

# EMC 340 INTRO TO CLINICAL MEDICINE

BLOOD PRESSURE

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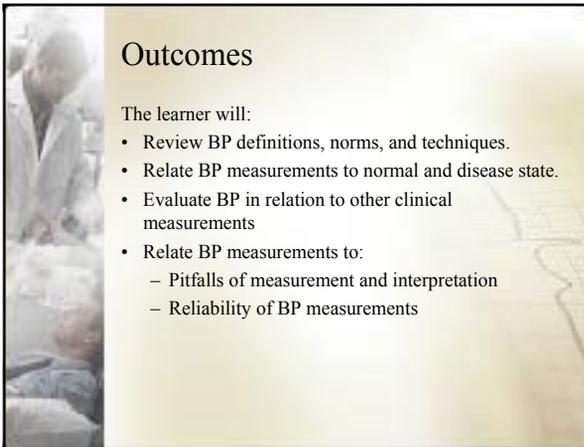
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## Outcomes

The learner will:

- Review BP definitions, norms, and techniques.
- Relate BP measurements to normal and disease state.
- Evaluate BP in relation to other clinical measurements
- Relate BP measurements to:
  - Pitfalls of measurement and interpretation
  - Reliability of BP measurements

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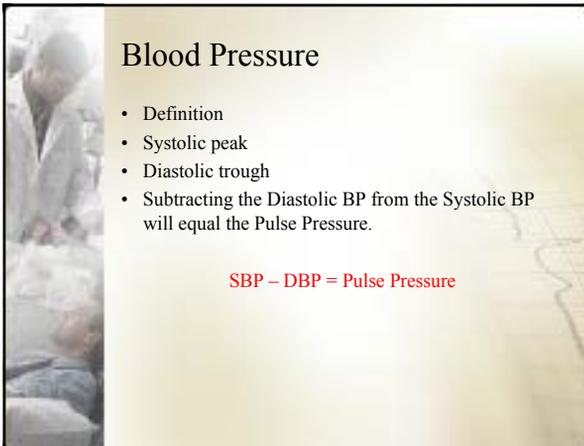
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## Blood Pressure

- Definition
- Systolic peak
- Diastolic trough
- Subtracting the Diastolic BP from the Systolic BP will equal the Pulse Pressure.

**SBP – DBP = Pulse Pressure**

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## Determinants of Adequate BP

- CO (cardiac output)
  - Blood volume
  - Stroke volume (i.e., left ventricular SV) \
- Total VR (vascular resistance)
  - Distensibility of arterioles (PVR)
  - Distensibility of the large arteries and aorta

**BP = CO x total VR**

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## BP Norms



- Adult
  - SBP: 100 + age (< 140 mmHg)
  - DBP: 2/3 SBP (< 90 mmHg)
- Child (<10):
  - Avg. SBP: 80 + (2 X age)
  - Min. SBP: 70 + (2 X age)

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## Normal BP Variations

- Time of day
- Age
- Physical activity
- Anxiety
- Exercise
- Drugs
  - Alcohol
  - Smoking

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## Sources of BP Variations

Validity and reliability affected by:

- Technique
  - Cuff
  - Arm position
  - Rate of deflation
  - Disappearance point
- Clinical setting
  - One arm vs. both arms
  - Arrhythmias
  - Inaudible Korotkoff sounds
  - Obesity

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## Sources of BP Variations

- Falsely high SBP readings:
  - Brachial artery positioned below heart
  - Ballooning out cuff
  - Normal BP variations
- Falsely high DBP readings:
  - Repeated inflation-deflation-inflations

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## Sources of BP Variations

Falsely low SBP readings:

- Rapid cuff deflation
- Auscultatory gap
- Arrhythmias
- Inaudible Korotkoff sounds
- Aortic tear

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## BP Pathophysiology

Disease states associated with abnormalities of BP determinants:

- Inadequate blood vol    Hypovolemic shock
- Inadequate SV            LV CHF
- Rigid distensibility      Hypertension (arteriosclerosis)
- Inadequate distensibility    Septic shock (↓PVR)

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## Hypertension Epidemiology

- Common (50 million in the U.S.)
  - Exact pre-hospital prevalence not established
- CV risk factor
  - Major
  - Modifiable
- Ambulatory medicine
  - “Silent killer”

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## BP Disease States

↑ BP

- CV disease
- Kidney disease
- Head injury ( with ↑ ICP)

↓ BP

- Pump disease
- Cardiogenic shock (TCA overdose)
- Obstructive shock (tension pneumothorax)
- Pipe disease
  - Septic shock
  - Neurogenic shock
- Volume disease
  - Dehydration
  - Hemorrhage

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## BP Technique

Cuff

- Cuff width: < 50 % of arm circumference
- For inadequate size:
  - Larger cuff
    - thigh
  - Smaller site:
    - Forearm
    - Calf



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## BP Tilt Test

- For ↓ BP and suspected volume deficit and no spinal injury suspected
- Normal
  - BP drop of < 15 % [i.e. , < 10-20 mmHg] (less sensitive)
  - HR rise of > 15 % [i.e. , > 10-20 / min.] (more sensitive)

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## BP Tilt Test

- Abnormal test defined as:
  - A significant ( $\approx$  15 %) change in HR or BP
    - Especially if accompanied by postural symptoms
- Abnormal test associated with:
  - Volume deficit (hemorrhage)
  - Medications (NTG; Viagra)
  - Vascular disease (diabetes)

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## Pulse Pressure

- Definition: **pulse pressure = SBP – DBP**
- Wide pulse pressure (aging) :
  - Aging → arteriosclerosis → stiff aorta →  
↑ SBP
- Narrow pulse pressure (shock) :
  - ↓ Blood vol → ↑ adrenaline → ↑ PVR →  
↑ DBP
  - ↓ Return of blood → ↓ left ventricle vol. →  
↓ CO → ↓ SBP

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## Summary

We have discussed:

- BP definitions, norms, and techniques.
- The use of BP measurements in:
  - Disease states.
  - Other clinical situations.
- Relating BP measurements to:
  - Measurement and interpretation pitfalls.
- The problems of reliability and validity

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