart beat (in sinus rhythm)
Palpable	Impalpable
Pulsation unaffected by pressure at the root of the neck	Pulsation diminished by pressure at the root of the neck
Independent of respiration	Height of pulsation varies with respiration
Independent of position of patient	Varies with position of patient
Independent of abdominal pressure	Rises with abdominal pressure

JVP

- EXAMINATION SEQUENCE:

1) Position the patient starting at 45°
2) Rest the patient head on a pillow
3) Head slightly tilted to the left
4) Identify the wavy pulsations:
   a) Diffuse Inward movement
   b) Two waves per pulse
5) By palpation:
   a) Impalpable
   b) Disappears with compression at root of neck
   c) Rises with abdominal pressure
6) Special maneuvers:
   a) Varies with respiration
   b) Varies with patient position
7) Measure height of JVP: *the JVP is the vertical height in centimeters between the top of venous pulsation and the sternal angle (+5cm water)*



Elevated JVP

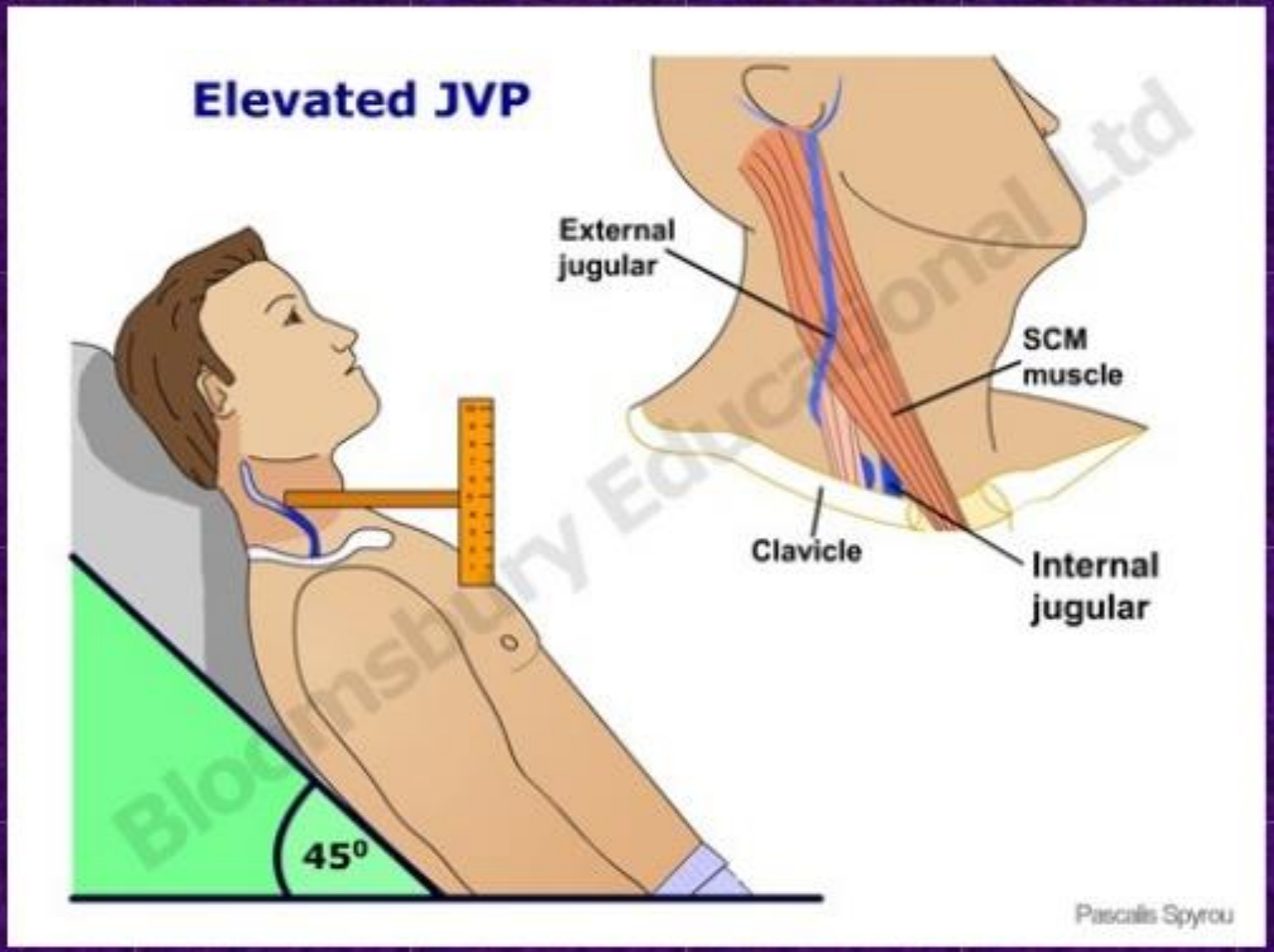
Elevated JVP :

-Fluid overload

The single most important sign of fluid overload

-In HF, rt ventricular dilatation (acute PE & COPD

-SVC obstruction : nonpalsatile & it no longer reflects rt atrial pressure , abdominojugular reflex : negative



JVP waveform

- Two peaks per cycle

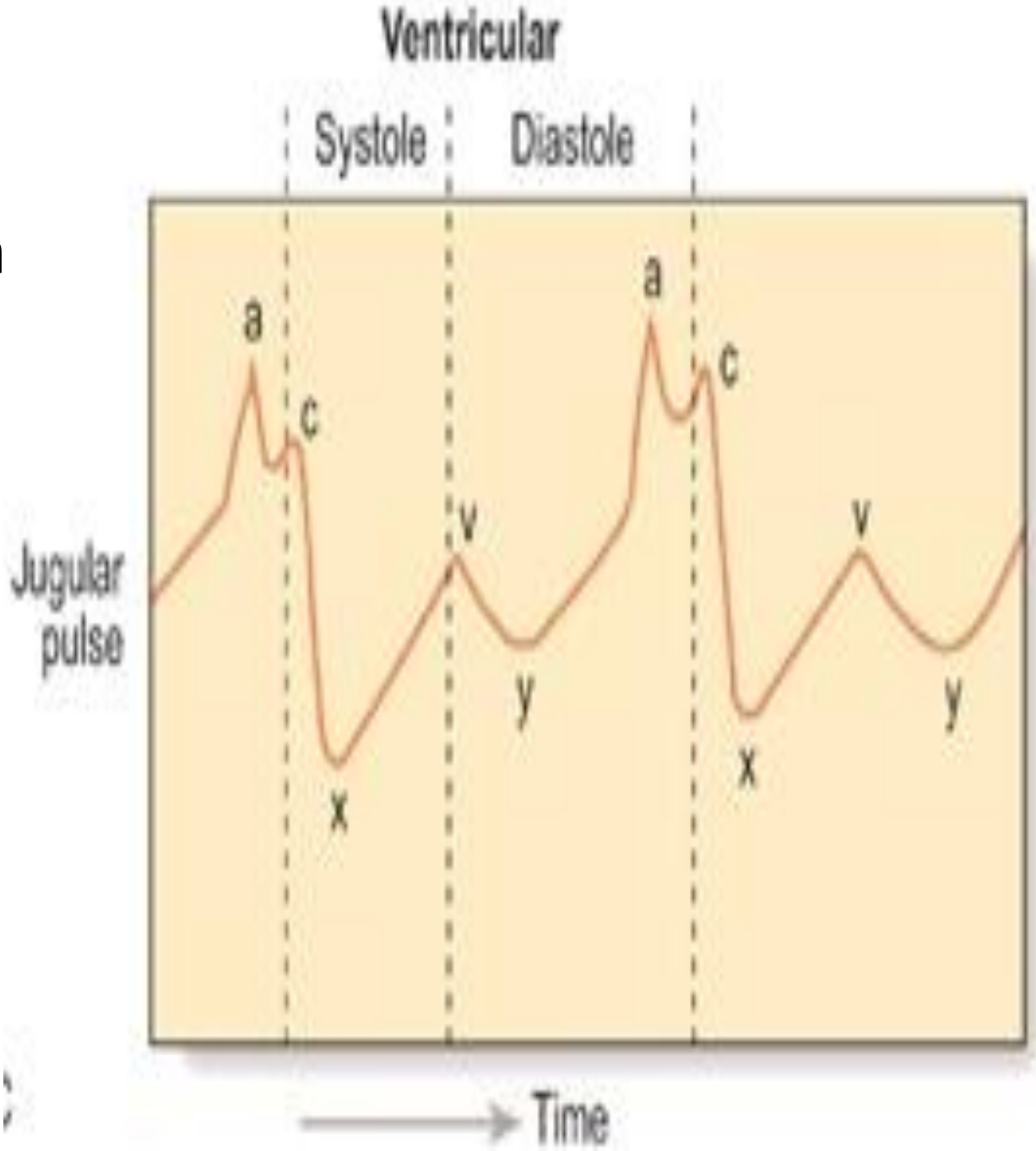
‘a’ wave: Rt atrial contraction, just before s1

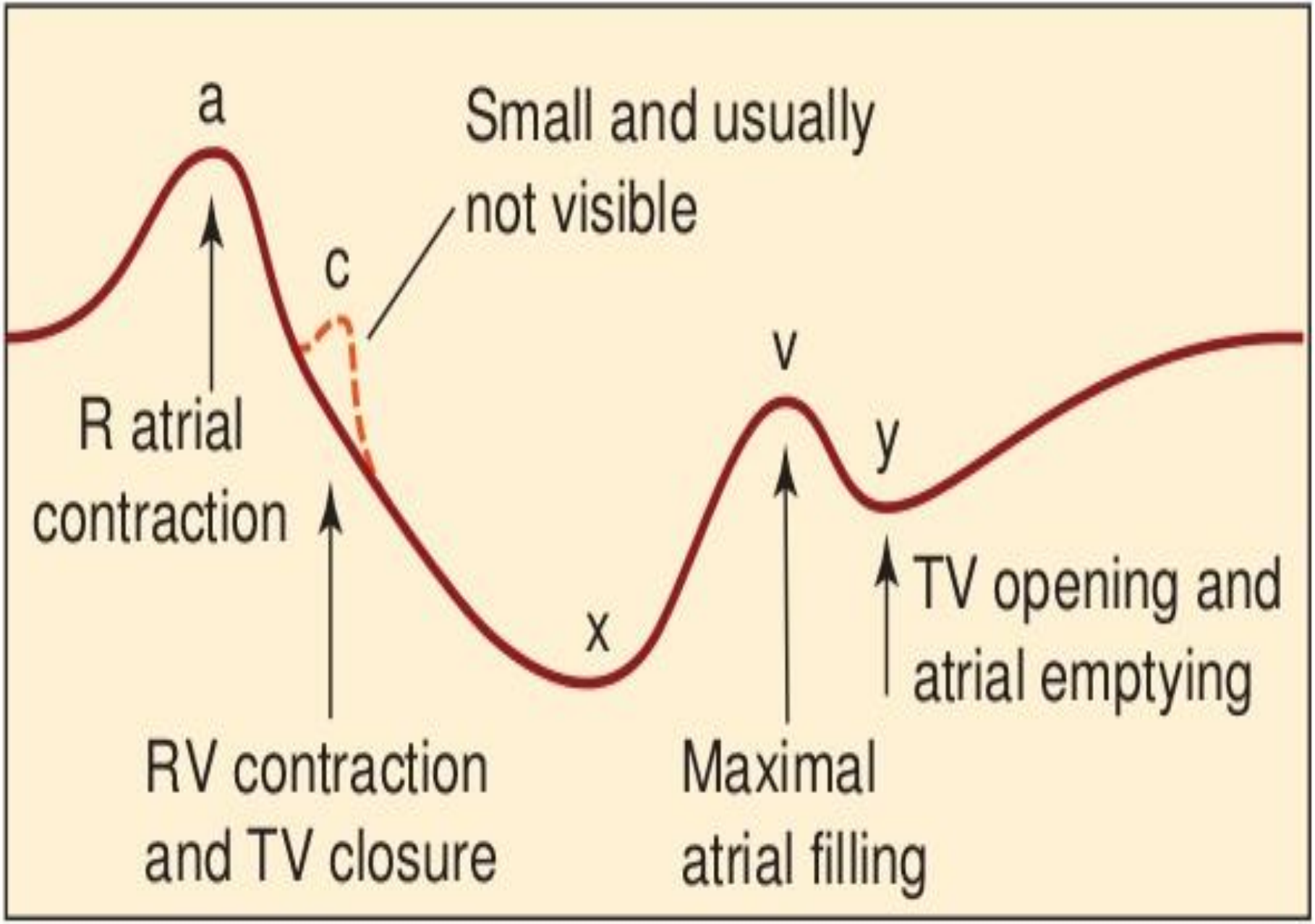
•**‘v’ wave**: atrial filling during ventricular systole (tricuspid valve is closed)= peak pressure in rt atrium immediately before opening of tricuspid .

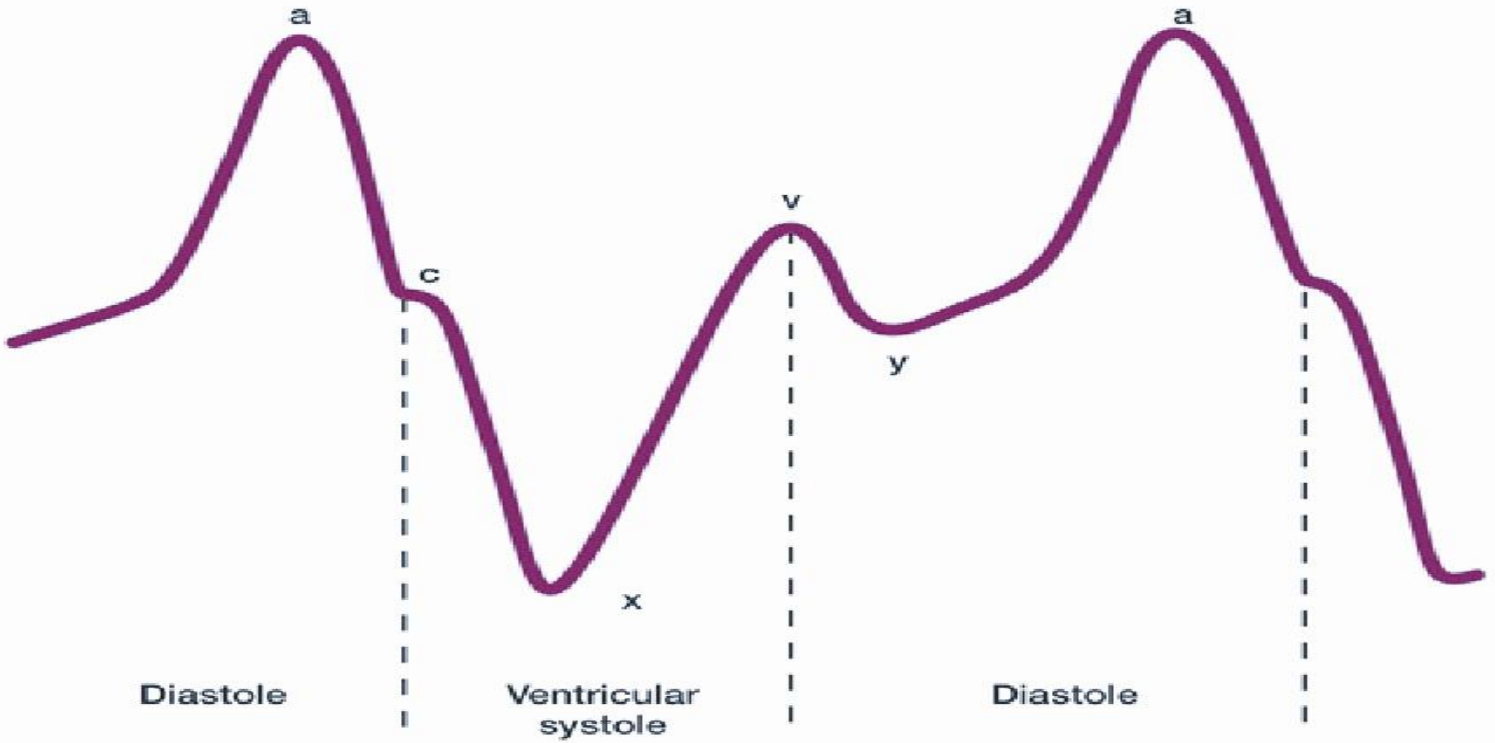
•‘c’ wave: rare 3rd peak :closure of the tricuspd valve

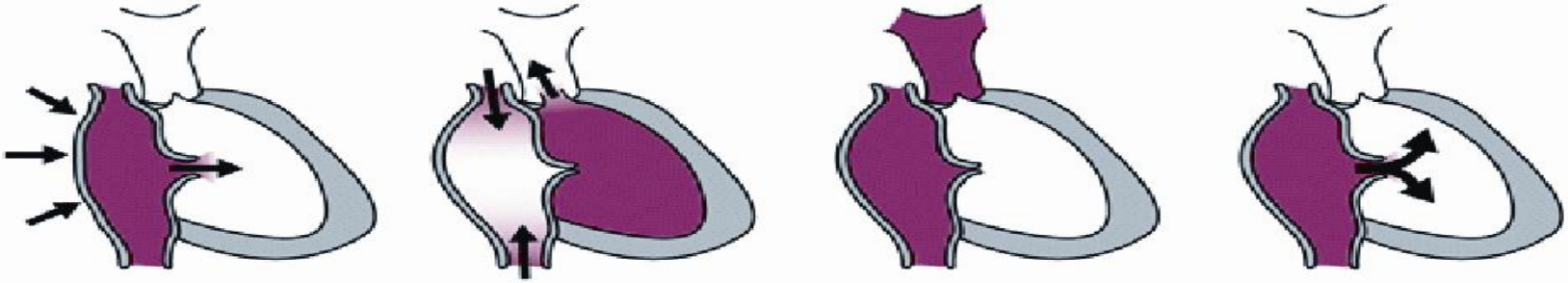
•A-x descent: downward displacement of the tricuspid ring during systole

•V-y descent at commencement of ventricular filling




a
Small and usually
not visible
c
v
R atrial
contraction
y
TV opening and
atrial emptying
x
RV contraction
and TV closure
Maximal
atrial filling





a wave

Atrium contracting tricuspid valve open

x descent

Atrium relaxing then filling, tricuspid closed

v wave

Atrium tense, full; tricuspid closed

y descent

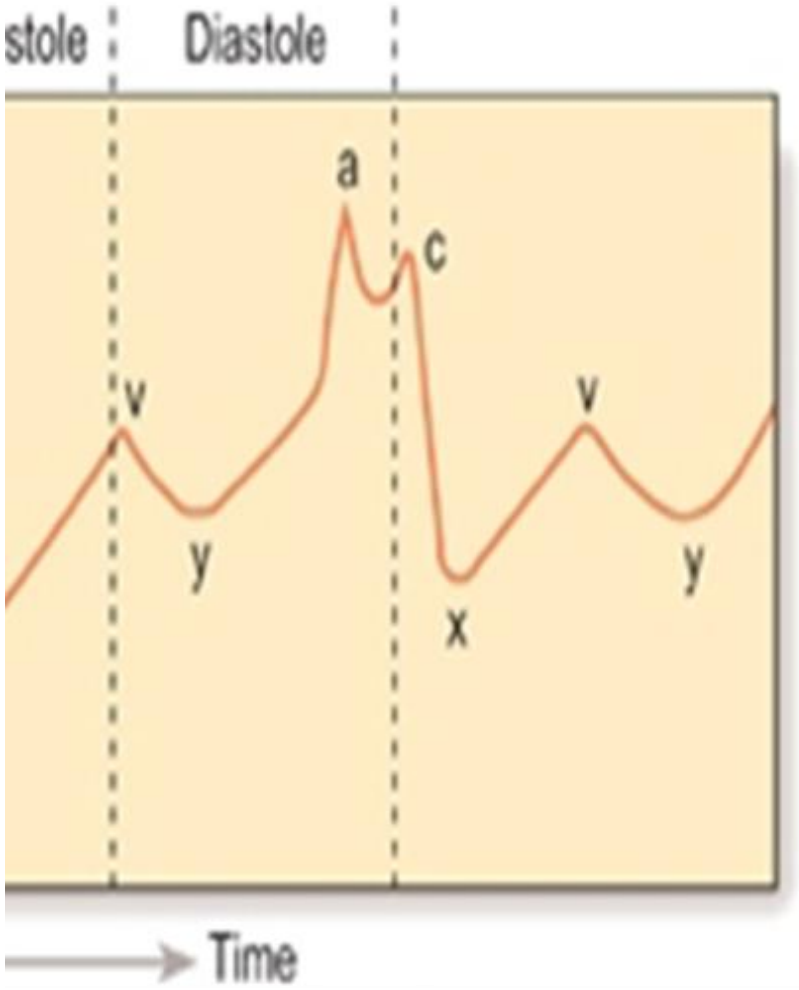
Atrium emptying, tricuspid open

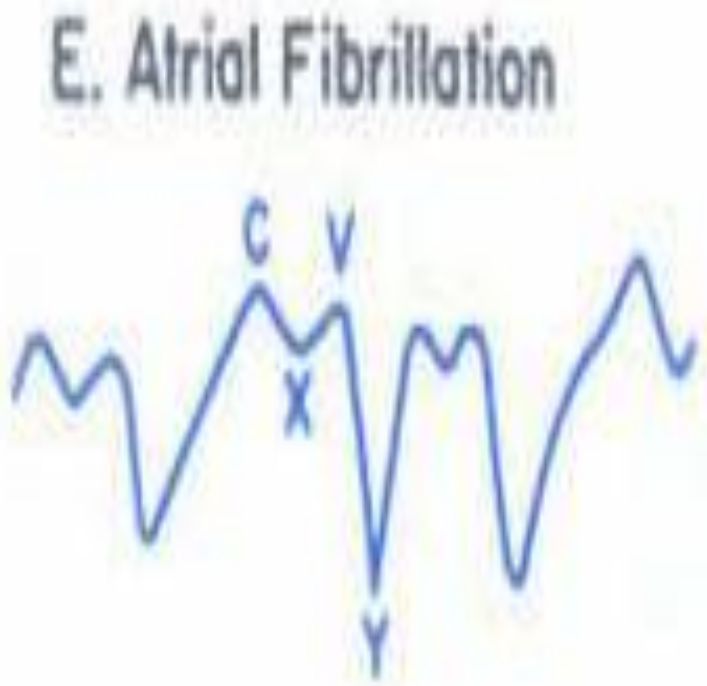
The JVP and its waveform are affected by certain arrhythmias and cardiac conditions

Abnormalities of the jugular venous pulse	
Condition	**Abnormalities**
Heart failure	Elevation, sustained abdominojugular reflux more than 10 seconds
Pulmonary embolism	Elevation
Pericardial effusion	Elevation, ***flattened y***
Pericardial constriction	Elevation, Küssmaul's sign
Superior vena caval obstruction	Elevation, loss of pulsation
Atrial fibrillation	Absent 'a' waves
Tricuspid stenosis	Giant 'a' waves
Tricuspid regurgitation	Giant 'v' waves aka cv wave
Complete heart block	**Irregular** Cannon' a waves

- kussmaul sign : paradoxical rise of jvp on inspiration. constrictive pericarditis, tamponade, severe rv failure , restrictive cardiomyopathy
- canon waves : regular (junctional rhythm , some ventricular & supraventricular tachycardias), irregular : complete heart block).

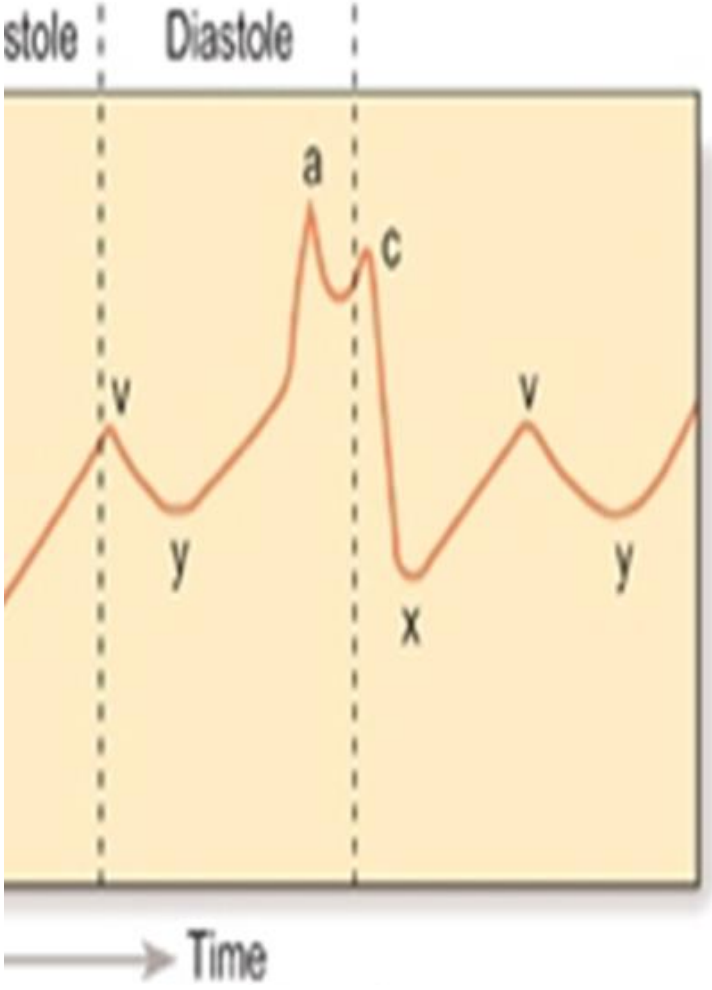
Atrial fibrillation

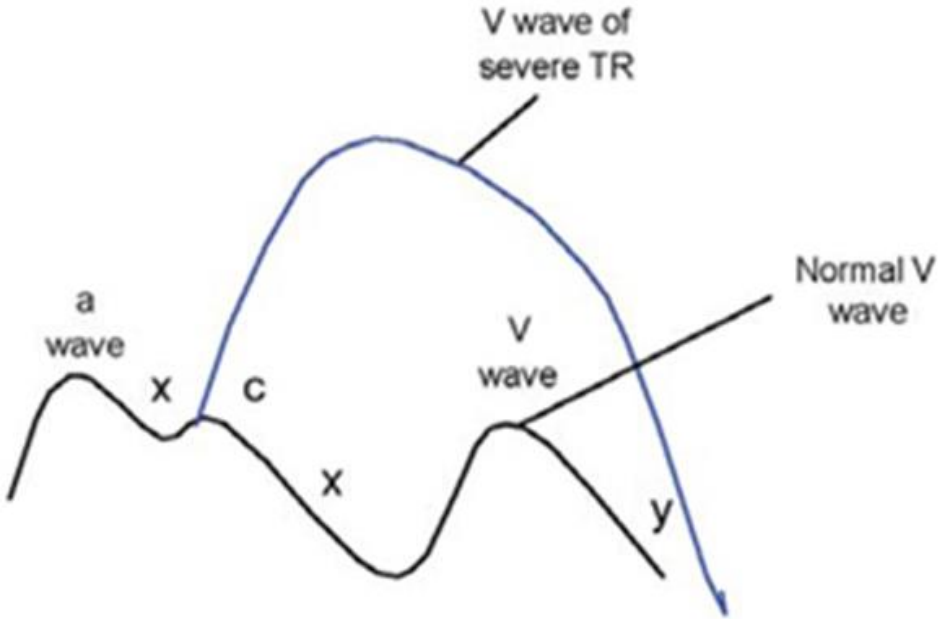




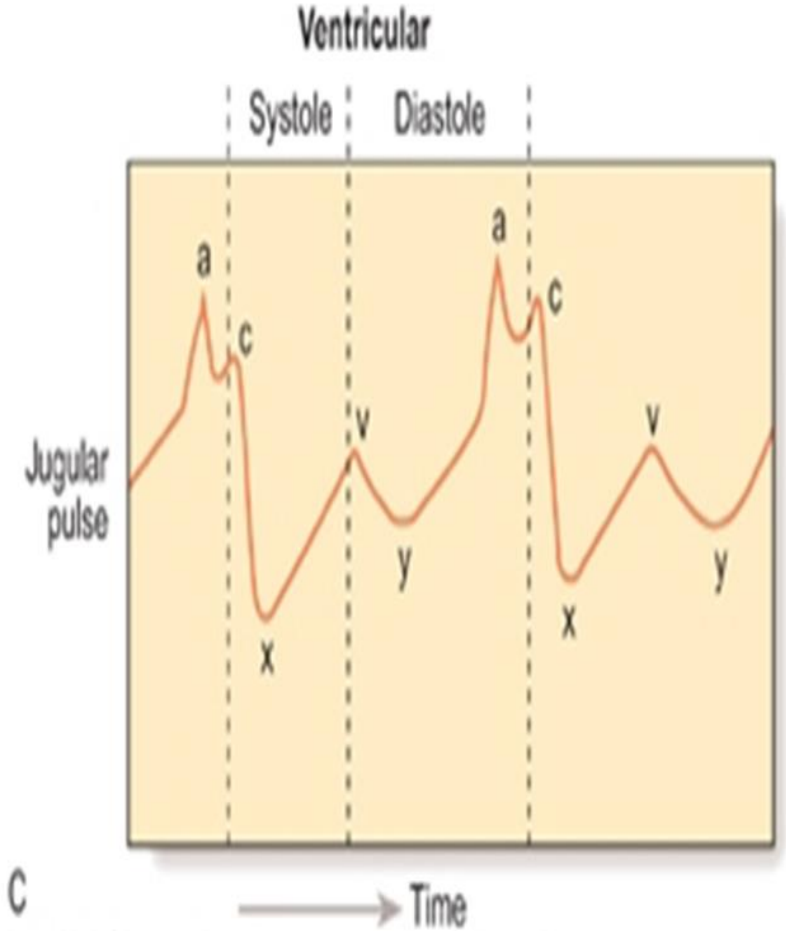
Tricuspid regurgitation

Giant v wave , aka cv wave , c &v fused resulting in a large systolic wave

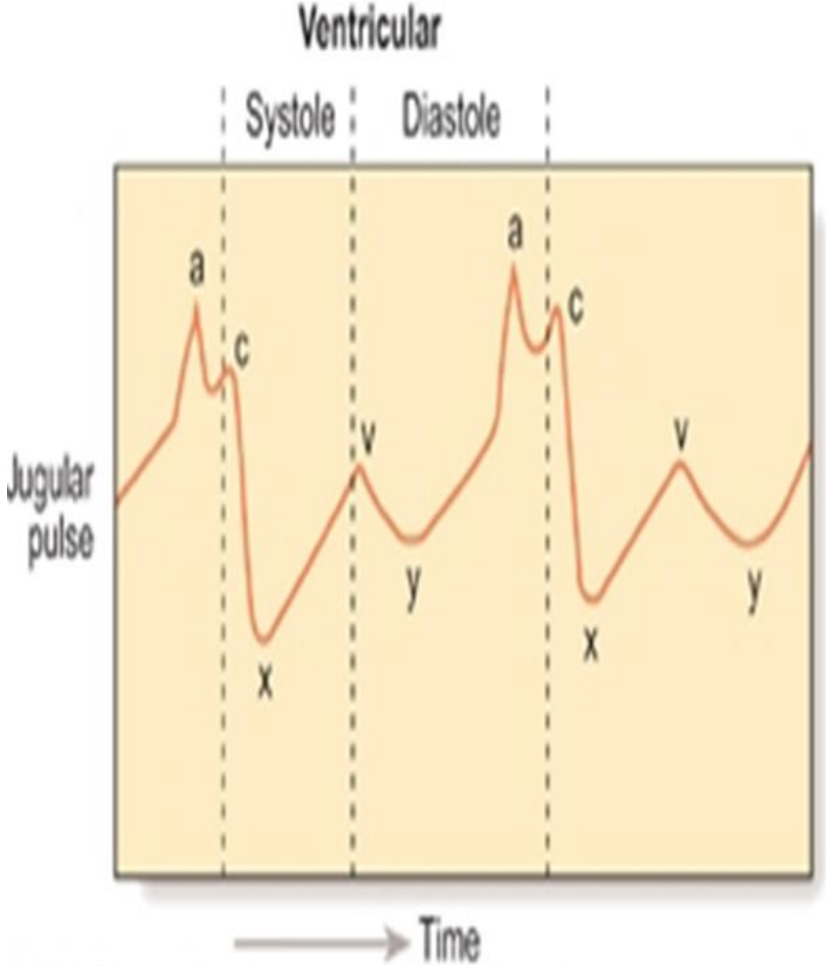


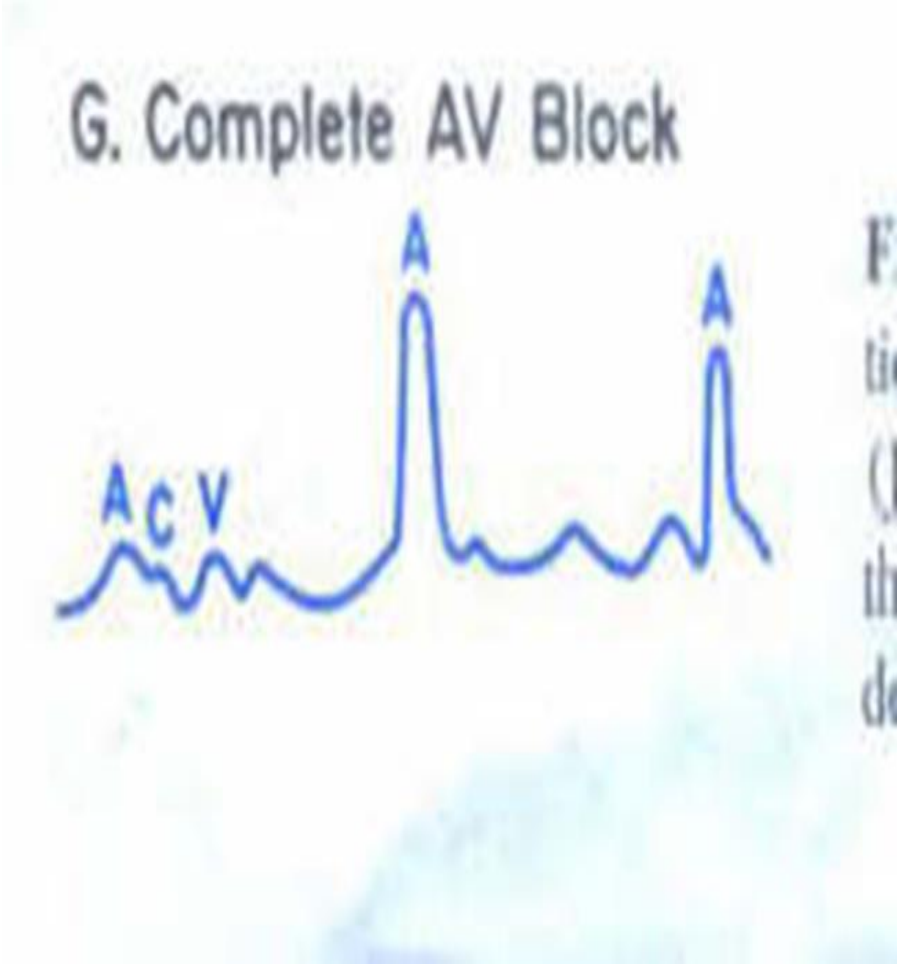


Tricuspid stenosis



Complete heart block





Cardiovascular exam sequence