
بسم الله الرحمن الرحيم

CARDIOVASCULAR SYSTEM MODULE
SKILL LAB /PHYSIOLOGY PRACTICAL
FIRST YEAR MBBS (BATCH 50)
DETERMINATION OF BLOOD PRESSURE

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September 2nd , 2023

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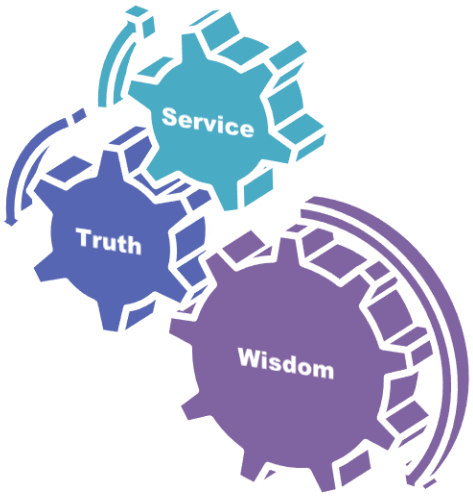
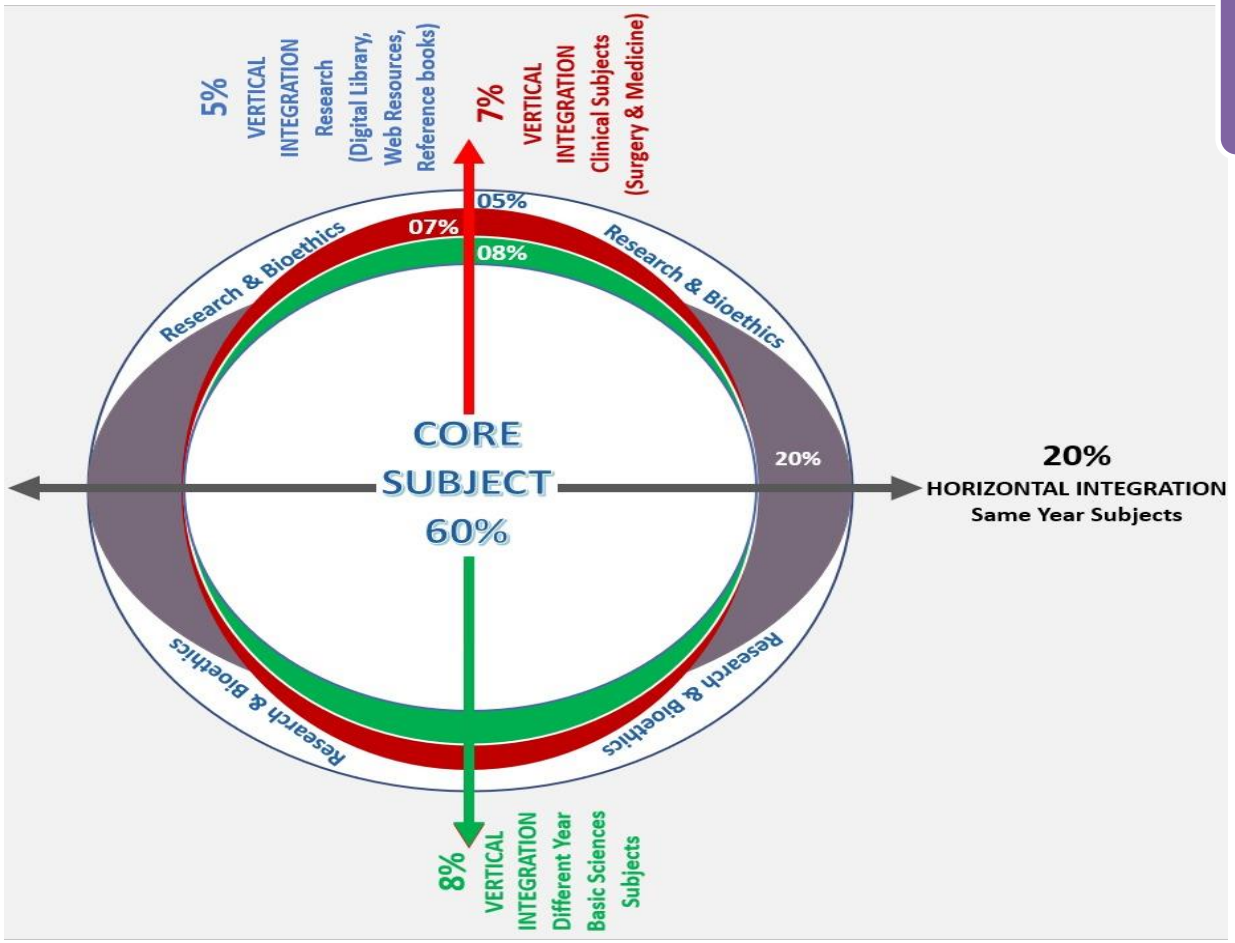
Motto



Vision; The Dream/Tomorrow

- To impart evidence based research oriented medical education
- To provide best possible patient care
- To inculcate the values of mutual respect and ethical practice of medicine

Professor Umar Model of Integrated Lecture



60% CORE SUBJECT

20% HORIZONTAL INTEGRATION Physiology biochemistry

8% VERTICAL INTEGRATION Pathology pharmacology

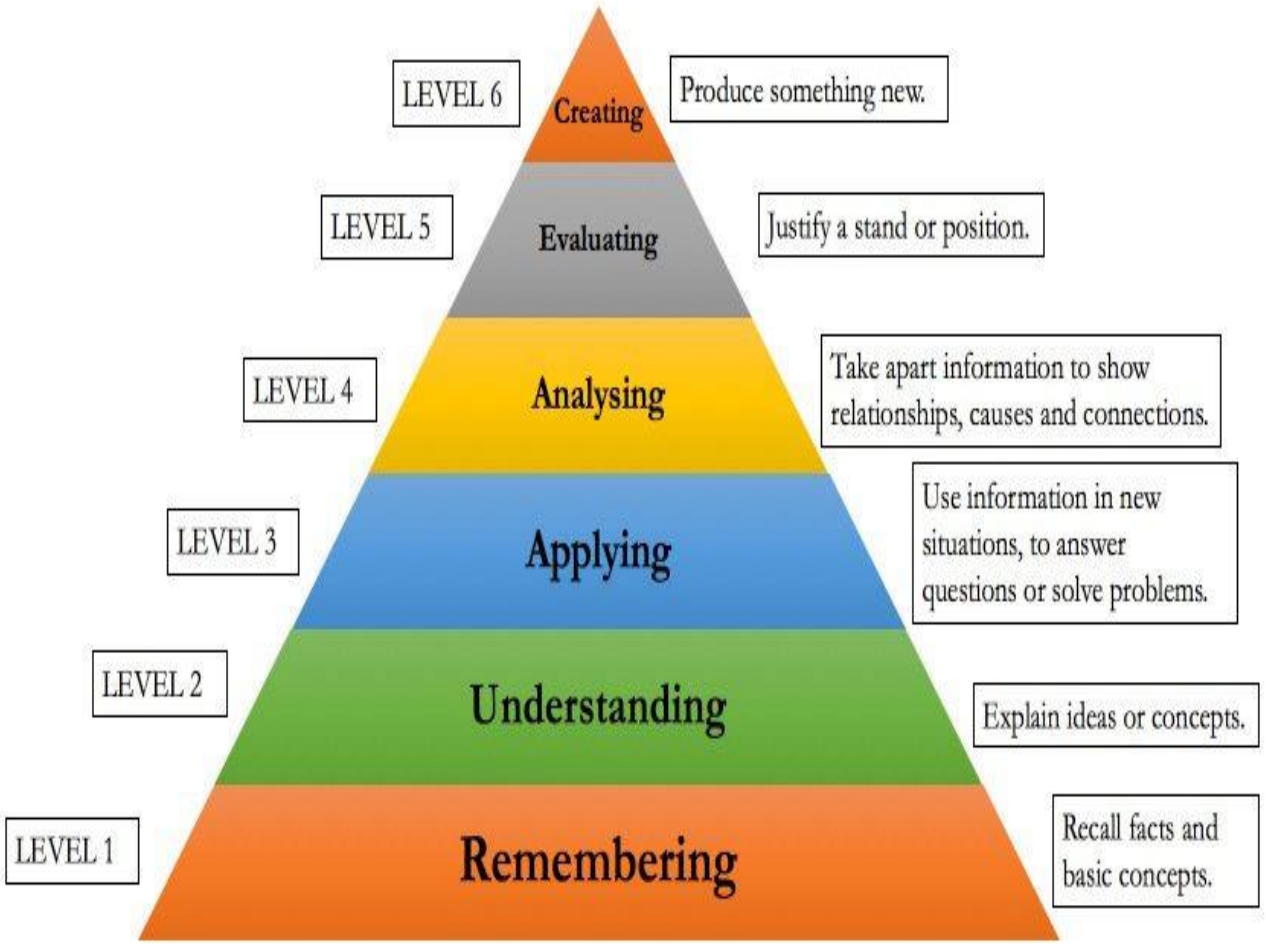
7% VERTICAL INTEGRATION Clinical integration

5% VERTICAL INTEGRATION Research, professionalism Ethics Digital library

BLOOM'S TAXONOMY : DOMAINS OF LEARNING

Sr. #	Domain of learning	Abbreviation	Levels of the domain	Meaning
1	cognition	C	C1	Recall / Remembering
2			C2	Understanding
3			C3	Applying / Problem solving
4	Psychomotor	P	P1	Imitation / copying
5			P2	Manipulation / Follows instructions
6			P3	Precision / Can perform accurately
7	Attitude	A	A1	Receiving / Learning
8			A2	Respond / Starts responding to the learned attitude
9			A3	Valuing / starts behaving according to the learned attitude

Diagrammatic Representation of Blooms Taxonomy

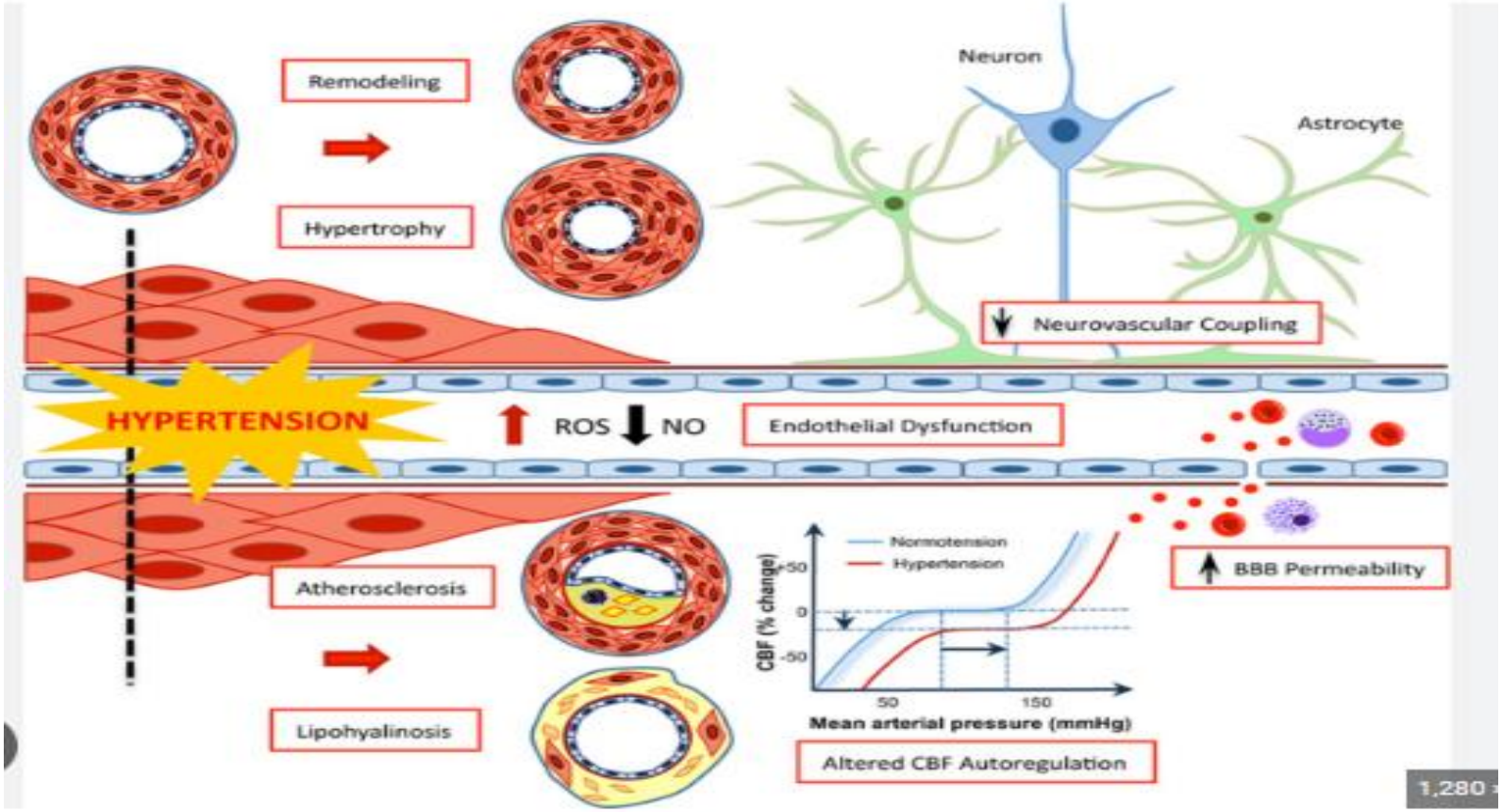


LEARNING OBJECTIVES

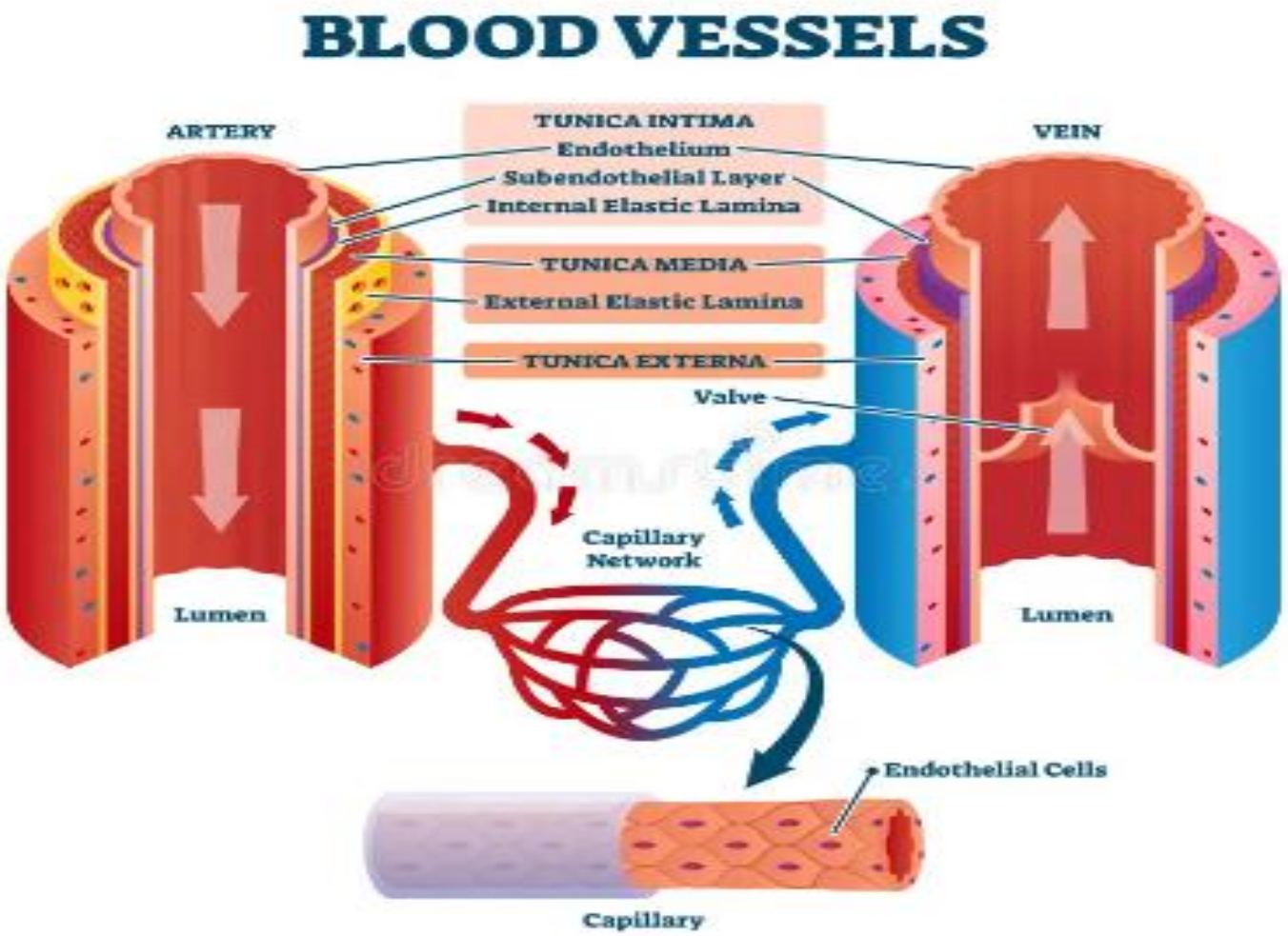
Sr. #	Learning Objectives	Domain of Learning
1	To define blood pressure and its different types.	C1
2	To perform step by step the determination of arterial blood pressure.	P3/A3
3	To explain different methods to determine blood pressure.	C2
4	To correlate clinically with variations in blood pressure.	C3
5	To explain hypertension and correlate grades of hypertension alongwith compliactions.	C2

Core Concept/Horizontal Integration With Biochemistry/Neuroanatomy/Pathology/Internal Medicine

Arterial Blood Pressure and Hypertension



Reference: Google Images



Reference: Google Images

THE SYSTEMIC ARTERIAL BLOOD PRESSURE

- The term blood pressure is the force exerted by the circulating blood laterally on the walls of the systemic arteries.
- The arterial blood pressure is the product of the cardiac output and the peripheral resistance.

Core Concept

THE MEAN ARTERIAL PRESSURE

- The mean arterial pressure is the average of the arterial pressures measured millisecond by millisecond over a period of time throughout the cardiac cycle.
- It is the pressure that propels the blood to the tissues.It is not simply the value halfway between systolic and diastolic pressures, because diastole usually lasts longer than systole.
- It is approximately equal to the diastolic pressure plus one-third of the pulse pressure.

Pulse Pressure

- It is the difference between systolic and diastolic pressure.
- PP =SBP(Systolic blood pressure)-DBP(Diastolic blood pressure)
- Normal value= 40mmHg.

Determinants of Arterial Blood Pressure

1. Cardiac Output
2. Total peripheral resistance

Cardiac output:

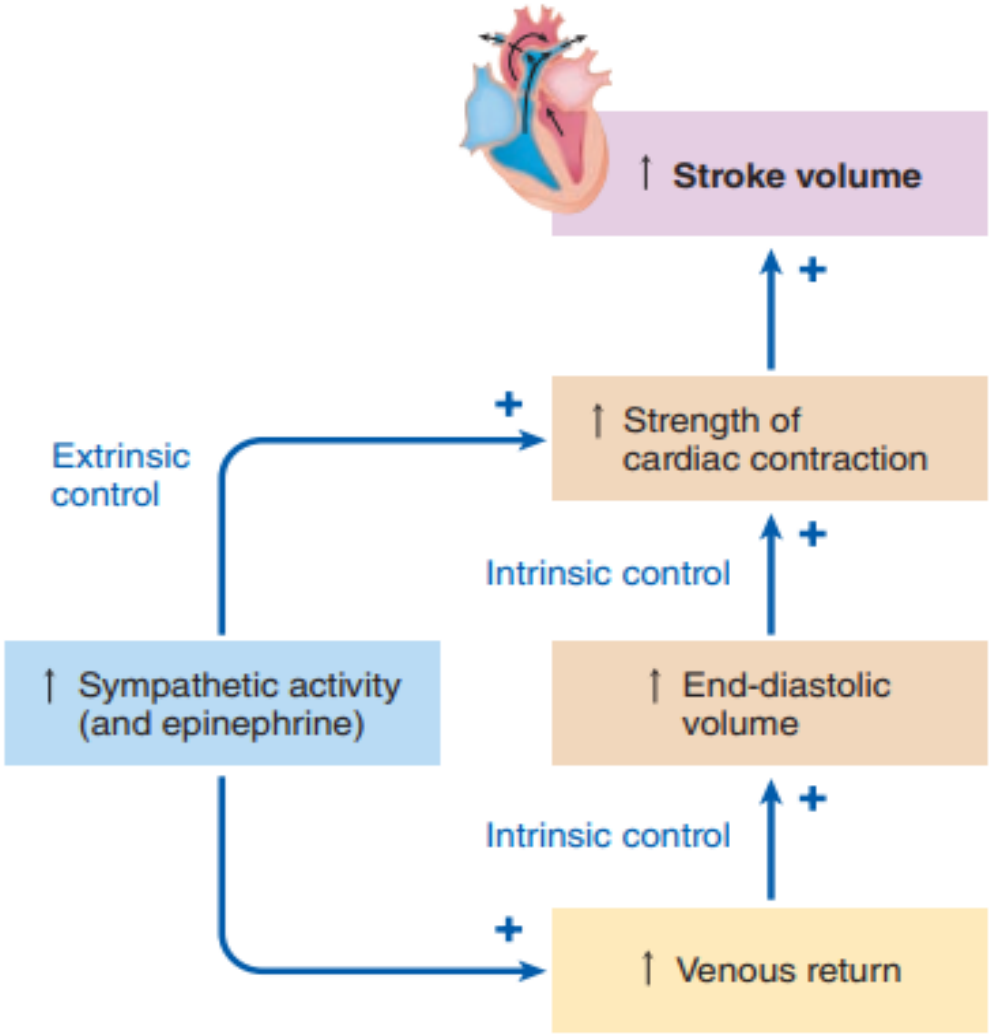
CO=Heart Rate X Stroke Volume

- 70 beats/min x 70 mL/beat
- 4900 mL/min =5 L/min

Total Peripheral Resistance:

It is frictional resistance to blood flow provided by all of the vessels between the large arteries and right atrium,including the small arteries,arterioles,capillaries,venules,small veins and veins.

Stroke volume



ıre 9-20 **Intrinsic and extrinsic control of stroke volume.**

Reference: Sherwood Human Physiology 9th Edition Page No.321

Cardiac output

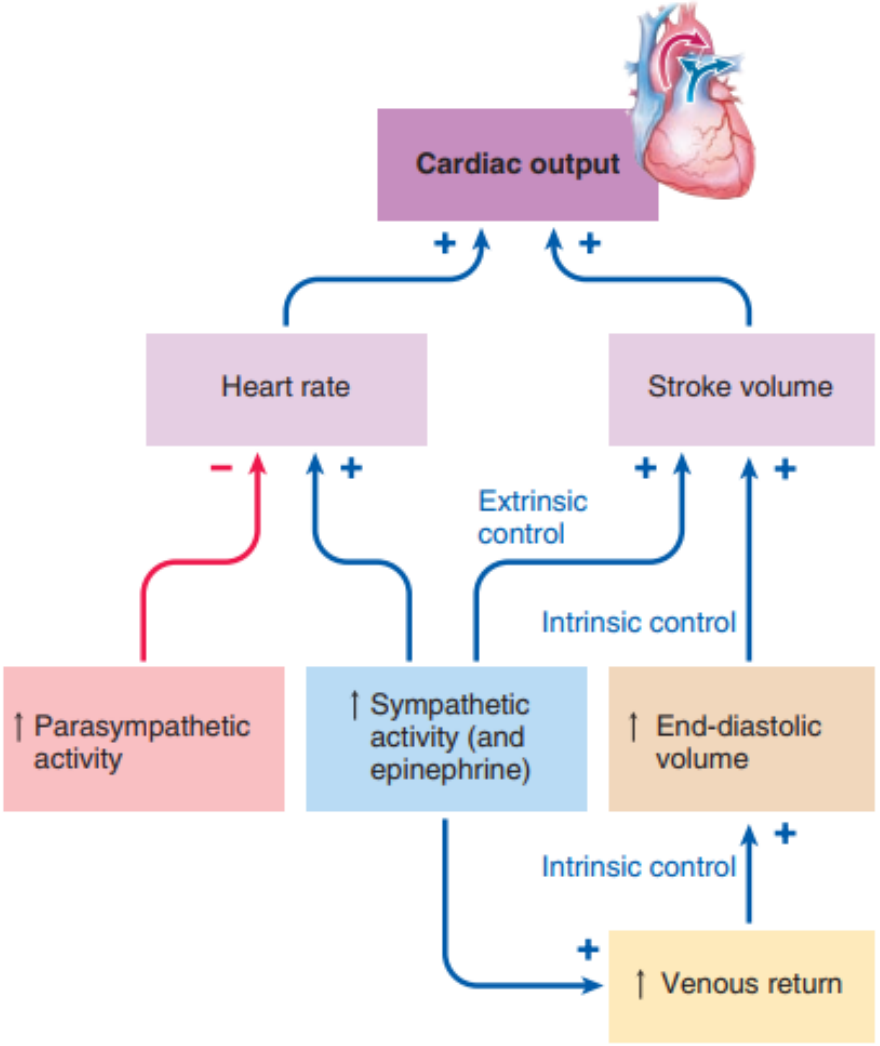


Figure 9-24 Control of cardiac output. Because cardiac output equals heart

Reference: Sherwood Human Physiology 9th Edition Page No.324

Determinants of Total Peripheral Resistance:

- MAJOR FACTOR:

  Radius (r)

- MINOR FACTORS:

  Viscosity (ŋ)

  Length of the vessel (L)

Formula: $\mathbf{R = 8\eta L/\pi r^4}$

Clinical Methods for Measuring Systolic and Diastolic pressures:

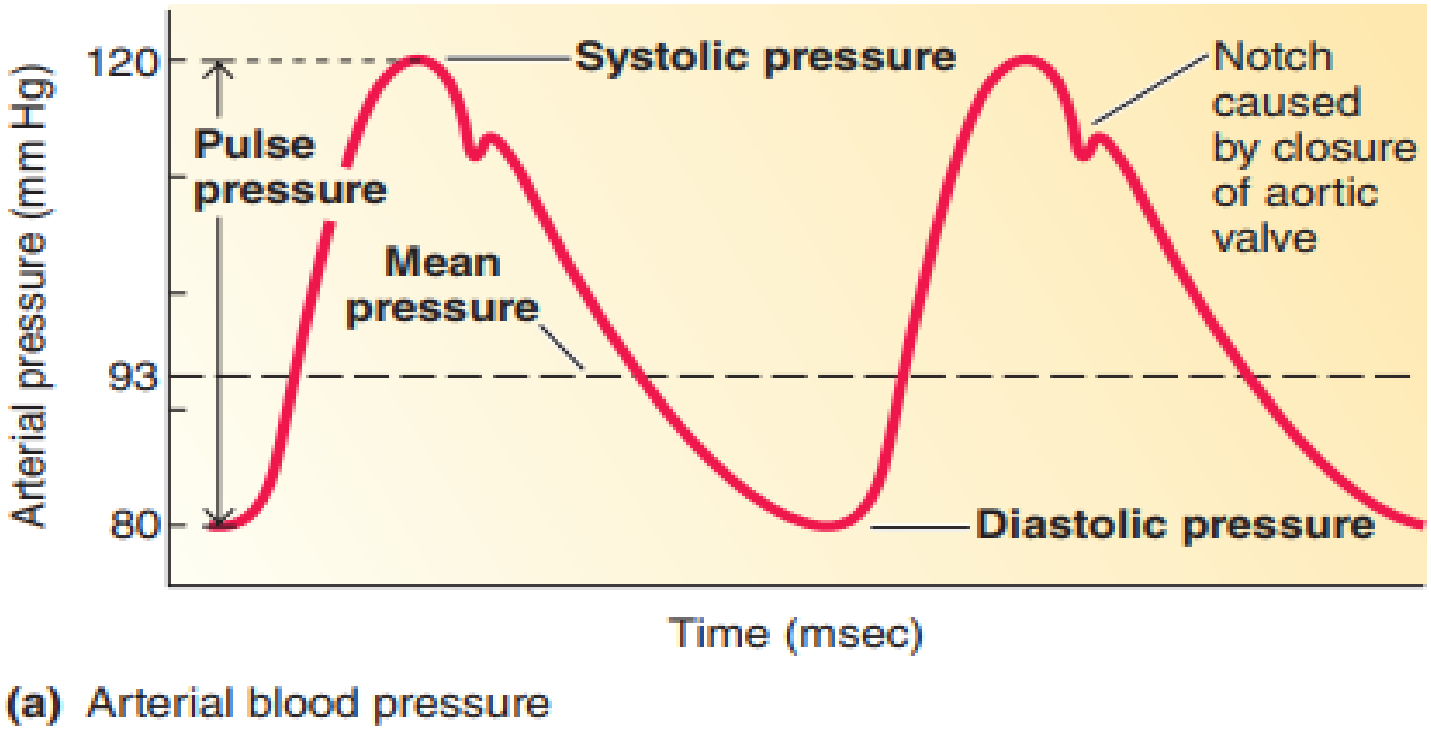
1) **Auscultatory method**:

- An inflatable cuff **(RivaRocci cuff)** attached to a mercury manometer **(Sphygmomanometer**) is wrapped around the arm and a stethoscope is placed over the brachial artery at the elbow.
- The cuff is rapidly inflated until the pressure is well above the expected systolic pressureb in the brachial artery.
- The artery is occluded by the cuff and no sound is heard with the stethoscope.
- The pressure in the cuff is lowered slowly,when it matches with the systolic pressure,A sudden tapping sound is heard below the cuff.
- The cuff pressure at which the sounds are first heard is the systolic pressure.

Contd…

- As the cuff pressure is lowered further,the sounds become louder,then dull and muffled.
- Finally in most individuals,they disappear.
- These are **the sounds of KOROTKOFF**.

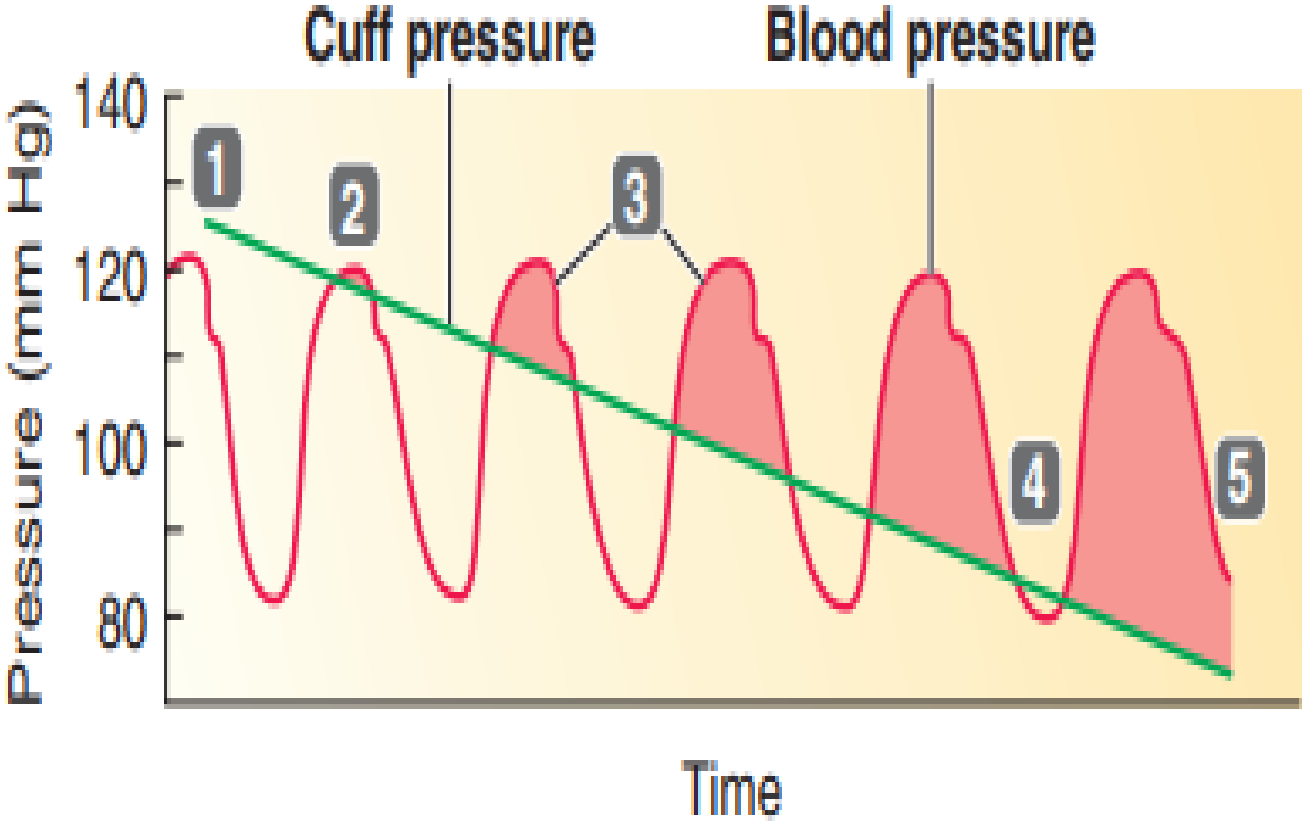
Types of Blood Pressure



(a) Arterial blood pressure

Reference: Sherwood Human Physiology 9th Edition Page No.342

Contd…



Reference: Sherwood Human Physiology 9th Edition Page No.342

Procedure for Measurement of Blood Pressure:

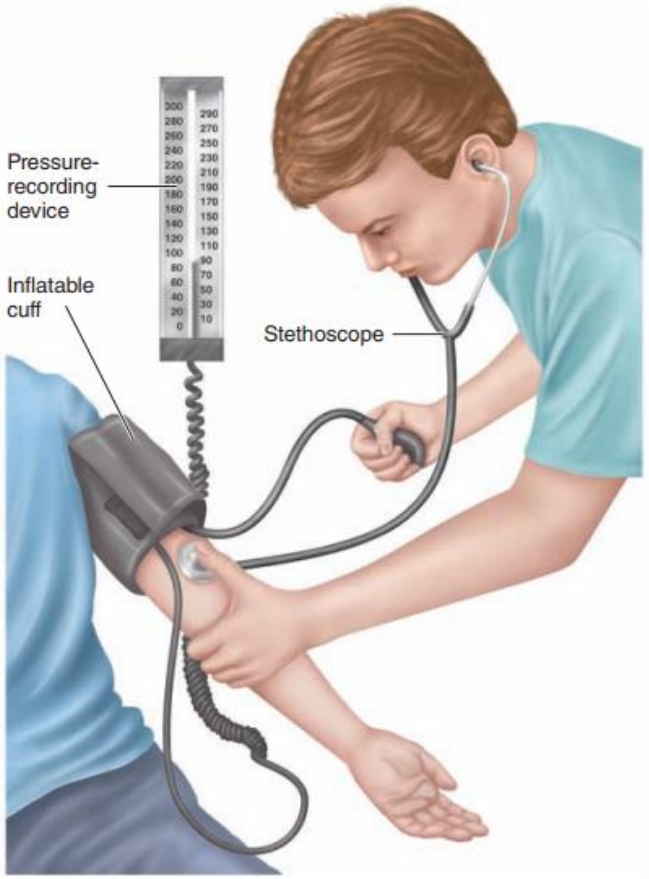
EXAMINATION SEQUENCE:

- Rest the patient for 05 minutes.
- With the patient saeted or lying down,support his arm comfortably at about heart level ensuring that no tight clothing constricts the upper arm.
- 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.Note the pressure on the manometer.This is a rough estimation of sytolic pressure.

Contd..

- Inflate the cuff another 30mmHg and listen through the diaphragm of the stethoscope placed over the brachial artery.
- Deflate the cuff slowly(2-3 mmHg/s) until you hear a regular tapping sound(Phase 1 Korotkoff sound).Record the reading to the nearest 2mmHg.This is the systolic pressure.
- Continue to deflate the cuff slowly until the sounds disappear.
- Record the pressure at which sounds completely disappear as the diastolic pressure (Phase 5).

Measurement of Blood Pressure



(b) Use of a sphygmomanometer in determining blood pressure

Reference: Sherwood Human Physiology 9th Edition Page No.342

ERRORS IN BLOOD PRESSURE MEASUREMENT:

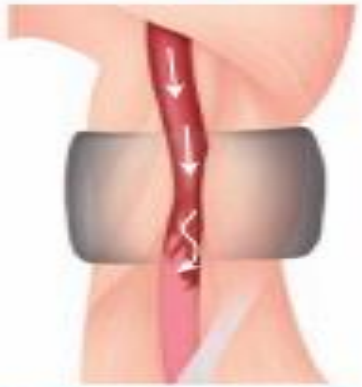
- Wrong Cuff size
- Excess pressure of stethoscope.
- Patient's arm at the wrong level.
- Postural change
- Abnormal pulse pressure
- Different Blood pressure in each arm.

Core Concept/Vertical Integration with Internal Medicine

When cuff pressure is greater than 120 mm Hg and exceeds blood pressure throughout the cardiac cycle:

No blood flows through the vessel.

1 No sound is heard because no blood is flowing.



When cuff pressure is between 120 and 80 mm Hg:

Blood flow through the vessel is turbulent whenever blood pressure exceeds cuff pressure.

2 The first sound is heard at peak systolic pressure.

3 Intermittent sounds are produced by turbulent spurts of flow as blood pressure cyclically exceeds cuff pressure.

When cuff pressure is less than 80 mm Hg and is below blood pressure throughout the cardiac cycle:

Blood flows through the vessel in smooth, laminar fashion.

4 The last sound is heard at minimum diastolic pressure.

5 No sound is heard thereafter because of uninterrupted, smooth, laminar flow.

(c) Blood flow through the brachial artery in relation to cuff pressure and sounds

Reference: Sherwood Human Physiology 9th Edition Page No.342

2023 European Society of Hypertension Guidelines for Arterial Hypertension

Classification of Hypertension

Category	Systolic (mmHg)		Diastolic (mmHg)
Optimal	<120	and	<80
Normal	120-129	and	80-84
High-normal	130-139	and/or	85-89
Grade 1 hypertension	140-159	and/or	90-99
Grade 2 hypertension	160-169	and/or	100-109
Grade 3 hypertension	180	and/or	>110
Isolated systolic hypertension	140	and	<90
Isolated Diastolic hypertension	140	and	>90

* The BP category is defined by the highest level of BP, either systolic or diastolic. Isolated systolic diastolic hypertension is graded 1,2 or 3 according to SBP and DBP values in the ranges indicated; the same classification is used for adolescents > 16 year old. (Section 15.1)

In addition to grades of hypertension, which are based on BP values, we also distinguish stages of hypertension as follows:

Stage 1: Uncomplicated hypertension (ie, without HMOD or established CVD, including CKD stage 1 and 2).
Stage 2: Presence of HMOD or CKD grade 3 or diabetes.
Stage 3: Established CVD or CKD stages 4 or 5.

Reference: Google Images

Core Concept/ Vertical Integration with Internal Medicine

Physiological Variations In Arterial Blood Pressure:

1. Diurnal variation
2. Age
3. Weight
4. Sleep
5. Exercise
6. Posture
7. Emotional state
8. Gender

Core Concept/ Vertical Integration with Internal Medicine/Pharmacology

Antihypertensive Drugs:

	Classes	Drug Names	Examples	Mechanism of Action	Main Effect on BP
A	ACE Inhibitors	"pril"	Lisinopril Enalapril	Inhibit ACE	↓ SVR, SV
A	ARBs	"sartan"	Losartan Valsartan	Block Angiotensin II Receptors	↓ SVR, SV
A	Alpha Blockers	"osin"	Doxazosin Terazosin	Block Alpha Receptors	↓ SVR
B	Beta Blockers	"lol"	Metoprolol Labetalol	Block Beta Receptors	↓ HR, SV
C	Calcium Channel Blockers (CCBs)	"dipine"	Amlodipine Nicardipine	Block Calcium Channels	↓ SVR
D	Diuretics	"ide"	Furosemide Hydrochlorothiazide	Facilitate Diuresis	↓ SV

**Alpha blockers refer to selective alpha-1 blockers, and calcium channel blockers refer to dihydropyridines

Reference: Google Images

Bioethics

Lesson Of The Day
TRUTH TELLING

- **Provision of information:**

In the practice of medicine, truth telling involves the provision of information about the situation of patients.

- **Enabling patients to make informed choices:**

The provided information enables patients to make choices about health care and other aspects of their lives.

Lesson Of The Day
TRUTH TELLING

- **Relevant case:**

If you have been informed about the result of an HIV test taken by someone in your community who then asks to know his/her result. What will be your responsibility as a doctor?

- **Solution:**

You should tell the person the truth even though this might be very upsetting to that person.

Suggested Research Article

International Journal of Diabetes in Developing Countries (December 2022) 42 (4):576–605
https://doi.org/10.1007/s13410-022-01143-7

GUIDELINES

RSSDI Guidelines for the management of hypertension in patients with diabetes mellitus

Vasanth Kumar[1,2] · Sanjay Agarwal[3,4,5] · Banshi Saboo[6,7] · Brij Makkar[8,9]

Received: 20 May 2022 / Accepted: 1 November 2022 / Published online: 15 December 2022

Abstract

Hypertension and diabetes mellitus (DM) are two of the leading lifestyle diseases in the Indian and South Asian populations that often co-exist due to overlapping pathophysiological factors. Obesity, insulin resistance, inflammation, and oxidative stress are thought to be some common pathways. Up to 50% of hypertensive cases in India are diagnosed with type 2 diabetes mellitus (T2DM), which defines the need for a comprehensive guideline for managing hypertension in diabetic patients. These RSSDI guidelines have been formulated based on consultation with expert endocrinologists in India and Southeast Asia, acknowledging the needs of the Indian population. Ambulatory blood pressure monitoring and office and home-based blood pressure (BP) monitoring are recommended for the early analysis of risks. Cardiovascular risks, end-organ damage, and renal disorders are the primary complications associated with diabetic hypertension that needs to be managed with the help of non-pharmacological and pharmacological interventions. The non-pharmacological interventions include the nutrition education of the patient to reduce the intake of salt, sodium, and trans fats and increase the consumption of nuts, fresh fruits, vegetables, and potassium-rich foods. It is also recommended to initiate 50 to 60 min of exercise three to four times a week since physical activity has shown to be more beneficial for hypertension control in Indian patients than dietary modulation. For the pharmacological management of hypertension in patients with T2DM, angiotensin II receptor blockers (ARBs) are recommended as the first line of therapy, demonstrating their superiority over other antihypertensive agents such as ACEi. However, most of the global hypertension guidelines recommend initiation with combination therapy to achieve better BP control in most patients and to reduce the risk of adverse events. For combination therapy, calcium channel blockers (CCBs) are recommended to be administered along with ARBs instead of beta-blockers or diuretics to avoid the risk of cardiovascular events and hyperglycaemia. Among the CCBs, novel molecules (e.g. cilnidipine) are recommended in combination with ARBs for better cardiovascular and reno-protection in diabetic hypertensive patients.

Journal Name: International journal of Diabetes in Developing Countries,2022.

How To Access Digital Library

- **Steps to Access HEC Digital Library**

1. Go to the website of HEC National Digital Library.
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5. A page will appear showing the resources of the institution
6. Journals and Researches will appear
7. You can find a Journal by clicking on JOURNALS AND DATABASE and enter a keyword to search for your desired journal.

Brainstorming

Structured Essay Question related to Topic

Q.NO.1: A 58 years old male presented in Emergency department of DHQ Hospital. He complains of apprehension,Headache and blurred vision for last 6 hours. No other associated symptoms. On Examination his pulse rate 110bpm,Temp=98°F,Sp02=98%,BP=200/110mmHg.

Calculate pulse pressure?

ANSWER

ANSWER: Pulse pressure =

Sytolic blood pressure(SBP)- Diastolic blood pressure (DBP)

200-110=90 mmHg

Question 2: What is the grade of hypertension in this patient**?**

ANSWER: Grade 3 (Severe Hypertension)

Structured Essay Question related to Topic

- **Q.NO.3:** A 69 years old patient presented in emergency department with altered state of consciousness for last 30 minutes.His son told about his history of pain in Retrosternal area for last 9 hours,difficulty in breathing.He is known case of Hypertension and Ischemic heart disease(IHD).On examination,His pulse rate 120bpm,Temp=98°F,Sp02=90%,BP=90/60 mm Hg. On auscultation, S3 Ventricular Gallop Murmur is present along with crackles over the base of lungs.What is your likely diagnosis?

CONTD....

- **ANSWER: Congestive Heart failure (CHF) leading to Cardiogenic Shock**

(Due to hypertension and IHD)

- **Q.NO.4:**What will be the cardiac output in this patient?

ANSWER: Low Cardiac Output

REFERENCES

1. Books:

- Guyton And Hall textbook of Medical Physiology 14th Edition
- Ganong's Review of Medical Physiology 25th Edition
- Sherwood, 9th edition.
- Silverthorn Physiology,6th edition
- Vander's Human Physiology,14th edition
- Google images.

2.Medical Journal articles:

RSSDI Guidelines for the management of hypertension in patients with diabetes mellitus

https://doi.org/10.1007/s13410-022-01143-7

3.Video link /youtube:

https://youtu.be/JtBtk00EiVM?si=y-2DAPW49eQwqU6N


Thank
you