Antihypertensive Drugs

Roslyn Garrigan Nott, MSNed, RN
rnott@dhs.lacounty.gov

1

Objectives

- Apply the nursing process in determining the mechanism of action, therapeutic dose, indications, adverse reactions, and nursing implications of antihypertensive drugs
- Contrast non-pharmacologic vs. pharmacologic treatments for hypertension
- Explain how the blood pressure can be reduced with the use of different antihypertensive medications
- Discuss how the blood pressure can be reduced with the use of diuretic therapy
- State how adverse effects of antihypertensive drugs can be minimized or prevented

Objectives

- Outline the contents of a teaching plan for a client newly diagnosed with hypertension
- State interventions by the various health care providers that may help hypertensive clients to adhere to their treatment regimens
- State potential consequences of untreated or inadequately treated hypertension
- Recognize indications for use of osmotic diuretics
- Summarize the rationale for using combination drugs in the treatment of hypertension

3

Non Pharmacologic Control of HTN

1. Stress reduction techniques
2. Exercise
3. Diet
4. Weight reduction
5. Lifestyle modifications

4

Stress Reduction Techniques

- Relaxation
- Meditation
- Yoga
- Laughter therapy

5

Diet

– Salt restriction (2 gm ↓Na^+ diet)

– ↓ Fat and caloric intake

– Increased intake of fiber

6

Exercise and Weight Reduction

Exercise

- Walking or bicycling
- Aerobic exercise
- Resistance training

- **Weight Reduction**

Lifestyle Modifications

- Lifestyle modification is the key factor
  - Smoking cessation
  - ↓ alcohol intake to 1 drink/day or avoid completely
    - "Red wine"/ Grape Juice
      - Polyphenolic compounds have an antioxidant effect
        - » Relaxes blood vessels

- Non-pharmacologic methods should be combined with anti-HTN drugs to control HTN

8

Pharmacologic Control of HTN

- Emphasis on reduction of other cardiovascular risk factors and the use of fewer drugs at the lowest effective dose
- **Lipid Studies: Normal Levels**

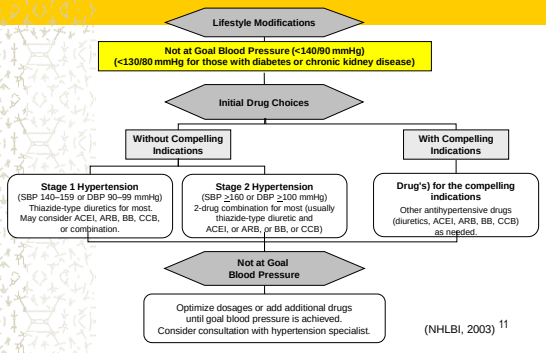
Cholesterol	: 150 – 200 mg/dL
Triglyceride	: 40 – 150 mg/dL
HDL (good)	: 45 – 60mg/dL
LDL (bad)	: 100 – 130 mg/dL

9

Joint National Committee HTN Guidelines

CATEGORY	SYSTOLIC PRESURE	DIASTOLIC PRESSURE
NORMAL	< 120	<80
PRE-HTN	120-139	80-89
STAGE I -HTN	140-159	90-99
STAGE 2 - HTN	> 160	>100

Algorithm for Treatment of Hypertension



(NHLBI, 2003) [11]

Algorithm Key

- Thiaz = thiazide diuretic
- ACEI = angiotensin converting enzyme inhibitor
- ARB = angiotensin receptor blocker
- BB = beta blocker
- CCB = calcium channel blocker
- Aldo ANT = aldosterone antagonist

Compelling Indications

- Heart failure
- Post myocardial infarction
- High risk CVD
- Diabetes
- Chronic kidney disease
- Recurrent stroke prevention

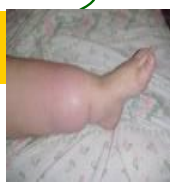
12

Six Classifications: Antihypertensive

1. Diuretics
2. Sympatholytics (sympathetic depressants)
3. Direct-acting arteriolar vasodilators
4. ACE inhibitors (ACEI)
5. Angiotensin II receptor blockers (ARBs)
6. Calcium channel blockers (CCB)

13

Diuretics



- First-line drugs for mild HTN

Purpose:

- Lower blood pressure (↓Na/ ECFV)
- Decrease edema
- Diuresis

- May be used in combination with antihypertensive drugs

14

Commonly Used Diuretics

Thiazide and thiazide-like diuretics

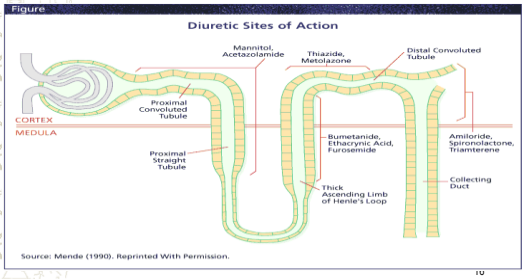
Loop or high-ceiling diuretics

Osmotic diuretics

Potassium-sparing diuretics

15

Diuretic Sites of Action



16

Thiazides

- Hydrochloro**thiazide (HCTZ, HydroDiuril)**
  - Act on the distal convoluted tubule to promote Na^+, Cl^-, K+, H_20 excretion
  - Not effective for immediate diuresis
  - Side effects: Hypokalemia, hypercalcemia, hyperglycemia, hyperuricemia, & hyponatremia

17

Thiazide Diuretics

- Should **not be** used with clients with renal insufficiency (use loop diuretics)
- Thiazides may be combined with Anti-HTN meds such as BB/ ACEI (pg. 636 Box 44-1 list)

Loop (High-Ceiling)

- **Furosemide (Lasix) & Bumetanide (Bumex)**
  - Act on the ascending loop of Henle by inhibiting Cl^- transport of Na^+ into the circulation

  - Potent, rapid diuresis
    - Alert: marked ↓ in BP
  - "High ceiling diuretics" (high diuretic potential)
    - Effects are dose dependent

19

Loop (High-Ceiling)…

- "Potassium wasting diuretics"
  - Hypokalemia

  S/S = muscle weakness, abdominal distension, leg cramps and/or cardiac dysrhythmias

- Orthostatic hypotension
- Drug to drug interaction with digoxin (toxicity)
  - Check your K+ levels

20

Osmotic Diuretics

Mannitol (Osmitrol)

- Pulls the fluid from interstitial tissue spaces into vascular tree
- Increase in osmolality
- Na^+, Cl^-, K+, & H20 excretion
- Potent osmotic potassium-wasting diuretic
- Diuresis occurs 1 to 3 hours after IV administration
- Side effects: Fluid & electrolyte imbalance, tachycardia, & pulmonary edema

21

Potassium-Sparing Diuretics

Spironolactone (Aldactone)

- Acts primarily in the collecting duct of renal tubules to promote Na^+ & H_20 excretion and K^+ retention
- Weaker than thiazides and loop diuretics

- If given with ACE inhibitor may cause ↑ K+
  - Hyperkalemia which could be life-threatening
    - s/s: tachycardia & later bradycardia, peaked narrow T waves on EKG nausea, diarrhea, abdominal cramps, numbness and tingling of hands and feet

22

Combination Drugs

- Thiazide/ ACE Inhibitors:
  - ex: Monopril HCT
- Thiazide/ Agiotensin II antagonists:
  - HCTZ + Losartan = Hyzaar

Pg. 636 Box 44-1 (information only)

Commonly Used Sympatholytics

Beta-adrenergic blockers

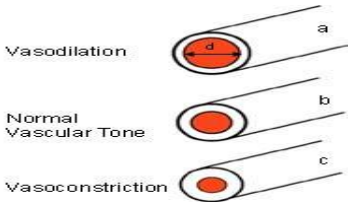
Centrally acting alpha 2-agonists

Alpha-adrenergic blockers

Alpha 1 and beta 2 adrenergic blockers

24

Peripheral Vascular Resistance (PVR)



Beta Adrenergic Blockers (Beta-Blockers)

- B_1 & B_2 adrenergic blockers
  - Reduces cardiac output by ↓ SNS response & reducing vascular resistance
- ↓ HR
- ↓ Contractility
- ↓ Renin release

  - **Net effect = lower BP**

26

Beta blockers

- **Abruptly stopping Beta Blockers**
  - **Rebound HTN, angina, dysrhythmias, & MI**
    - **Important teaching point**
- May be used in combination with a diuretic

Beta Adrenergic Blockers (Beta-Blockers)

1. Nonselective beta-blockers e.g. Propranolol (Inderal) = "lols"

- Inhibit beta 1 (heart) receptors
  - Heart Rate slows = Net effect ↓in B/P
- Inhibit beta 2 (bronchial) receptors
  - Bronchoconstriction occurs (unopposed parasympathetic tone)

Noncardioselective Beta Blockers Considerations

- Inhibit the liver's ability to covert glycogen to glucose in response to hypoglycemia (DM use cautiously)
- Do not use noncardioselective BB in COPD patients

Beta-Blockers…

2. Cardioselective beta-blockers

Atenolol (Tenormin) & Metoprolol (Lopressor)

- Act mainly on $beta_1$ rather than $beta_2$ receptors
  - Preferred
- Major side effects: Bradycardia, ↓ BP, insomnia, depression, impotence & brochospasm (noncardioselective)

30

Beta-Blockers

(Lols)

- Propranolol (noncardioselective)
- Atenolol
- Metoprolol

- Use with caution in clients with pulmonary disease

- Parameters Hold if HR = less than *45-50 min per micromedics

Centrally Acting Alpha$_2$-Agonists

Methyldopa (Aldomet) & Clonidine HCl (Catapress)

– ↓ Sympathetic response from the brainstem to the peripheral vessels
– ↓ Serum epi/ norepi & renin release

• Net effect: ↓ peripheral vascular resistance (PVR) & ↑ vasodilation

32

Centrally Acting Alpha$_2$-Agonists

- Causes Na^+ & H_20 retention
  – Diuretic may be ordered to ↓ edema

- Major side effects: Bradycardia, drowsiness

- Do not abruptly stop may cause rebound HTN crisis

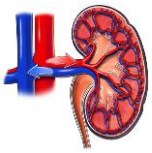
Alpha-Adrenergic Blockers (Alpha Blockers)

Prazosin HCl (Minipress) &Tamsulosin (Flomax)

- Blocks the alpha-adrenergic receptor
  - Resulting in vasodilation and decreased BP
  - Helps maintain renal blood flow rate

*Also used to treat BPH

Benign Prostatic Hypertrophy



Alpha-Adrenergic Blockers (Alpha Blockers)

- Does not affect glucose metabolism or respiratory function (Safe: DM & Asthmatics)
- Used to treat HTN with clients with lipid abnormalities
  Decrease LDL and increase HDL (friendly)
- Causes Na+ & H20 retention with edema (diuretic)
- Side effects: Orthostatic hypotension, N/V/D

Adrenergic Neuron Blockers

- Potent antihypertensive: Reserpine (serpasil)
  - Blocks norepinephrine release = ↓B/P (↓CO & PVR)
- Rarely used (considered last choice tx for HTN)
- Side Effects: Orthostatic hypotension, vivid dreams, suicidal ideation, nightmares

Alpha1 & Beta1 Adrenergic Blockers

Labetalol (Normodyne) & (Cartrol)

- Blocks both alpha1 & beta1 receptors
  - **Alpha effect is stronger** than the beta effect
- Alpha 1 blocking causes vasodilation
  - ↓ resistance to blood flow

- Beta 1 blocking (moderately)↓ the HR =↓B/P

37

Alpha1 & Beta1 Adrenergic Blockers

- Large doses could block beta 2 receptors and could lead to airway resistance
  - Clients with asthma should not take large doses
- Major side effects: Orthostatic hypotension, AV block (large doses)

Direct Vasodilators

Potent antihypertensives

Hydralazine HCl (Apresoline HCl)

*Moderate to severe HTN

Nitroprusside (Nipride)

*Hypertensive Emergencies

- Direct-acting arteriolar vasodilators
  - Relaxing the smooth muscles of the blood vessels (mainly arteries) = VASODILATION
    - ↓ BP, Na^+ & H_20 retention → peripheral edema

39

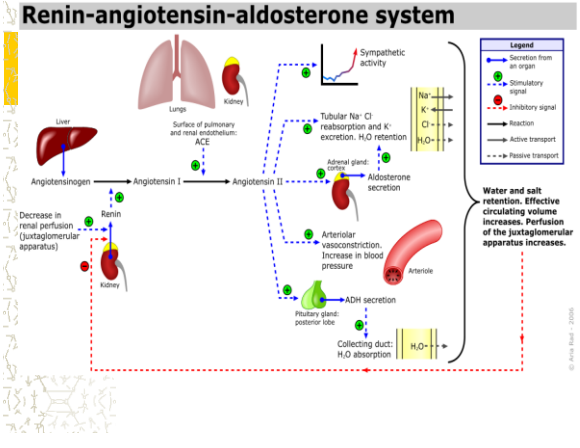
Direct Vasodilators

- Hydralazine Major Side Effects:
  - Tachycardia, palpitations, edema, dizziness
    - Beta blocker may be prescribed
- Nipride Major Side Effects:
  - Tachycardia, palpitations, agitation, confusion
    - Beta blocker may be prescribed
- HYPOTENSION (titrate slowly)

Angiotensin Converting Enzyme (ACE) Inhibitors

- **Captopril (Capoten) & Enalapril (Vasotec) = "prils"**
- Inhibits the formation of angiotensin II (vasoconstrictor) & **blocks** the release of aldosterone
- Aldosterone: (promotes Na+ retention & K+ excretion)

41



Angiotensin Converting Enzyme (ACE) Inhibitors

- Net Effect: Lowers PVR (↓ BP) & little change in CO and HR
- Side effects: dizziness, ↑K+, constant irritating cough- (ACE cough) tachycardia, N/V/D, insomnia
  - *First dose hypotension
- Thiazide diuretics are recommended
  - African Americans & older adults do not respond to ACEI unless used in conjunction with diuretics (↓ renin)

Commonly Prescribed ACE Inhibitors

"prils"

- Benazepril
- Captopril
- Enalapril
- Lisinopril

Angiotensin II Receptor Blockers (A-II Blockers) or ARBs

Losartan (Cozaar) & Valsartan (Diovan)

- Blocks the vasoconstrictor effects of angiotensin II at the receptor site
- Prevents the release of aldosterone
  - Similar to ACE Inhibitors

- Net Effect: Vasodilation & ↓ peripheral resistance = ↓B/P

45

Angiotensin II Receptor Blockers (A-II Blockers) or ARBs

- Side effects: Dizziness, insomnia (no cough)
- May be used as a first line tx for HTN
- Hyzaar (Combo Drug)
  - Losartan potassium and low dose HCTZ

Calcium Channel Blockers

"pines"

Nifedipine (Procardia) & Amlodipine (Norvasc)

- Free calcium ↑ muscle contractility, PVR, and BP
- Calcium Blockers: ↓ Ca^{++} levels in the vascular smooth muscle (VSM) = vasodilation
- Net Effect: ↓B/P

48

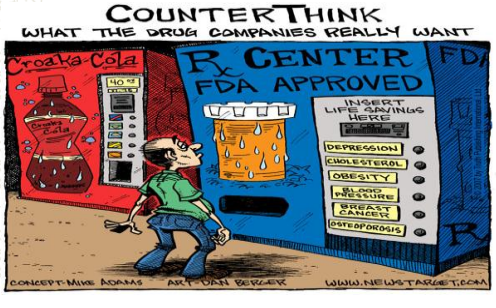
Calcium Channel Blockers (CCB)

- Nifedipine concern: (immediate release form) has been associated with sudden cardiac death in high doses
- Sustained release preparations (SR) of CCB are more commonly used
- Side effects: Flushing, HA, dizziness, ankle edema, bradycardia, AV block & reflux tachycardia
- May be used more commonly in African American patients (better control of B/P)

Commonly Used Calcium Channel Blockers (CCB)

- Amlodipine
- Felodipine
- Nifedipine
- Nicardipine
- Benzothiazepines (Cardizem/Diltizem)

What is the significance of using combination drugs in the treatment of HTN?



Combination of Drugs

- To obtain increased BP control
- To enhance compliance
- To minimize the clinical effects and side effects

52

Prevention of Adverse Effects of Anti-HTN Drugs

- Complete physical assessment
- Monitor VS, Labs, hydration status
- Monitor for Drug-drug interactions
- Evaluate the drug effectiveness
- Effective patient teaching

53

Major Considerations

Diuretics:

- Monitor VS & weight
- Monitor Electrolytes:
  - Specifically hypokalemia or hyperkalemia
- Urine output: Report if urine output is <30ml/hr or <600 ml/day
- Administer in day time to avoid nocturia

54

Major Considerations with Older Clients

- Be aware of "auscultatory gap"
- More susceptible to adverse effects and drug toxicity
- Reduced doses are given because of dose-related side effects (electrolyte imbalance)
- Alpha 1 blockers & alpha 2 blockers are rarely prescribed because of orthostatic hypotension

55

Major Considerations with Older Clients…

- Isolated systolic HTN (ISH) & white coat HTN are most common among older adults
- Older adults produce less renin & are more resistant to the effects of ACE inhibitors & A-II blockers

56

Major Considerations with Children

- ↑ BP as children puts them at greater risk for HTN in adulthood
- National norms have been established for BP in children & adolescents of comparable age, body size (ht. wt. & gender)

Goal of Treatment :

- To reduce BP below the 95th percentile
- Prevent the long term effects of persistent HTN

57

Major Considerations with Children…

- Most principles of managing adult HTN apply to managing children & adolescent with HTN
  - Prevention of obesity
  - Exercise
  - Avoid excessive Na^+ intake

58

Guidelines for Choosing Anti-HTN Drugs for Children

- Beta blockers are used in children of all ages
  - *Should be avoided when the resting pulse rate is under 60/min
- Thiazides may be used; do not commonly cause hyperglycemia & hypercalcemia in children
- CCB are used to treat acute & chronic childhood HTN

59

Nursing Process

- **Assessment**
  - **Subjective data**
    - Medication history
    - Family history
    - Lifestyle
  - **Objective data**
    - VS, weight, BMI
    - Lab values & diagnostics

60

Nursing Process…

Nursing Diagnoses:

- Noncompliance with drug regimen related to multiple drugs ordered AEB…
- Ineffective management of therapeutic regimen related to inadequate assistive resources (written schedule) AEB…
- Anxiety related to inability to cope with hypertensive state AEB…

61

Nursing Process…

- **Goal should be realistic!**

- **Implementation:**
  Educating clients with the disease process, possible complications, & treatment regimen is significant to control HTN

62

Nursing Process…

- **Healthcare team collaborative efforts:**
  - Minimize/prevent side effects of anti-HTN drugs
  - Follow up, routine check-up, referral
  - Access to available health resources

63

Nursing Process… Diuretics: Loop

- See Kee pg. 627 (Collaborative Care)
  - Assessment
  - Nursing Diagnosis
  - Planning
  - Nursing intervention
  - Client Teaching
  - Evaluation

64

Healthy Way LA

- **Residency:** Los Angeles County
- **Age**: Adult, 19 to 64 years of age
- **Citizenship**: U.S. Citizen/National or Legal Permanent Resident of 5 + years
- **Income**: Monthly income limit ($1,207 or less for a family of one)
- **Pregnancy**: Not pregnant or eligible for Medi-Cal

- lacounty.gov

Nursing Process…

Teaching plan:

- General instructions
- Self-administration
- Side effects
- Diet

66

Nursing Process…

General instructions:

- Compliance with drug regimen
- Avoid OTC drugs without checking with MD
- MedicAlert bracelet

67

Nursing Process…

Self monitoring:

- BP reading, radial pulse
- I &O, weight

Self administration:

- Safe technique

68

Nursing Process…

Side effects:

- Take diuretics in the morning, to avoid sleep disturbances from nocturia
- Slowly change positions (orthostatic hypotension)
- Inform about sexual dysfunction (impotence)
- Report dizziness, edema, shortness of breath

69

Nursing Process…

Diet:

- Potassium supplements
- Take drugs with meals to avoid GI problems
- ↓ Na+ intake

Evaluation:

- Evaluate the effectiveness of the drug therapy
- Determine that client adheres to the drug regimen

70

Consequences of Untreated HTN/Inadequate Treatment

- Rebound hypertension
- Target organ complications
- Debilitating condition, disability
- Death

71

Consequences…

- **Rebound hypertension:** An increase in BP in response to stopping or reducing BP medications
- **Target organ complications:**
  - CVA
  - Heart failure
  - PVD
  - Nephrosclerosis
  - Retinopathy

72

Consequences…

Target organ complications:

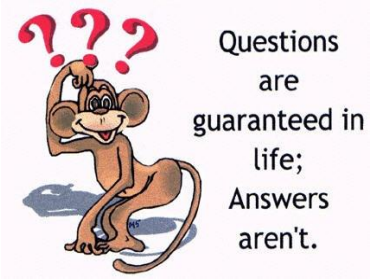
- **CVA**: Cerebral atherosclerosis – stroke
- **Heart failure:** HTN – increased workload – LVH
- **PVD**: Intermittent claudication (a classic symptom of PVD involving arteries)
- **Nephrosclerosis:** Narrow intrarenal blood vessels- destruction of glomeruli – ESRD
- **Retinopathy:** Blood vessel damage

73

Conclusion

- Non-pharmacologic treatment of HTN
- Pharmacologic treatment
- Minimizing adverse effects of anti-HTN drugs
- Nursing process – Teaching plan
- Combination drug therapy
- Consequences of untreated HTN

74



References

- Kee, J. L., Hayes, E. R. & McCuistion, L. E. (2015c). Drugs affecting the central nervous system. In *Pharmacology: A Nursing Process Approach.* (8th ed.). St. Louis, Missouri: Sunders Elsevier.
- Aschenbrenner, D. S., Venable, S.J. (2006). Central nervous system drugs. In *Drug Therapy in Nursing.* (2nd ed.). Philadelphia: Lippincott Williams & Wilkins.
- Lewis, S.L., Heitkemper, M. M., Dirksen, S.R., O'Brien, P.G., & Bucher. L. (2007). Hypertension. In *Medical Surgical Nursing: Assessment and Management of Clinical Problems.* (7th ed.). St. Louis, Missouri: Mosby Elsevier.

76