Best Practices Cardiology in Primary Care: Focus on Hypertension

Satellite Conference and Live Webcast
Wednesday, November 9, 2011
2:00 - 4:00 p.m. Central Time

Produced by the Alabama Department of Public Health
Video Communications and Distance Learning Division

Faculty

Narinder P. Bhalla, MD, FAAC, FSCAI
River Region Cardiology
Montgomery, Alabama

Clinical Assistant Professor of Medicine
New York University School of Medicine
New York, New York

Hypertension Epidemiology

- The prevalence of adverse events is a continuum as blood pressure increases
  - BP of 115/75mm HG
  - No threshold identified

Hypertension Epidemiology

- Second most modifiable disease in the United States
  - 295,000 preventable deaths in the United States in 2005
  - 54% of strokes linked to high blood pressure
    - Up to half may never have known of hypertension

Hypertension Epidemiology

- Mean BP is rising in American children
  - Obesity
  - Fast foods
  - Lack of exercise

Hypertension Epidemiology

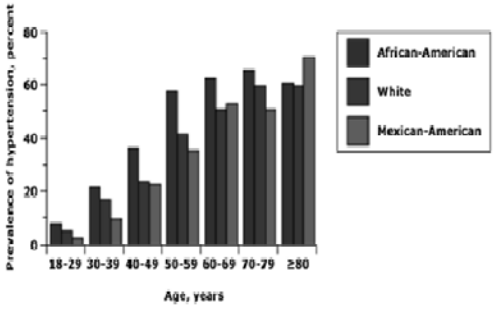
- Percentage of children who are greater than 95th percentile for BP almost doubled between 1988 and 2004
  - NHANES data

Hypertension Epidemiology

- School-based screening studies have also demonstrated a rise in the prevalence of HTN from 1.1 percent in 1989 to rates of 3.2 to 4.5 percent in studies conducted between 2002 and 2005

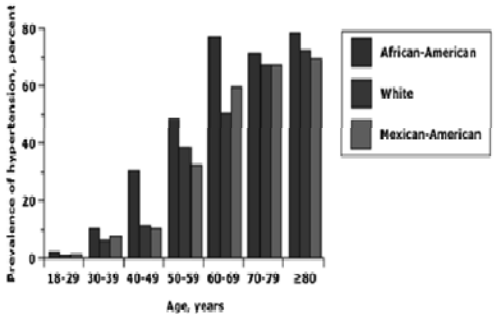
Hypertension Epidemiology

Prevalence in men by ethnicity



Hypertension Epidemiology

Prevalence in women by ethnicity



Hypertension Classification

- Primary (Essential) Hypertension
  - Poorly understood mechanisms/pathogenesis
    - Increased sympathetic activity
      - Gaining acceptance in resistant hypertension
    - Increased Angiotensin II activity
      - Excess mineralocorticoids

Hypertension Classification

- Genetic predisposition in up to 30% of patients
- Reduced adult nephron mass

Hypertension Classification

- Secondary Hypertension
  - Renal disease
    - Acute or chronic
  - Oral contraceptives
  - NSAIDs
  - Pheochromocytoma
  - Renovascular disease

Hypertension Classification

- Cushing's Syndrome
  - Mostly diastolic hypertension
- Sleep apnea syndrome
- Hyperthyroidism
- Coarctation of the aorta
  - In young children

Staging Hypertension – JNC 7

- Normal
  - <120 systolic
  - < 80 diastolic
- Pre Hypertension
  - 120-139; 80-89
    - Exception with diabetes, renal disease, CVD

Staging Hypertension – JNC 7

- Stage 1
  - 140-159 or 90-99
- Stage 2
  - >/= 160 or >/= 100
- Hypertensive urgency
- Hypertensive crisis/malignant hypertension

Describing Hypertension

- True hypertension
- Pseudohypertension
  - Resistant hypertension
- White coat hypertension
  - Resistant hypertension
- Masked hypertension

Pseudohypertension

- Blood pressure measurements are elevated in the clinic and on home measurements
  - Including ABPM
- A diastolic BP phenomenon
  - > 5mm HG
- Systolic BP is actually a bit lower
- MAP is accurate

Pseudohypertension

- May occur in 7% of elderly patients
- There is no evidence of end organ damage or compromise

Pseudohypertension

- Lack of correlation with Osler's Maneuver
- Causes
  - Age with stiffening arteries
  - Poor measurement techniques
    - Albeit ABPM would eliminate this to some degree
- Some will be treated as resistant hypertension

Pseudohypertension

- Improved measurements
  - Oscillometric devices
  - Following MAP
    - Diastolic + (systolic-diastolic)/3
  - Intra-arterial pressure
  - Arterial closing pressure
- Does not change treatment of isolated systolic hypertension

White Coat Hypertension

- Elevation of three successive clinic blood pressures while having normal ABPM readings or self administered readings
- Prevalence is 10-20% in the clinic population

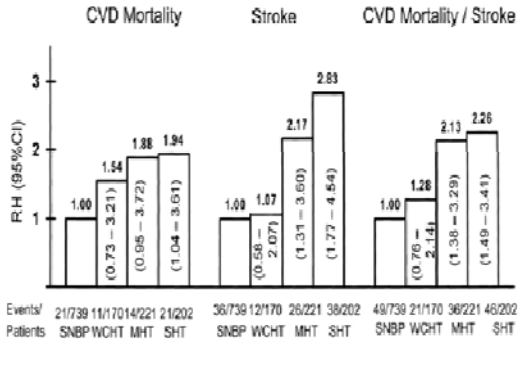
White Coat Hypertension

- Indication for ABPM
- Prognosis of white coat hypertension
  - Remains somewhat controversial
  - Differences between early and more recent studies

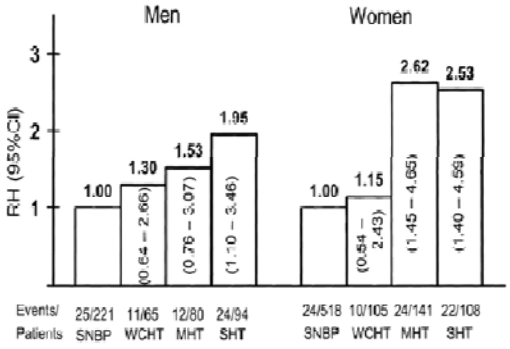
White Coat Hypertension

- 1,332 subjects
  - 872 women, 460 men
- >/= 40 years old in a Japanese community
- Survival and stroke morbidity measured for a mean duration of 10 years

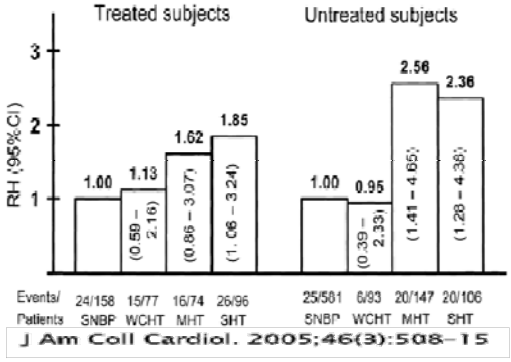
White Coat Hypertension



White Coat Hypertension



White Coat Hypertension



J Am Coll Cardiol. 2005;46(3):508–15

White Coat Hypertension

Results From the HARVEST Study – 940 patients

Variable	Normotensive	Threshold Level=130/80 mm Hg			Threshold Level=135/85 mm Hg		
		White Coat Hypertensive	Sustained Hypertensive	P	White Coat Hypertensive	Sustained Hypertensive	P
n	95	119	603	...	260	462	...
IV septum thickness, mm	8.8 0.1	9.4 0.1	9.7 0.1	<.001	9.5 0.1	9.8 0.1	<.001
LV posterior wall thickness, mm	8.3 0.1	8.9 0.1	9.1 0.1	<.001	8.9 0.1	9.2 0.1	<.001
LV wall thickness, mm	17.2 0.1	18.4 0.1	18.8 0.1	<.001	18.4 0.1	18.9 0.1	<.001
LV diastolic diameter, mm	51.2 0.5	50.1 0.4	51.0 0.2	NS	50.4 0.3	51.1 0.2	NS
LV end systolic diameter, mm	33.8 0.5	32.6 0.4	33.2 0.2	NS	32.9 0.2	33.2 0.2	NS
LV mass index, g/m²	82.1 1.9	88.0 1.6	92.9 0.7	<.001	89.1 1.0	93.8 0.8	<.001
Relative wall thickness	0.337 0.005	0.370 0.004	0.371 0.002	<.001	0.368 0.003	0.373 0.002	<.001
E/A	1.49 0.05	1.36 0.04	1.42 0.02	NS	1.40 0.03	1.41 0.02	NS
LV ejection fraction, %	62.4 0.8	63.6 0.6	63.6 0.3	NS	63.5 0.4	63.7 0.3	NS

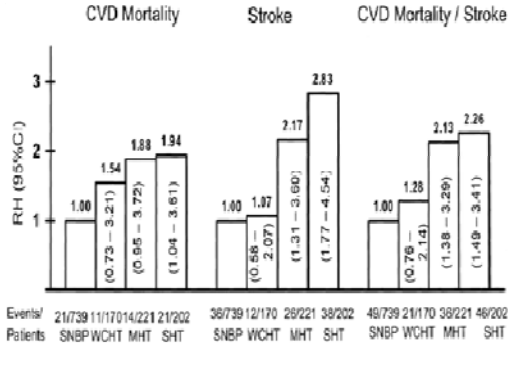
Masked Hypertension

- **Normotensive in the clinic**
- **Hypertensive on ABPM**
- **Prevalence is 10-40% of patients**

Masked Hypertension

- **1,332 subjects**
  - **872 women, 460 men**
- **>/= 40 years old in a Japanese community**
- **Survival and stroke morbidity measured for a mean duration of 10 years**

Masked Hypertension



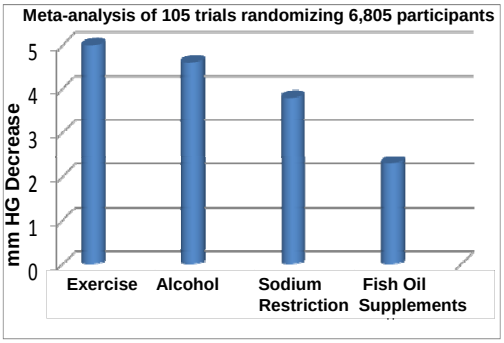
Treating Hypertension

- Non-pharmacologic methods
  - Exercise
  - Weight loss
  - Alcohol
  - Dietary sodium restriction

Treatment of Hypertension

- Exercise
  - Regular aerobic exercise helps with control of blood pressure
    - Swimming maybe particularly beneficial
  - May decrease the incidence of hypertension

Treatment of Hypertension



Treatment of Hypertension

- Weight loss
  - Up to a 25% reduction in risk of developing hypertension
    - Framingham data
  - Reduction in blood pressure with weight reduction is time dependent

Treatment of Hypertension

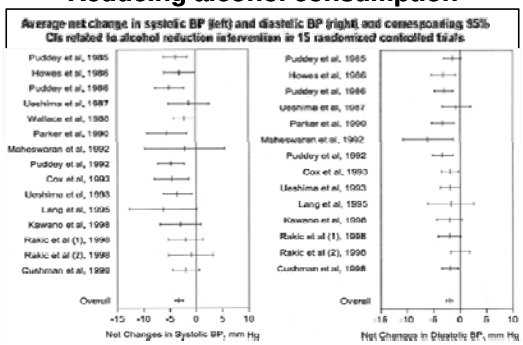
- Robust early effect
  - 1mm HG systolic and diastolic pressure decrease for each 1lb reduction in weight

Treatment of Hypertension

- Attenuated late effect
  - 6-8 mm HG systolic and 4mm HG diastolic pressure decrease for a 20lb reduction at greater than 2 years

Treatment of Hypertension

Reducing alcohol consumption



Treatment of Hypertension

- **Reducing alcohol consumption**
  - **Dose response curve when it comes to reduction in BP**
  - **Average of greater than 2 drinks per day seems to be the threshold**
  - **Not all alcohol is created equal**

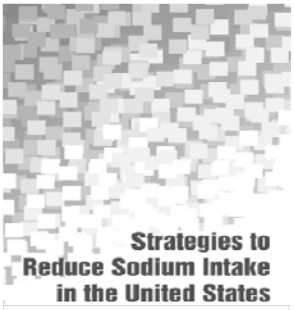
Treatment of Hypertension

- **Studies show cardio protective effects of moderate alcohol use, even in patients with hypertension**
  - **Physicians Health Study and Health Professional Follow-up Study**
- **Most consumption was wine**
- **Delicate balance between type of alcohol, calories, amount as related to benefit vs. risk**

Treatment of Hypertension

- **Dietary salt**
  - **The Importance of Population-Wide Sodium Reduction as a Means to Prevent Cardiovascular Disease and Stroke: A Call to Action From the American Heart Association**
    - **Lawrence J. Appel, MD, MPH, FAHA; Edward D. Frohlich, MD, FAHA;**
    - **John E. Hall, PhD, FAHA; Thomas A. Pearson, MD, PhD, FAHA; Ralph L. Sacco, MD, FAHA;**
    - **Douglas R. Seals, PhD; Frank M. Sacks, MD, FAHA; Sidney C. Smith, Jr, MD, FAHA;**
    - **Dorothea K. Vafiadis, MS; Linda V. Van Horn, PhD, RD, FAHA**

Treatment of Hypertension



Institute of Medicine 2010

Treatment of Hypertension

- **Mobilizing for dietary salt reduction in the Americas**
  - **Meeting report - Miami, Florida**
  - **13-14 January 2009 – February 2009**
  - **Prepared for PHAC WHO Collaborating Centre on Chronic Non-Communicable Disease Policy**

Treatment of Hypertension

- Mobilizing the Americas for dietary salt reduction
  - Norm RC Campbell
  - Barbara Legowski
  - Branka Legetic
- The Lancet, March 2011

Treatment of Hypertension

- Dietary salt
  - Average United States sodium intake is 4.5 - 6 grams a day
  - It has steadily increased in the last 25 years
  - There is geographic variation in sodium intake within the United States

Treatment of Hypertension

- Alabama, Louisiana, North Carolina, Georgia, Mississippi have the highest average sodium intakes in the country
- Sodium intakes in certain parts are as high as 10-11 grams a day

- Current recommendations of US RDA
  - 2,300mg/d (same as JNC 7- 2004)

Treatment of Hypertension

- European Society of Hypertension
  - 2,000mg/d (2007)
- European Society of Cardiology
  - 1,600 mg/d (2009)
- Adequate intake
  - 1,300 mg/d

Treatment of Hypertension

- Epidemiology
  - Essential HTN is seen in societies where average sodium intake is greater than 2,300 mg/d and rare in those where it is less than 1,200 mg/d
  - Chloride is as important when coupled with sodium in sodium sensitive patients

Treatment of Hypertension

- Issues not as significant when sodium coupled with another anion
  - Citrate
- Issues not as significant when chloride coupled with another cation
  - Ammonium

Treatment of Hypertension

- Salt restriction minimizes the age related BP increase
- Salt restriction lowers BP in normotensive patients

Treatment of Hypertension

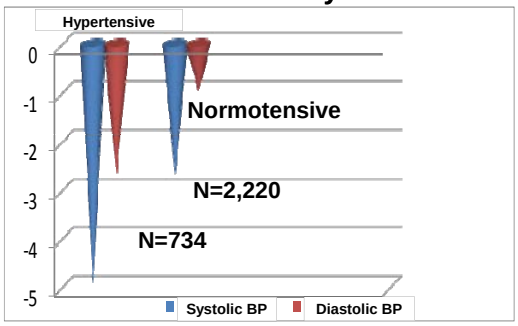
- Dietary salt
  - The main sources of sodium in the average U.S. diet
    - 5% added while cooking
    - 6% added while eating
    - 12% from natural sources
    - 77% from processed and prepared foods

Treatment of Hypertension

- Grams of salt (NaCl) = Grams of sodium x 2.5

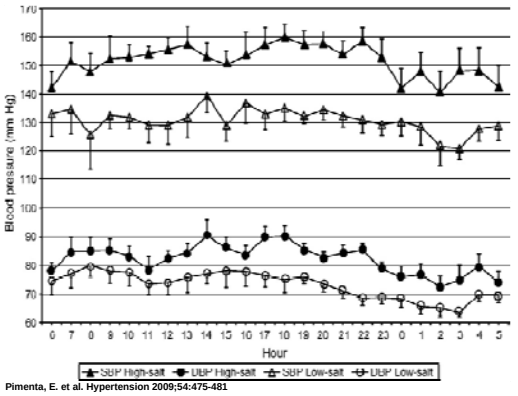
Treatment of Hypertension

Cochrane Analysis



Treatment of Hypertension

- Comparison of 24-hour ambulatory blood pressure values during low sodium (1150mg/d) and high sodium (5750mg/d) diet



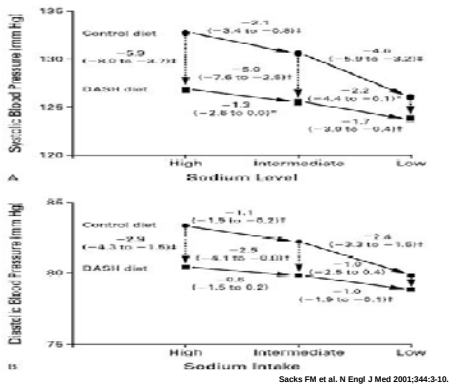
Pimenta, E. et al. Hypertension 2009;54:475-481

Treatment of Hypertension

- 412 patients – randomized
- Control diet vs. DASH diet with 3 different sodium levels
  - High – 3,450 mg/day
  - Intermediate – 2,300 mg/day
  - Low – 1,150 mg/day

Treatment of Hypertension

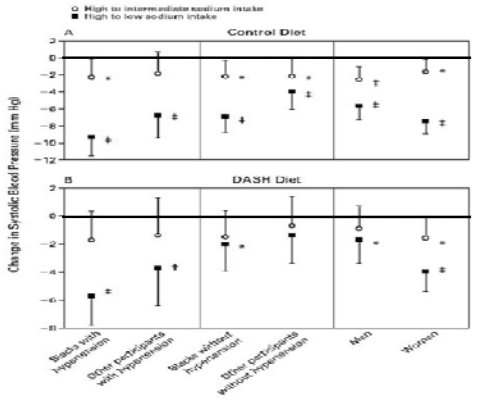
- The effect on systolic blood pressure (Panel A) and diastolic blood pressure (Panel B) of reduced sodium intake and the DASH diet



Sacks FM et al. N Engl J Med 2001;344:3-10.

Treatment of Hypertension

- The effect on systolic blood pressure of dietary sodium intake during the control diet (Panel A) and the DASH diet (Panel B)
  - According to subgroup



Treating Hypertension

- Pharmacologic approaches
  - Thiazide diuretics
  - Beta blockers
  - Calcium channel blockers
  - Angiotensin converting enzyme 1 inhibitors
  - Angiotensin II receptor blockers

Treating Hypertension

- Direct renin inhibitors
- Vasodilators
- Alpha blockers

Treatment of Hypertension

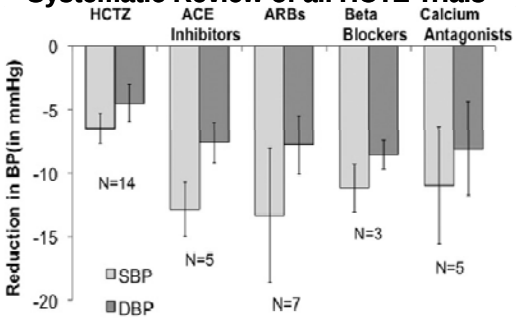
- Thiazide diuretics
  - Hydrochlorothiazide (HCTZ) is the most commonly prescribed diuretic in the USA
    - Doses used are 12.5 to 25 mg/d
    - Higher doses associated with increased morbidity and not advised
      - Particularly in patients with CVD

Treatment of Hypertension

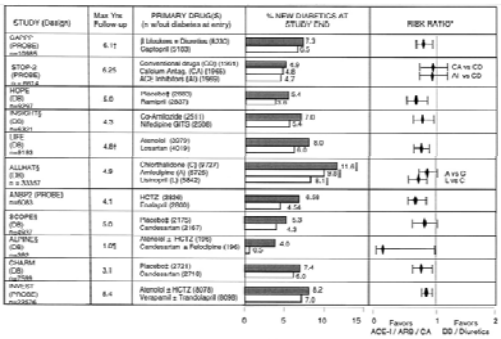
- Very little data to show superiority of HCTZ at prescribed dosing levels for being superior to other regimens
  - Most thiazide trials have used Chlorthalidone
    - Chlorthalidone is longer acting and 2X as potent as HCTZ

Treatment of Hypertension

Systematic Review of all HCTZ Trials

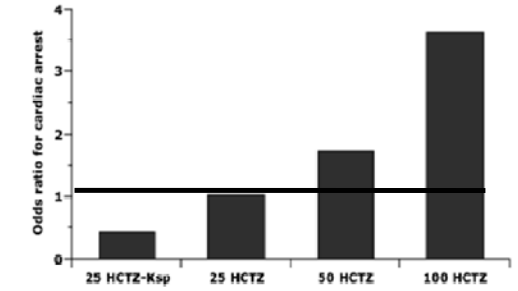


Treatment of Hypertension



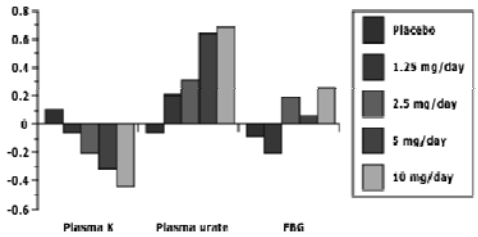
Treatment of Hypertension

Dose-dependence of thiazides and cardiac arrest



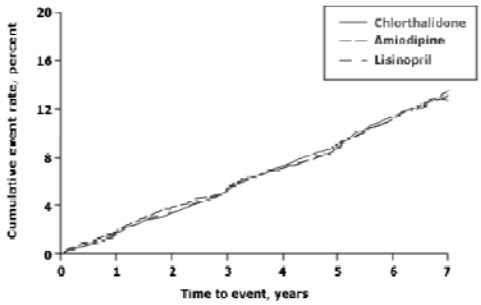
Treatment of Hypertension

Metabolic complications induced by bendrofluazide in relation to daily dose



X10 to get equivalent dose of HCTZ

Treatment of Hypertension



Treatment of Hypertension

- Thiazide diuretics
  - Measure potassium levels in 2-3 weeks post initiating treatment and after increasing dose
  - Have patient report any change in medications or other that might alter potassium balance

Treatment of Hypertension

- Pay particular attention to potassium when combining multiple medications that effect potassium balance
  - May require more frequent measurement

Treatment of Hypertension

- Edema from calcium channel blockers
  - Caused by arteriolar dilatation
  - Least with verapamil
  - Highest with nifedipine
  - 7-10% with amlodipine in patients without CHF

Treatment of Hypertension

- May be as high as 25% in patients with systolic heart failure
  - One study – Milton Packer, 1996
- Mitigated to a large degree with use of an ACE I inhibitor
- Some diminishment with a diuretic

Treatment of Hypertension

- Personal approach
  - Use a calcium channel blocker or beta blocker combined with an ACE I inhibitor depending on comorbidities
  - Avoid use of two negatively chronotropic agents together
    - Verapamil or diltiazem with a beta blocker

Treatment of Hypertension

- Sudden/unpredictable bradycardia and heart block
  - Increases in patients over the age of 60 years
- Thiazide diuretics and direct renin inhibitors are 3rd line
  - Latter because of cost effectiveness

Treatment of Hypertension

- Alpha blockers and vasodilators are 4th line

Treatment of Hypertension

- Secondary HTN
  - Thyroid chemistries, electrolytes, testing for renin/angiotensin system
  - Renal artery stenosis (RAS)
    - Atherosclerotic or fibromuscular dysplasia (FMD)

Treatment of Hypertension

- FMD more common in younger white females
- Atherosclerotic disease in older patients
  - Most often involves the aorto-ostial junction
- Suspect RAS in the following circumstances

Treatment of Hypertension

- Young female with resistant hypertension and bruits
- Lateralizing abdominal bruit
  - More specific than sensitive
- Resistant HTN
- Sudden escape from control
- Multisystem atheroscelrotic vascular disease

Treatment of Hypertension

- –Unexplained pulmonary edema episodes
- –Mild increases in creatinine or unexplained rise in creatinine or rise in creatinine with ACE I inhibitors
- –Evaluate with duplex ultrasound, MRA, CTA or contrast angiography

Treatment of Hypertension

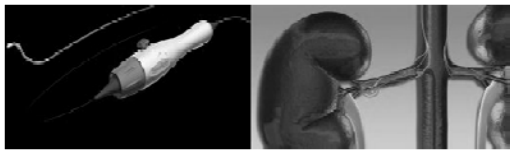
- Secondary hypertension
  - –Renal artery stenosis
    - Treatment usually involves balloon angioplasty for FMD
    - Angioplasty/stent for atherosclerotic disease
    - 10-15% restenosis in FMD with balloon angioplasty

Treatment of Hypertension

- 15-30% restenosis in with angioplasty/stent in atherosclerotic disease
- Treatment effects in the group with atherosclerosis
  - –60-70% will come under better control with current regimen
  - –10-20% will be able to reduce the medication
  - –10-15% will have no benefit

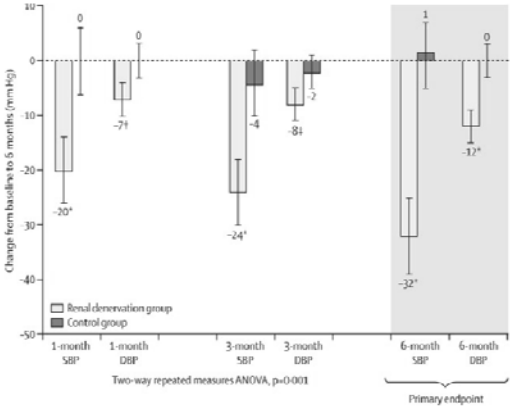
New Horizons

- Renal sympathetic denervation in patients with treatment-resistant hypertension (The Symplicity HTN-2 Trial): A randomized controlled trial
  - – Symplicity HTN-2 Investigators



New Horizons Renal Sympathetic Denervation

- 106 patients with resistant HTN (>/=3 medications) randomized to denervation vs. control therapy 40% with DM in treatment group vs. 28% in the control group



Evaluating Response to Treatment

- Self BP checks
  - 3 to 4 readings a day
- Ambulatory BP monitoring
  - More accurate
  - Expensive and somewhat inconvenient
  - Lets you know the “dippers” from the “non-dippers”

Evaluating Response to Treatment

- Assessing end organ effects
  - EKG
  - Echocardiogram
  - Funduscopic exam
  - Microalbuminuria

Ahead in JNC 8

- Diuretics may not hold the sole position when initiating treatment
  - European Society of Hypertension backed away from recommending thiazide diuretics as first line therapy (2009)

Ahead in JNC 8

- Dietary sodium restriction and adequate intakes will take center stage in non pharmacologic management

Ahead in JNC 8

- Greater concentration on treatment strategies for younger cohorts
- Emphasis on ABPM and frequent BP checks and overcoming the clinical inertia