HUMAN ANATOMY AND PHYSIOLOGY-1(BP101T)

UNIT: 5 CARDIOVASCULAR SYSTEM

CLASS: 5

TOPIC: REGULATION OF BLOOD PRESSURE

Blood pressure is defined as lateral pressure exerted by the blood on the walls of blood vessels.

➢ The Blood pressure is regarded as –

1. Arterial B P

2 .Venous B P

3 .Capillary BP

➢ Various phases of atrial blood pressure are –

1. Systolic B P – When the left ventricle contracts and pushes blood into the aorta, the pressure produced within the arterial system is called the systolic blood pressure.

➢ In adults it is 120 mm of Hg or 16 k pa.

2 Cardiac Diastole - When completer cardiac diastole occurs and heart is resting following the ejection of blood, the pressure within the arteries is much lower is called as diastolic blood pressure. ➢ In an adult this is about 80 mm of Hg or 11 kpa.

PULSE PRESSURE: The difference between these two is called as pulse pressure.

➢ The arterial blood pressure is measured with a sphygmomanometer and usually expressed with the –

Blood Pressure = Systolic Blood Pressure = 120/80 mg of Hg or 16/11 kpa
Diastolic Blood Pressure

Factors affecting BP:

1. Posture of Body – during night less B P.
2. Age – In old age people more B P.
3. Sex/Gender – In female more B P.
4. Cardiac output.
5. Peripharal resistance.

B P = Cardiac output x Peripheral resistance

MEASUREMENT OF BLOOD PRESSURE:

NORMAL VALUE: Blood pressure in adults - 120/80mm of Hg.

Systolic Blood Pressure range -100-140mm of Hg.

Diastolic Blood Pressure range - 60-90mm of Hg.

SPHYGMOMANOMETER: It consists of a mercury manometer and inflatable cuff. The cuff is called a "Reva Rocci" cuff. the manometer is a U-shaped tube. One limb being broader than the other. The broader limb is the reservoir for the mercury and the narrow limb is graduated from 0-300mm with the smallest division corresponding to a reading of 2mm.

Cuff consists of an inflatable rubber bag covered by a non-distensible cotton fabric. The cuff is connected to the manometer and to a hand bulb by rubber tubing the cuff

can be inflated to any desired pressure with the help of a rubber pump permits. The reductions in the cuff pressure to overcomes tissues resistance the width of the cuff should be 20% more than the diameter of that arm width of a cuff for adult is 12.5cm and for children below 8years is 8cm, below 5 years is 5cmand for the infants below 1 year is 2.5cm wider cuff should be used to record the blood pressure in obsess individuals length of the cuff should be 23cm it should cover 2/3rd of the circumference.

PROCEDURE: Blood pressure is recorded by following methods

DIRECT MATHOD: It is possible in experiment animals because it is unsafe in this method artery is cannulated and other end of cannula is connected to mercury manometer by this method we record end pressure which is slightly higher than lateral pressure measure by in direct method.

INDIRECT METHOD: By this method lateral pressure exerted by the column of blood on artery is recorded. Subject is asked to sit comfortably in chair or mail to lie down supine on the couch and the arm is kept at the level of heart to obtain a pressure that is uninfluenced by gravity. The arm is exposed and cuff is tied in such a way that the midpoint of the cuff overlies the brachial artery and the lower edge of the cuff is one inch above cubital fossa. Now the BP is recorded by palpatory method first and then by auscultator method.

PALPATORY METHOD: Rubber bag is inflated until the air pressure within it overcomes the arterial pressure and obliterates the arterial lumen. This can be confirmed by the feelings and radial pulse which will disappear when pressure is raised a little beyond the point by the feeling and radial. These which will disappear when pressure is raised a little beyond the point by about 30-40mm Hg and then slowly reduced again so that the pressure falls at the rate of 2-3mmHg. See pulse a

rate reappearing at a point when pressure in the artery is equal to the pressure of air in the cuff and blood escapes beyond the cuff in the peripheral part of the artery of the artery. Manometer reading is taken and the radical pulse is fist felt at the wrist. It is the index of the systolic BP.

DISADVANTAGES: Pressure recorded is about 6-10 mmHg less than that recorded by auscultator method. only systolic BP can be recorded by this method.

AUSCULTATOTORY METHOD:

Place the chart piece of the stethoscope over the arm medial to the tendons of biceps where palpitations of brachial artery are felt. Now gradually lower pressure is 30-40mm Hg more than the reading obtained by palpatory method. Now gradually lower the pressure till a sharp light tapping sound is header. When the pressure in the cuff is further lowered sound undergoes a series of changes in quality and in density which were first described by koratkoff a Russian scientist in1905 this sound was labeled as korotkoff sound. These are five phases of their sounds:

Phase 1: sudden appearance of a clear but faint tapping sound growing louder during succeeding 10mm/hg fall in pressure.

Phase 2: the sound takes murmur like quality during the next 15 mm/hg in pressure.

Phase 3: sound changes little in quality during the 15mmhg falls in pressure.

Phase 4: muffed quality lasting throughout the next 5-6 mm/hg falls in pressure.

Phase 5: complete disappearance of the sound.

The appearance of the sound indicates the systolic BP disappearance of sound in phase5 indicates the diastolic BP if sound does not disappearance is taken as

diastolic BP it happens in case of hyper dynamic circulation take three readings to readings to reach the conclusions regarding BP.

Control of blood pressure (BP): Blood pressure is controlled in two ways:

1. Short-term control.

2. Long-term control.

1. Short-term control:

a) Baroreceptors (pressure receptors)

b) Chemoreceptors

c) Higher centres in the brain

A) BARORECEPTORS:

❖ These are nerve endings sensitive to pressure changes (stretch) within the vessel, situated in the arch of the aorta and in the carotid sinuses.

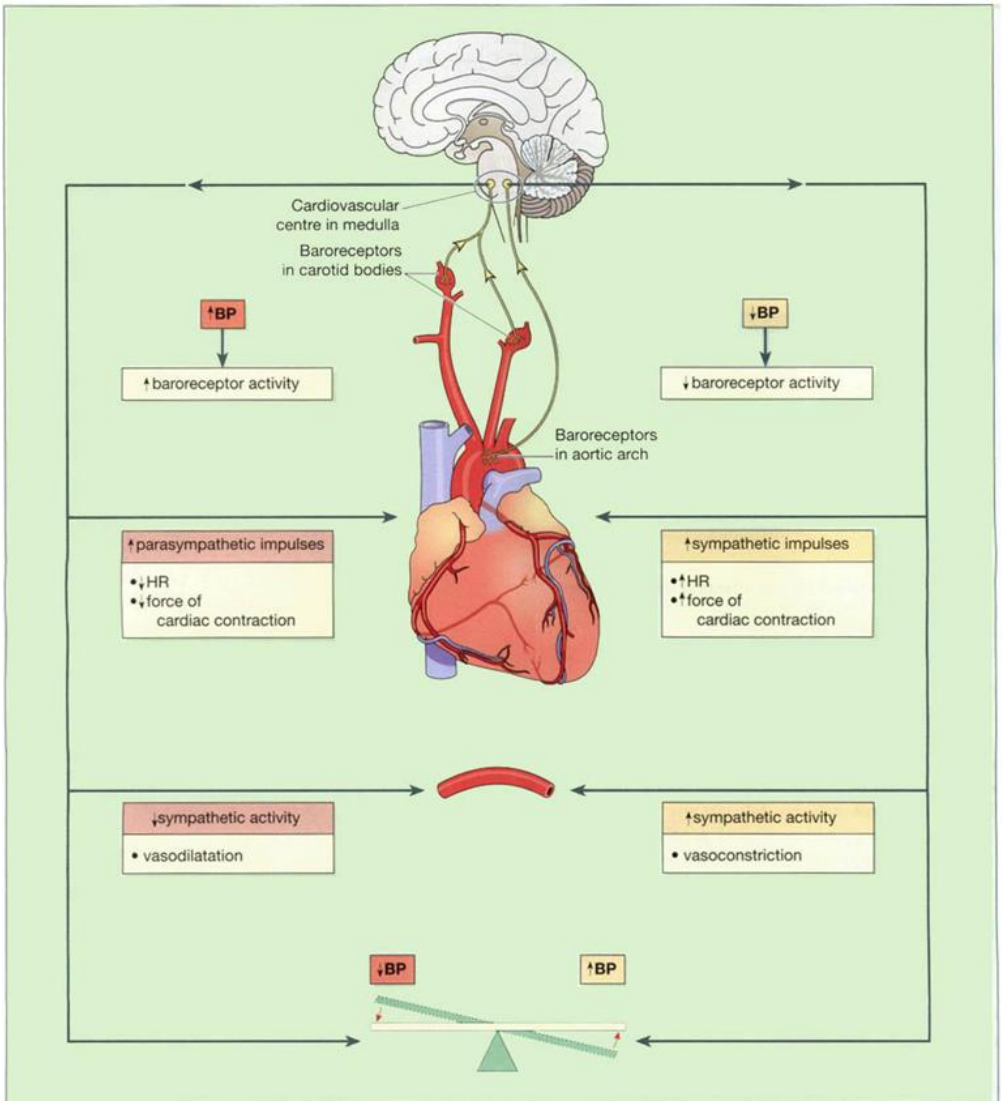
❖ A rise in blood pressure in these arteries stimulates the baroreceptors, increasing their input to the CVC (cardio vascular centre).

❖ The CVC responds by increasing parasympathetic nerve activity to the heart; this slows the heart down. At the same time, sympathetic stimulation to the blood vessels is inhibited, causing vasodilatation.

❖ The net result is a fall in systemic blood pressure.

Table 5.1 The sympathetic and parasympathetic nervous systems

	Sympathetic stimulation	Parasympathetic stimulation
Heart	↑Rate ↑Strength of contraction	↓Rate ↓Strength of contraction
Blood vessels	Most constrict	There is little parasympathetic innervation to most blood vessels



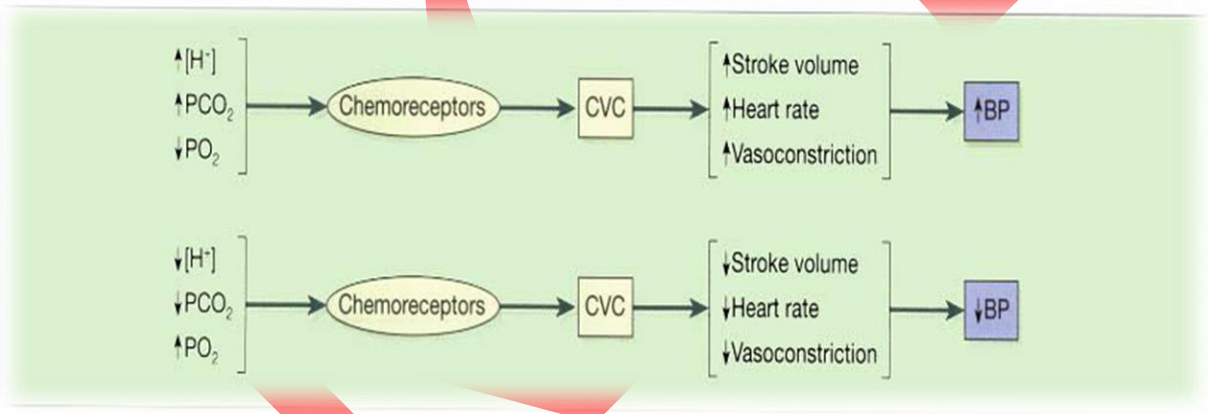
❖ Conversely if pressure within the aortic arch and carotid sinuses falls the rate of baroreceptor also falls.

❖ The cvc responds by increasing sympathetic drive to the heart to speed it up.

b) CHEMORECEPTOR:

❖ These are nerve endings situated in the carotid and aortic bodies. They are primarily involved in control of respiration they are sensitive to changes in the levels of carbon dioxide, oxygen and the acidity of the blood (pH).

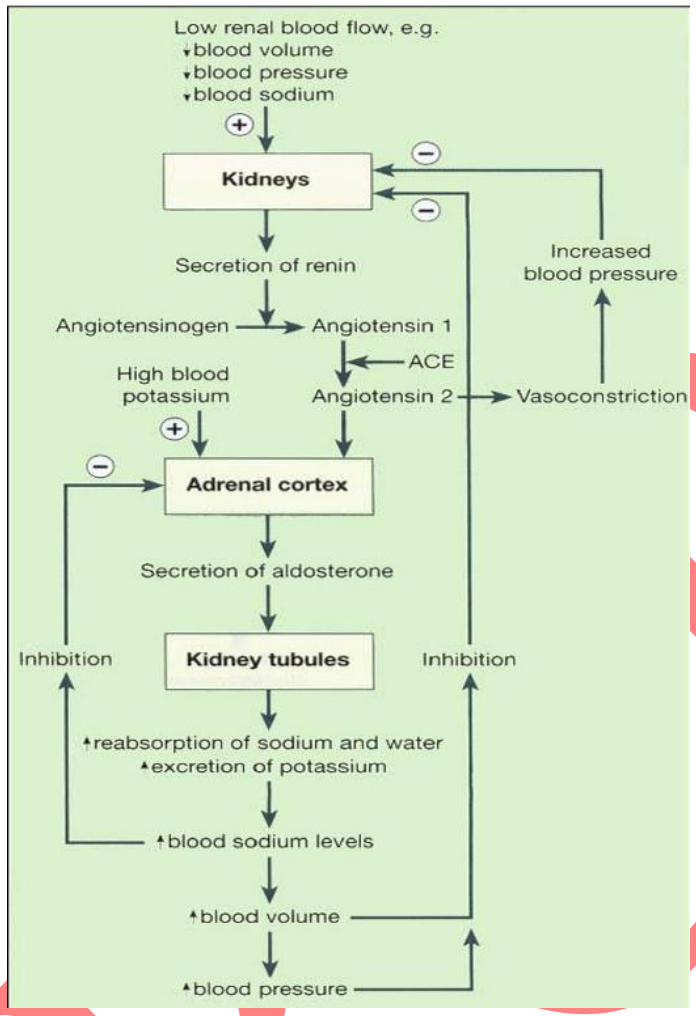
❖ Their input to the CVC influences its output only when severe disruption of respiratory function occurs or when arterial BP falls to less than 80 mmHg.



C) HIGHER CENTERS IN THE BRAIN:

❖ The higher centres are influenced by emotional states such as fear, anxiety, pain and anger that may stimulate changes in blood pressure.

❖ The hypothalamus in the brain controls body temperature and influences the CVC which responds by adjusting the diameter of blood vessels in the skin — an important mechanism in determining heat loss and retention.



2. LONG-TERM CONTROL:

a) Renin-angiotensin-aldosterone system: When renal blood flow is reduced or blood sodium levels fall the enzyme renin is secreted by kidney cells. Renin converts the plasma protein angiotensinogen, produced by the liver, to angiotensin 1. Angiotensin converting enzyme (ACE), formed in small quantities in the lungs, proximal kidney tubules and other tissues converts angiotensin 1 to angiotensin 2, which stimulates secretion of aldosterone it also causes vasoconstriction and increases blood pressure.

a) ADH Antidiuretic hormone (ADH) or vasopressin:

❖ The main effect of antidiuretic hormone is to reduce urine output (diuresis is the production of a large volume of urine).

❖ ADH increases the permeability to water of the distal convoluted and collecting tubules of the nephrons of the kidneys.

❖ As a result the reabsorption of water from the glomerular filtrate is increased.

❖ Due to increase volume of blood the blood pressure increases.