**Arterial blood pressure (ABP)**

Systolic blood pressure (SBP) is the peak pressure reached during systole in the Aorta and other large arteries. It is about 120 mm Hg (normal range is 90-140) in adults.

Diastolic blood pressure (DBP) is the lowest pressure during diastole and is about 80mm Hg (normal range is 60-90 mmHg) in adults.

**Pulse pressure:** it is the difference between systolic and diastolic pressure. It is normally about 30-50 mmHg.

**Mean arterial pressure (MAP)** is the average pressure throughout the cardiac cycle. It is approximately equal to diastolic pressure plus one third of the pulse pressure (about 90mm Hg in normal adults).

**Mean arterial pressure** = **Diastolic pressure + 1/3 pulse pressure**

Mean arterial pressure does not equal to the arithmetic mean because systole (during which pressure rises) is shorter than diastole (during which pressure decreases), therefore, the mean pressure is lower than the arithmetic mean i.e nearer to the value of diastolic pressure. However, when the heart rate is rapid, the
cardiac cycle become shorter. Shortening affects diastole more than systole. Under such conditions, mean arterial pressure become nearer to the arithmetic mean.

**Determinants of mean arterial blood pressure**

Mean arterial pressure (MAP) = cardiac output (COP) X total peripheral resistance (TPR)

Since cardiac output = stroke volume (SV) X heart rate (HR),

Then:

\[
\text{MAP} = \text{SV} \times \text{HR} \times \text{TPR}
\]

Accordingly, the following factors determine the arterial blood pressure:

1- **Stroke volume**: Big stroke volume elevates ABP. It increases the systolic more than the diastolic pressure and therefore the pulse pressure is increased.

2- **Heart rate**: Increased heart rate elevate ABP. It increases the diastolic pressure more than the systolic because less time is available for drop of pressure as the diastole is shortened. The pulse pressure is decreased.

3- **Total peripheral resistance**: Increased TPR elevates ABP. It increases the diastolic more than systolic pressure, therefore the pulse pressure decreases.
4-Arterial compliance: If arterial compliance decreases e.g due to atherosclerosis, systolic pressure increases because arteries are not able to distend enough to accommodate the stroke volume. Diastolic pressure decreases because the ability of the arteries to recoil in diastole is decreased. Pulse pressure therefore increases.

Physiologic variations in ABP

1-Age: ABP generally increases with age. Normal value of ABP in infant is about 80/40 mm Hg. In children, it is about 100/65 mm Hg. In young adults, it is about 120/80 mm Hg. In old age, it should not rise above 140/90.

2-Sex: Below the age of menopause, women usually have lower ABP than men of the same age. However after menopause, ABP rises in women due to hormonal changes that occurs after menopause.

3-Race: People belonging to certain races have higher ABP and higher incidence of hypertension.

4-Circadian rhythm and ABP: In normal persons (working at daytime), ABP reaches peak value early in the morning and decreases to its lowest level at midnight. These variation in ABP between day time and midnight may account for 15-25 mmHg. The nocturnal ABP changes follow sympathetic nervous system activity
which is minimal during nocturnal sleep and increases during awaking.

5-**Emotions:** strong emotional stress elevate ABP.

6-**Muscular exercise:** changes in ABP during exercise depend on the type muscular contraction, if the contraction is isotonic, systolic pressure is moderately increased while diastolic pressure either falls or not changed. If exercise involve isometric muscular contraction then both systolic and diastolic pressure increases.

7-**Respiration:** ABP fluctuate with respiratory cycles, These fluctuations are known as *(Traube –Hering waves)*. At the beginning of inspiration, blood pressure decreases because inflation of the lungs causes reflex vasodilation. Pressure starts to rise and reaches maximum late in inspiration and at the beginning of expiration.

8-**Effect of gravity on ABP:** The MAP in all major arteries is about 100 mm Hg. When they are at the level of left ventricle e.g when the subject is lying down.

However, in standing position, pressure in arteries above the level of the left ventricle decreases by 0.77 mm Hg for each 1 cm above the level of left ventricle. Pressure in arteries below the level of the left ventricle
increases by 0.77 mmHg for each 1 cm below the level of the left ventricle.

Example:
The MAP in a large artery 50 cm above heart = 100 - (0.77\times50) = 62\, \text{mm Hg}
The MAP in a large artery 105 cm below the heart = 100 + (0.77\times105) = 180\, \text{mm Hg}.

Next lecture will be about capillary circulation.

Note: These lectures are downloadable from

[www.dr-mutazclinic.com](http://www.dr-mutazclinic.com)

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