Management of Hypertension

Hypertension (HTN)
• Systolic blood pressure of 140 mm Hg or higher
• Diastolic blood pressure of 90 mm Hg or higher

Resistant HTN
• Uncontrolled blood pressure despite the use of three antihypertensive medications
• Prevalence is unknown

Resistant HTN
• Poor patient compliance
• Physician inertia
• Inadequate dosing
• Inappropriate combination of medications
• Excess alcohol intake

Secondary HTN
• Endocrine disorders
• Renal disease
• Neurological conditions
• OSA
• Acute stress
• Drug-induced

Drug-induced HTN
• NSAIDS
• Oral contraceptives
• Glucocorticoids
• Mineral corticoids
• Herbal products
White Coat Effect

- Blood pressure elevated while in doctors office but normal or significantly lower elsewhere
- 20 - 30% of population

HTN

- Increase in the resistance of blood flow through arteries
- Contributes to atherosclerosis
- Stroke

HTN

- 73 million Americans
- 1 in 6 deaths among adults
- $73.4b in direct and indirect costs in 2009

JNC 7

- The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure
  - Guideline for hypertension prevention and management

NHBPEP CC

- National High Blood Pressure Education Program Coordinating Committee

HTN

- NIH
- National Heart, Lung and Blood Institute
- CDC Division for Heart Disease and Stroke Prevention
- AHA
- National Center for Health Statistics
**Risk Factors**
- Coronary heart disease
- Dyslipidemia
- Diabetes mellitus
- Physical inactivity
- Obesity
- Cigarette smoking
- Diet

**Risk Factors**
- Sleep apnea
- Chronic kidney disease
- Chronic steroid therapy
- Drug-induced
- Thyroid disease

**Life Style Modification**
- Obesity
- Alcohol
- Physical activity
- Diabetes mellitus
- Diet
- Cigarette smoking

**Obesity**
- 97 million adults in the United States
- Obesity BMI > 30
- Overweight BMI 25 - 29
- Increase risk of CHD, stroke and mortality
- Associated with dyslipidemia, Type II DM and hypertension

**Physical Activity**
- Associated with lower LDL and triglyceride levels, increases HDL, improve insulin sensitivity, and lower blood pressure
- 150 minutes of moderate aerobic activity weekly
- 75 minutes of vigorous aerobic activity weekly

**HTN**
- AHRQ [www.ahrq.gov](http://www.ahrq.gov)
Physical Activity

- Decreases risk of CVD
- Decreases risk of Type II DM
- Decreases risk of some cancers
- Strengthens bones and muscles
- Improves mental health and mood
- Increases chance of living longer
- Improves ability of daily activities

Moderate Intensity

- Walking briskly
- Water aerobics
- Bike riding less than 10 miles/hour
- Doubles tennis
- Ballroom dancing
- General gardening

Vigorous Activity

- Race Walking, Jogging or Running
- Swimming Laps
- Jumping Rope
- Heavy Gardening
- Hiking uphill
- Singles Tennis
- Bicycling 10 miles+/hr

Diabetes Mellitus (DM)

- Blood glucose of 126 mg/dL or greater
- Risk of all forms of cardiovascular disease are increased with Type I or Type II DM
- Mortality rate of patients with DM and CHD is higher than the non-diabetic patient

Alcohol

- 1 - 2 drinks per day reduces risk of coronary heart disease by 20 - 40%
- Increases HDL
- Improved insulin sensitivity
- Reduced inflammation
- Decreases thrombogenic tendency

Nicotine

- Decreases oxygen to heart
- Increases blood clotting
- Damages cells of coronary arteries
- Increases BP and HR
### Sodium

- 2,300 mg/day for anyone 2 years of age and older
- Equals 1 teaspoon of salt
- Average American consumes 3,400 mg/day
- Minimum 1,500 mg/day

<table>
<thead>
<tr>
<th>Food</th>
<th>Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>1</td>
</tr>
<tr>
<td>Tomato</td>
<td>1-14</td>
</tr>
<tr>
<td>Plain yogurt (1 cup)</td>
<td>105</td>
</tr>
<tr>
<td>Tap water (8oz)</td>
<td>12</td>
</tr>
<tr>
<td>Fresh corn (1 ear)</td>
<td>1</td>
</tr>
</tbody>
</table>

### Sodium

<table>
<thead>
<tr>
<th>Food</th>
<th>Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White bread 1 slice</td>
<td>114</td>
</tr>
<tr>
<td>Bacon 4 slices</td>
<td>548</td>
</tr>
<tr>
<td>Peanut butter 1 tbsp</td>
<td>81</td>
</tr>
<tr>
<td>Catsup 1 tbsp</td>
<td>156</td>
</tr>
<tr>
<td>Club soda 8oz</td>
<td>39</td>
</tr>
<tr>
<td>Tomato juice 1 cup</td>
<td>878</td>
</tr>
</tbody>
</table>

### Sodium

<table>
<thead>
<tr>
<th>Food</th>
<th>Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken noodle soup 1 cup</td>
<td>1,107</td>
</tr>
<tr>
<td>Salted butter 1 tbsp</td>
<td>116</td>
</tr>
<tr>
<td>Frankfurter 1</td>
<td>639</td>
</tr>
<tr>
<td>Cottage cheese ½ cup</td>
<td>257</td>
</tr>
<tr>
<td>Corn flakes 1 cup</td>
<td>256</td>
</tr>
<tr>
<td>Dill pickle 1</td>
<td>928</td>
</tr>
<tr>
<td>Ham 3 oz</td>
<td>1,114</td>
</tr>
</tbody>
</table>

### Dietary Approaches To Stop HTN

- **Dash Diet**
  - Rich in fruits, vegetables, complex carbohydrates and low-fat dairy products
  - Lower in fat, saturated fat, cholesterol and sodium
  - Higher in potassium, magnesium and calcium

### Dash Diet

- 7-8 servings of grains or grain products
- 4-5 servings of vegetables
- 4-5 servings of fruits
- 2-3 servings of low-fat or fat free milk products
- 2 or less meats, poultry or fish
- 4-5 times/week nuts, seeds and beans
What To Do?
- Thiazide diuretics
- Loop diuretics
- Potassium-sparing diuretics
- Aldosterone receptor blockers
- Beta-blockers
- Combined alpha and beta-blockers
- Ace Inhibitors

Angiotensin II antagonists
- Calcium channel blockers
  - Non-dihydropyridines
  - Calcium channel blockers
  - Dihydropyridines
  - Alpha 1 blockers
  - Central Alpha 2 antagonists
  - Direct vasodilators

What To Do?

Combinations
- ACEIs and CCB
- ACEIs and diuretics
- ARBs and diuretics
- BBs and diuretics
- Central acting drugs and diuretics
- Diuretic and diuretic

Diuretics
- Act by diminishing sodium reabsorption at different sites in the nephron
- Increasing urinary sodium and water loses

Thiazide Diuretic
- Chlorothiazide (Diuril)
- Acts on the distal renal tubule
- Increases excretion of sodium
- Not metabolized
- 10-15% of dose excreted unchanged in urine

Precautions
- Anuria
- Impaired hepatic function
- Crosses placenta
- Excreted in breast milk
Adverse Reactions

- Hypotension
- Orthostatic hypotension
- Electrolyte imbalances
- Muscle spasm
- Headache
- Transient blurred vision

Dosing

- **Adult**
  - 500 - 1000 mg in 1 or 2 divided doses
  - Maximum dose 2000 mg
- **Pediatric**
  - 10 - 20 mg/kg/day in 1 or 2 divided doses

Nursing Implications

- Monitor I & O
- Monitor electrolytes
- May potentiate action of other antihypertensives
- May exacerbate or activate systemic lupus

Furosemide (LASIX)

- Used alone or in combination with other antihypertensive agents
- Contraindicated in hypersensitivity or sulfonamides

Dosing

- **Adults**
  - Oral, IM or IV
    - 20 - 80 mg/day BID or QID up to 600 mg daily
- **Infants and Children**
  - Oral 2 mg/kg daily or BID
    - IM and IV 1 - 2 mg/kg/dose Q 6-12 hours

Precautions

- Oral solution may contain sorbitol
- Oral solution may contain propylene glycol which can cause potentially fatal toxicity
- Neonates
- Cirrhosis
**Adverse Reactions**
- Acute Hypotension
- Dizziness
- Urticaria
- Gout
- Jaundice
- Hearing impairment
- Tinnitus

**Drug Interactions**
- ACE inhibitors
- Antihypertensives
- Herbs
- Hypoglycemic agents

**Beta Blockers**
- Block the effects of the sympathetic nervous system on the heart reducing workload of the heart

**Metoprolol Tartrate**
- Lopressor
- Pediatrics safety and efficacy not established
- Adults
  - Initial 100 mg/day in single or divided doses
  - Increase weekly to desired effect
  - Maximum dose 450 mg daily

**Contraindications**
- Sinus bradycardia
- Cardiogenic shock
- Severe peripheral vascular disease

**Precautions**
- Hepatic dysfunction
- Excreted in breast milk
**Adverse Reactions**
- Bradycardia
- Confusion
- Sleep disturbance
- Constipation
- Tinnitus
- Dyspnea
- Cold extremities

**Food Interactions**
- Food increases medication absorption

**Nursing Implications**
- Administer with food or meals
- Monitor BP, HR and RR
- Monitor peripheral circulation

**Ace Inhibitors**
- Block the action of the angiotensin converting enzyme in the lungs so that angiotensin I is not converted to angiotensin II which prevents blood vessel constriction resulting in decreased blood pressure

**Enalapril**
- **Vasotec**
- **Adults**
  - Initial 2.5 - 5mg/day increase as needed to maximum dose of 10 - 40 mg/day
- **Infants and Children**
  - Initial 0.1mg/kg/day increase gradually as needed to maximum dose of 0.5 mg/kg/day

**Precautions**
- Renal impairment
- Excreted in breast milk
Adverse Reactions
- Orthostatic hypotension
- Dizziness
- Cough
- Increased serum creatinine

Drug Interactions
- Antihypertensives
- Herbs
- NSAIDS

Food Interactions
- Limit salt substitutes
- Limit potassium intake
- Avoid natural licorice

Nursing Implications
- Monitor for angioedema
- Monitor vital signs
- Monitor renal function
- Monitor serum potassium

CCB - Non-Dihydropyridines
- Negative inotropic effect
- Decrease the force of contraction of the myocardium

Diltiazem
- Cardizem CD
- Adults
  - 30 - 120 mg TID or QID can increase until optimal response obtained to maximum 180 - 360 mg daily
- Children
  - 1.5 - 2 mg/kg/day TID or QID to maximum dose of 3.5 mg/kg/day
Contraindications
- Second or third degree heart block
- Acute MI

Precautions
- Excreted in breast milk
- Renal impairment
- Hepatic impairment

Adverse Reactions
- Bradycardia
- Edema
- Dizziness
- Myalgia
- Pharyngitis

Drug Interactions
- Antihypertensives
- Grapefruit juice
- Herbs
- Macrolide antibiotics
- Simvastatin

Food Interactions
- Avoid natural licorice
- Avoid grapefruit juice

Nursing Implications
- Can be administered with/without food
- Administer with full glass of water
- NG/NJ tubes dilute suspension with an equal amount of dilutant and flush tubing after administration
- Monitor BP
- Monitor renal function
- Monitor liver enzymes
CCB - Dihydropyridines

- Reduce systemic vascular resistance and arterial pressure
- Cause vasodilation

Amlodipine

- Norvasc
  - Adults
    - 2.5 – 5 mg daily to maximum dose 15 mg daily
  - Infants
    - 0.1 mg/kg/day
  - Children 6 - 17 years
    - 2.5 - 5 mg daily

Precautions

- Hepatic impairment
  - May increase frequency, duration and severity of angina

Adverse Reactions

- Palpitations
- Dizziness
- Pulmonary edema
- Muscle cramps

Drug Interactions

- Antihypertensives
- Herbs
- Macrolide antibiotics
- Simvastatin

Food Interactions

- Avoid natural licorice
**Nursing Implications**
- Administer with food
- Monitor vital signs

**Alpha 1 Blocker**
- Alpha-adrenergic blocking agents block the alpha 1 receptors of vascular smooth muscle reducing arterial resistance resulting in vasodilation

**Prazosin**
- Minipress
- **Adults**
  - 2 – 20 mg/day in divided doses BID or TID
- **Pediatric**
  - Unlabeled use 0.5 mg/kg/day in divided doses
- Unlabeled use in adults
  - PTSD
  - Raynauds
  - Benign prostatic hyperplasia

**Precautions**
- Floppy iris syndrome
- Orthostatic hypotension
- Excreted in breast milk

**Adverse Reactions**
- Palpitations
- Dizziness
- Blurred vision
- Orthostatic hypotension
- Headache
- Xerostomia

**Drug Interactions**
- Antihypertensives
- Herbs
Food Interactions

- Food has variable effects on absorption
- Avoid alcohol
- Avoid dong quai, ephedra, yohimbe, ginseng, saw palmetto and garlic

Nursing Implications

- Monitor BP: sitting, standing and supine
- Administer with/without meals
- Monitor for changes in urinary pattern
- Monitor for vision changes
- Monitor for depression

Central Alpha 2 Agonists

- Stimulate alpha receptors in the brain causing vasodilation of peripheral arteries
- Used also for ADHD and analgesia

Clonidine

- Catapress
- Adults
  - 0.1 mg BID to maximum dose 2.4 mg/day
- Children
  - 0.005 - 0.01 mg/kg/day BID or TID

Precautions

- Renal impairment
- Recent MI
- SA or AV node conduction disturbances

Adverse Reactions

- Arrhythmia
- Bradycardia
- Palpitations
- Gynecomastia
- Parotitis
- Otalgia
- Nasal congestion
- Rhinorrhea
- Epistaxis
- Pharyngitis
- Tinnitus
Drug Interactions
- Antihypertensives
- Herbs

Nursing Implications
- Administer with/without food
- Monitor vital signs
- Monitor for signs of depression
- May cause xerostomia
- Taper gradually over 2 - 4 days to avoid rebound hypertension

HTN Treatment
- Lifestyle modification and drug therapy
- Requires patient compliance

HTN Vaccine
- Immunization against renin and the angiotensins
- Initial study in 1951 by Goldblatt et al by administration of heterologous (hog) renin in man produced antirenin antibody
- Multiple studies

Questions