Case Studies in Managing Hypertension: Defining the Barriers to Control

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Learning Objectives

- Aggressively screen for and manage hypertension, using evidence-based guidelines to help you and your patients set treatment goals
- Target interventions (lifestyle changes and pharmacologic agents) to prevent disease progression and reduce morbidity and premature mortality
- Recognize and remove important barriers to improving blood pressure control
- Explore therapeutic combinations that can prevent disease progression and improve morbidity and mortality
- Identify one change you can make to your practice that will support ongoing implementation of these lessons
Significance of Hypertension

• In the United States, hypertension affects approximately 50 million individuals, and accounts for 35 million office visits per year. Worldwide, about 1 billion people have hypertension.

• Only 33% of people who are receiving treatment for hypertension have their blood pressure under control.

• Relationship between blood pressure (BP) and risk of cardiovascular disease (CVD) is continuous, consistent, and independent of other risk factors.

• Individuals who are normotensive at 55 years of age have a 90% lifetime risk of developing HTN (Framingham).

• For those between 40 and 70 years of age whose BP is between 115/75 to 185/115, each increase of 20 mmHg in systolic BP or 10 mmHg in diastolic BP doubles the risk of CVD.

JNC 7

• Men age 55 and woman age 65 have a 90% risk of developing hypertension.

• 2004 direct costs = $55.5 billion

• If co-morbidities are added (end-stage renal disease, coronary artery disease, congestive heart failure, diabetes mellitus, cerebrovascular accident), cost is $108 billion.
JNC 7: Are You Surprised?

- 30% of adults do not know they have hypertension.
- 40% of those who are hypertensive are not being treated.
- 66% of those who are being treated have a blood pressure greater than 140/90 mmHg.

Benefits of Lowering Blood Pressure

Anti-hypertensive therapy associated with:

- 35% – 40% mean decrease in stroke
- 20% – 25% decrease in MI
- More than 50% decrease in heart failure

Patients who have stage 1 hypertension/additional risk factors:

- Achieving a sustained 12 mmHg decrease in systolic BP for 10 years will prevent 1 death for every 11 pts treated
JNC 7: Treatment Algorithm for Hypertension

Lifestyle modifications

Not at goal blood pressure (<140/90 mm Hg)
(<130/80 mm Hg for those with diabetes or chronic kidney disease)

Initial drug choices

Without compelling indications

Stage 1 hypertension
(SBP 140–159 or DBP 90–99 mm Hg)
Thiazide-type diuretic for most.
May consider ACEI, ARB, BB, CCB, or combination.

Stage 2 hypertension
(SBP ≥ 160 or DBP ≥ 100 mm Hg)
Two-drug combination for most
(usually thiazide-type diuretic and ACEI or ARB or BB or CCB).

With compelling indications

Drugs for compelling indications
Other antihypertensive drugs (diuretic, ACEI, ARB, BB, CCB) as needed.

Optimize dosages or add additional drugs until goal blood pressure is achieved.
Consider consultation with hypertension specialist.

JNC 7: The Fine Print

- Cracking open the door beyond diuretics for first line in a patient without co-morbid conditions
  - Along with promoting a thiazide diuretic for Stage 1 HTN, the committee added this surprising sentence:
    “May consider ACE-I, ARB, BB, CCB.”

- The ‘Compelling Indication’ Category - JNC put emphasis on evidence showing benefits with specific antihypertensive agents for certain medical conditions. Again, taking a small sidestep from the NHLBI dictum of diuretics first.
Case Presentation #1

Vicki Struthers

- 36 y/o white female
- PMH
  - Recently returned to work 10 weeks after the birth of first child
  - Total cholesterol: 160 mg/dL
  - HDL: 66 mg/dL
  - LDL: 120 mg/dL
  - Family history of diabetes
  - No history of smoking

*Hypothetical case based on a typical patient expected to present in clinical practice*
**Vicki Struthers – by the numbers**

**Tests Ordered Before Your Visit Today**
- ECG-normal

**Labs**
- Cr: 0.9 mg/dL; Na: 135 mmol/L; glucose: 97 mg/dL; HCT: 35; TSH: 2.1; K: 4.2 mmol/L

**Vitals**
- HR: 88 bpm, BP: 138/89mm/Hg, BMI: 23
- No Rx, NKDA

**Treatment Alternatives**

What do you recommend now?

A. Diet and lifestyle modification
B. Begin drug therapy
C. Ask her to come back for a BP recheck in one week.
D. All of the above.
E. A & C
Treatment Alternatives
Correct Answer

What do you recommend now?

A. Diet and lifestyle modification
B. Begin drug therapy
C. Ask her to come back for a BP recheck in one week.
D. All of the above.
E. A & C

1-week Follow-up

Vicki returns in a week. She’s begun a daily exercise program and her BP on return is 138/88 mm Hg. What is the correct diagnosis?

A. Normal BP
B. Prehypertension
C. Stage 1 hypertension
D. Not sure
Vicki returns in a week. She’s begun a daily exercise program and her BP on return is 138/88 mm Hg. What is the correct diagnosis?

A. Normal BP
B. Prehypertension
C. Stage 1 hypertension
D. Not sure

What is the best treatment for Vicki at this point?

A. Diet and lifestyle modification, and regular follow-up of her BP
B. Drug therapy
C. Both of the above
D. Have her fill out her “bucket list” and enjoy the last year of her life.
Treatment Alternatives
Correct Answer

What is the best treatment for Vicki at this point?

A. **Diet and lifestyle modification, and regular follow-up of her BP**
B. Drug therapy
C. Both of the above
D. Have her fill out her “bucket list” and enjoy the last year of her life.

Vicki Struthers @ 1 & 12 Years Later

- At 1 yr: “I take my medicine”, structured exercise program
- Low-salt, low-fat diet
- At 12 yrs: Running 10Ks, daughter in middle school.
- BP: 118/70
Clinical Practice Recommendation

Exercise may be beneficial in lowering blood pressure and reducing cardiovascular risk.

Strength of Evidence:
Three reviews of 50 observational studies found the risk of CV disease was lowered in those who were physically active. Conversely, a review of 43 epidemiological studies found that physical inactivity was associated with a doubling of cardiovascular disease.

Evidence Based Source:
Bandolier

Website of Supporting Evidence:
http://www.jr2.ox.ac.uk/bandolier/booth/hliving/ExcerCVD.is.html

JNC 7: Classification and Management of Blood Pressure for Adults

<table>
<thead>
<tr>
<th>BP Classification</th>
<th>SBP* (mm Hg)</th>
<th>DBP* (mm Hg)</th>
<th>Lifestyle Modification</th>
<th>Without Compelling Indications</th>
<th>With Compelling Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
<td>Encourage</td>
<td>No antihypertensive drug indicated.</td>
<td>Drug(s) for compelling indications.</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120–139</td>
<td>80–89</td>
<td>Yes</td>
<td>Thiazide-type diuretic for most. May consider ACEI, ARB, BB, CCB, or combination.</td>
<td>Drug(s) for compelling indications.</td>
</tr>
<tr>
<td>Stage 1 hypertension</td>
<td>140–159</td>
<td>90–99</td>
<td>Yes</td>
<td>Two-drug combination for most (usually thiazide-type diuretic and ACEI or ARB or BB or CCB).</td>
<td>Other antihypertensive drugs (diuretic, ACEI, ARB, BB, CCB) as needed.</td>
</tr>
<tr>
<td>Stage 2 hypertension</td>
<td>≥160</td>
<td>≥100</td>
<td>Yes</td>
<td>Two-drug combination for most (usually thiazide-type diuretic and ACEI or ARB or BB or CCB).</td>
<td>Other antihypertensive drugs (diuretic, ACEI, ARB, BB, CCB) as needed.</td>
</tr>
</tbody>
</table>

Case Presentation #2

Nate Biddleson

55 y/o African-American male presents for follow-up after an Executive Physical.

Past Medical History
- Blood pressure on initial presentation was 157/95, now 146/94
- Non-smoker, no known CAD
- Fasting glucose 140 mg/dL (repeated from previous visit, when it was 142 mg/dL); A1C: 8.2%
- Initial therapy: Diet modification, increased exercise, took “some vacation”, and started 25 mg of HCTZ
When the First Drug Doesn’t Work

- JNC 7 advocates for rapid progression to combination therapy before fully exploring mono-therapy.

- This approach is not an issue for those with Stage 2, but for Stage 1. Different mechanisms may cause HTN in different patients; and heterogeneous mechanisms from multiple class of agents may be necessary.

- Alternative approach: if there is a partial response, then increase the dose or add a second agent. If there is no response at all, try an alternate class. The goal here being to find the simplest way to control blood pressure.

What Should We Do Next?

A. Continue dietary modification and exercise recommendations
B. Begin therapy with an ACEi, ARB, or CCB
C. Refer to dietitian for diet counseling
D. Begin metformin
E. All of the above
F. A & B only
**What Should We Do Next?**

**Correct Answer**

A. Continue dietary modification and exercise recommendations  
B. Begin therapy with an ACEi, ARB, or CCB  
C. Refer to dietitian for diet counseling  
D. Begin metformin  
E. **All of the above**  
F. A & B only

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**2-Week Follow-Up**

Mr. Biddleson returns, having visited with the dietitian and is trying to implement his recommendations. He has started walking daily. His BP at this visit is 136/84; 2hr postprandial glucose is 126 mg/dL. What should we consider next?

A. Increase the dose of the ACEi/ARB or CCB  
B. Consider additional up-titration or new medications for diabetes, High BP or cholesterol as needed.  
C. Initiate a dose of aspirin, if not already started  
D. All of the above
2-Week Follow-Up
Correct Answer

Mr. Biddleson returns, having visited with the dietitian and is trying to implement his recommendations. He has started walking daily. His BP at this visit is 136/84; 2hr postprandial glucose is 126 mg/dL. What should we consider next?

A. Increase the dose of the ACEi/ARB or CCB
B. Consider additional up-titration or new medications for diabetes, High BP or cholesterol as needed.
C. Initiate a dose of aspirin, if not already started
D. **All of the above**

1-Month Follow-Up

Mr. Biddleson returns for follow-up. His BMI is 29; 2hr postprandial glucose is 92 mg/dL; HgA1c is 6.8% and his BP is 120/78.
High-Risk Hypertensive Patients Require Multiple Agents to Get to Goal

<table>
<thead>
<tr>
<th>Study</th>
<th>Achieved Systolic BP</th>
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<tbody>
<tr>
<td>AASK&lt;sup&gt;1&lt;/sup&gt;</td>
<td>(134 mm Hg)</td>
</tr>
<tr>
<td>ABCD&lt;sup&gt;2,3&lt;/sup&gt;</td>
<td>(132 mm Hg)</td>
</tr>
<tr>
<td>ALLHAT&lt;sup&gt;4&lt;/sup&gt;</td>
<td>(135 mm Hg)</td>
</tr>
<tr>
<td>HOT&lt;sup&gt;2,5&lt;/sup&gt;</td>
<td>(141 mm Hg)</td>
</tr>
<tr>
<td>IDNT&lt;sup&gt;6&lt;/sup&gt;</td>
<td>(140 mm Hg)</td>
</tr>
<tr>
<td>RENAA&lt;sup&gt;7&lt;/sup&gt;</td>
<td>(140 mm Hg)</td>
</tr>
<tr>
<td>UKPDS&lt;sup&gt;2,8&lt;/sup&gt;</td>
<td>(144 mm Hg)</td>
</tr>
</tbody>
</table>

Number of BP Medications
AASK=African-American Study of Kidney Disease and Hypertension; ABCD=Appropriate Blood Pressure Control in Diabetes; ALLHAT=Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trials; HOT=Hypertensive Optimal Treatment; IDNT=Irbesartan Diabetic Nephropathy Trial; RENAA=Reduction of Endpoints in Non-Insulin Diabetes Mellitus with the Angiotensin II Antagonist Losartan; UKPDS=United Kingdom Prospective Diabetes Study.


Compelling Indications for Consideration of One Drug Class vs. Another

- **Heart Failure:** Thiazide/loop, BB, ACEi, ARB, Aldosterone antagonist
- **Post- MI:** BB, ACE, Aldosterone antagonist
- **High CVD risk:** Thiazide, BB, ACEi, ARB
- **DM:** Thiazide, BB, ACEi, ARB, CCB
- **CRF:**
  - Cr > 1.5 in men: ACEi, ARB. For creatinine 2-3 try loop diuretic
  - Cr > 1.3 in women
Pyramid Approach to HF Stages

ACC/AHA Practice Guidelines

Case Presentation #3
Clark Galloway

42 y/o white male

Past medical history

- “borderline” hypertension
- “…too busy to exercise”
- Total cholesterol: 223 mg/dL
- HDL: 24 mg/dL
- Parents deceased related to “some heart failure thing”
- +TOB (smoker)

*Hypothetical case based on a typical patient expected to present in clinical practice

Clark Galloway – by the numbers

Tests Ordered Before Visit Today

- ECG: normal sinus rhythm (NSR), No Q wave, an intraventricular conduction delay and voltage c/w left ventricular hypertrophy.
- Echo: next slide

Labs

- Total cholesterol 223 mg/dL, HDL-C 24 mg/dL, SCr: 1.1mg/dL; Na: 140 mmol/L, fasting glucose: 140 mg/dL; HCT: 44; TSH: 1.1; fasting glucose taken on two separate days 128 mg/DL and 138 mg/DL

Vitals

- Heart Rate: 82 bpm; BP: 142/86 mmHg; BMI: 26
- No prescription medicine (Rx), NKDA
What Do You Recommend?

A. Begin an ACEi or ARB
B. Strongly recommend dietary and lifestyle modification, including low Na, low-fat diet and a daily exercise program
C. Begin a statin and aspirin
D. Return visit in 2 weeks with recheck of fasting blood glucose and blood pressure and consider a BB at this juncture as an additional medication.
E. All of the above
What Do You Recommend?
Correct Answer

A. Begin an ACEi or ARB
B. Strongly recommend dietary and lifestyle modification, including low Na, low-fat diet and a daily exercise program
C. Begin a statin and aspirin
D. Return visit in 2 weeks with recheck of fasting blood glucose and blood pressure and consider a BB at this juncture as an additional medication.
E. All of the above

Clark Galloway 1 Year Later

- At 1 yr: “I was too busy to exercise and I don’t like medicine… I felt fine”
- BP is 156/98, HR93 bpm. His BMI is 26. His fasting blood glucose is 130 mg/dL. His total cholesterol is 240.
What Are Appropriate Actions At This Visit?

A. Discuss the potential outcomes and risks of uncontrolled hypertension with other factors such as elevated blood glucose and dyslipidemia
B. Re-prescribe medications mentioned earlier
C. Cautiously add a prescription for metformin and a nonspecific-BB in a short period of time.
D. Admit to the hospital
E. Choices A and B
F. Choices A, B and C

What Are Appropriate Actions At This Visit? Correct Answer

A. Discuss the potential outcomes and risks of uncontrolled hypertension with other factors such as elevated blood glucose and dyslipidemia
B. Re-prescribe medications mentioned earlier
C. Cautiously add a prescription for metformin and a nonspecific-BB in a short period of time.
D. Admit to the hospital
E. Choices A and B
F. **Choices A, B and C**
Clark Galloway 5 Years Later

- In the past 5 years he has received a major promotion, gained 15lbs and joined a cigar club.
- Today his BP is 162/100. He is angry and significantly short of breath at rest.

After leaving your office and rebuking your suggestions, Clark presents in the emergency room after two additional hours of symptoms

- Now with unremitting chest pain for 2 hours.
- His EKG and cardiac enzymes confirm ACS.
- At his heart cath, he is found to have 2-vessel disease, and two stents are placed in one artery.
- His LEVF is 40-45%, BP is 148/100 and his HbA1C is 12.0%.
Post-Discharge

- He is discharged on several medications, including a beta-blocker, an ACE inhibitor, aspirin, clopidogrel, a statin and diabetic regimen (including low dose insulin and an oral agent(s)).
- He is advised to cease tobacco immediately.
- He is scheduled to see a dietitian, a diabetes educator, and start cardiac rehab (four weeks after d/c). He is instructed to return to your office in one week, and follow-up with the cardiologist that was established in the hospital.

What’s Your Advice To Clark Today?

A. If he does not follow his recommended regimen, his risk of recurrent MI is almost certain, only the exact timing is uncertain.

B. Of all the actions that he can take to lower his risk, the most important are to control his blood pressure and take his clopidogrel/aspirin combination.

C. Dietary and lifestyle modification are important in preventing further cardiovascular disease

D. All of the above

E. A & C only
What’s Your Advice To Clark Today?

**Correct Answer**

A. If he does not follow his recommended regimen, his risk of recurrent MI is almost certain, only the exact timing is uncertain.

B. Of all the actions that he can take to lower his risk, the most important are to control his blood pressure and take his clopidogrel/aspirin combination.

C. Dietary and lifestyle modification are important in preventing further cardiovascular disease

D. **All of the above**

E. A & C only

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Clark Galloway 12 Years Later

- Shortness of breath at rest and PND for the past 3 weeks.
- Recurrent substernal chest pain 2-3 times daily with limited activity.
- He has had a 9 kg. weight gain.
- Significant jugular venous distension, bi-basilar rales, a prominent S3 and S4 and 3+ pitting lower extremity edema.
- His BP is 105/50 and HR 95. LVEF is <20% and VO2 max 11.
Your Best Action Would Be To:

A. Start an ACE inhibitor and low-dose beta-blocker
B. Admit to the hospital to start an ACE inhibitor AND low dose beta-blocker
C. Admit to the hospital to re-start an ACE inhibitor ASA/clopidogrel and low dose beta-blocker and obtain cardiology consultation
D. Send him to the ED ASAP

Your Best Action Would Be To: Correct Answer

A. Start an ACE inhibitor and low-dose beta-blocker
B. Admit to the hospital to start an ACE inhibitor AND low dose beta-blocker
C. **Admit to the hospital to re-start an ACE inhibitor ASA/clopidogrel and low dose beta-blocker and obtain cardiology consultation**
D. Send him to the ED ASAP
Hypertension in Patients With High-Risk Conditions

- ~3/4 of adults with diabetes have BP \( \geq 130/80 \) mmHg or use prescription medications for HTN\(^1\)
- ~2/3 of patients with HF have a past or current history of HTN\(^2\)
- More than 50%–75% of patients with chronic kidney disease have BP \( > 140/90 \) mmHg\(^3\)

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Chronic Kidney Disease

Goals:  1) Slow deterioration of renal function  
       2) Prevent CVD

Often need 3 or more drugs

Target < 130/80

Drugs:  ACE inhibitors/ARBs—favorable effects on progression
       -- Increase in creatinine of 35% is acceptable

Advanced Renal Disease:
• GFR < 30, CR 2.5 – 3.0 mg/dL
• Increased dose of loop diuretics usually needed in combo with other drugs

Incidence of Coronary Heart Disease (CHD)
Events in Patients With and Without Diabetes

<table>
<thead>
<tr>
<th></th>
<th>Nondiabetics with no prior MI</th>
<th>Nondiabetics with prior MI</th>
<th>Diabetics with no prior MI</th>
<th>Diabetics with prior MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-Year Follow-up (%)</td>
<td>3.5</td>
<td>18.8</td>
<td>20.2</td>
<td>45.0</td>
</tr>
<tr>
<td>n=69</td>
<td>n=1,304</td>
<td>n=169</td>
<td>n=890</td>
<td></td>
</tr>
<tr>
<td>Events per 100 Person-years</td>
<td>3.0</td>
<td>0.5</td>
<td>7.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Causes of Death in Persons With Diabetes, Based on US Studies

- Cardiac Disease
- Pneumonia/Influenza
- Malignant Neoplasms
- Diabetes
- Cerebrovascular Disease
- All Other

Deaths (%)

1990 US death certificates with mention of diabetes, all ages.
1990 US death certificates with mention of diabetes, age at death ≥45 years.

The Diabetic Hypertensive Patient Is at Especially High Risk...

- For cardiovascular disease (CVD)
  - “Two thirds to three fourths of people with diabetes mellitus die of some form of heart or blood vessel disease”¹

- For myocardial infarction (MI)
  - Patients with diabetes without a previous MI have as high a risk of MI as patients without diabetes with a previous MI²

- For congestive heart failure (CHF)
  - In the DIGAMI trial, 66% of total mortality among patients with diabetes was due to HF³

DIGAMI=Diabetes Insulin-Glucose Infusion in Acute MI.
UKPDS: Blood Pressure Control Study in Type 2 Diabetes Effect of Intensive BP Lowering on Micro- and Macrovascular Complications Risk

![Bar chart showing risk reduction for various diabetes-related endpoints.](chart1.png)

1,148 hypertensive patients with type 2 diabetes were allocated to tight (144/82 mm Hg, n=758) or less tight (154/87 mm Hg, n=390) and followed for a median of 8.4 years.


UKPDS: Benefits of Glycemic vs BP Control With ACEi’s or β-Blockers

![Bar chart showing risk of event for various endpoints.](chart2.png)

**Clinicin Input**

When we first encountered Clark, what are the things we could have done that would have made a difference?

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**Clinical Practice Recommendation**

Treating high blood pressure to JNC-7 GOALS with anti-hypertensive medications reduces the risk of cardiovascular disease and death.

**Strength of Evidence:**
A Recommendation; There is robust evidence to recommend a pattern of care.

**Evidence Based Source:**
National Guideline Clearinghouse

**Website of Supporting Evidence:**
Importance of Patient Education

- 50% of patients discontinue their antihypertensive within one year of initiating treatment.

- DASH diet for hypertension:
  - limit sodium
  - increase fruits and vegetables (8-10/day)
  - increase low fat dairy (3-4/day)

- Focus on diet history for hypertensive patients

Key Diet History Questions for Patients with HTN

- Do you use a salt shaker?
- Do you taste your food before you add salt?
- How often do you eat salty foods, such as chips, pretzels, salted nuts, canned and smoked foods?
- Do you read labels for sodium content?
- How many servings of fruits and vegetables do you eat everyday?
- How often do you eat or drink dairy products? What kind?
- How often do you eat out? What kinds of restaurants?
- Do you like to drink alcohol? How much?
- How often do you exercise, including walking?
Lack of Adherence

• Causes 125,000 deaths a year - twice the mortality rate from MVAs
• Direct cause of 30% of hospital admissions for people over the age of 65
• Half of all prescriptions are taken incorrectly, contributing to prolonged or additional illnesses.
• Increases with the number of meds and doses per day; at 4 times a day, only 40% of patients get it right.

Selected Factors that Influence Dissemination and Implementation

- Systems of Care
  - Access to care
  - Coverage
  - Marketing influences

- Providers
  - Limited visit time to address a patient's multiple issues (CVD, diabetes, smoking)
  - Office design oriented toward acute, rather than chronic care
  - Innovation bias
  - Lack of knowledge

- Patients
  - Beliefs about disease
  - Relationships with health care providers and systems
  - Preferences
  - Understanding of disease (inextricably connected to beliefs)
Differences Between More and Less Successful Providers

<table>
<thead>
<tr>
<th>More Successful</th>
<th>Less Successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involved patients in decision-making.</td>
<td>Referenced technical aspects of drug benefits.</td>
</tr>
<tr>
<td>Used med changes to educate / engage.</td>
<td>Less information sharing – “only if asked”.</td>
</tr>
<tr>
<td>Patient-maintained record card to monitor compliance.</td>
<td>Felt time constraint did not permit discussing adverse effects of meds.</td>
</tr>
<tr>
<td>Progressively introduce effective dose and number of meds.</td>
<td>Felt knowledge of side effects would hinder compliance.</td>
</tr>
<tr>
<td>Awareness of patient ability to afford / role of formulary (e.g., VA)</td>
<td></td>
</tr>
<tr>
<td>Least expensive appropriate med when possible.</td>
<td></td>
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<tr>
<td>Greater attention to gender, comorbidities, age when prescribing.</td>
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</tr>
</tbody>
</table>

Shared Traits of More and Less Successful Providers

- Several BP readings to confirm hypertension, multiple visits.
  - Unless BP very high or comorbidities present.
- High awareness of national BP guidelines.
- Concurrence on hypertension treatment goals, especially for comorbidities, e.g., diabetes, etc.
- Likely to begin hypertension treatment with 2-3 months of lifestyle management.
  - Not sufficient to attain desired BP
- Difficulty / reluctance in treating older patients to JNC standards.
  - Questioned value of aggressively treating older (80+ years) patients with other severe problems
- Would look at any BP reduction as partial success
### Causes of Resistant Hypertension

<table>
<thead>
<tr>
<th>Improper Measurement</th>
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<tbody>
<tr>
<td>Volume Overload</td>
</tr>
<tr>
<td>Excess Sodium</td>
</tr>
<tr>
<td>Volume retention from Renal Disease</td>
</tr>
<tr>
<td>Inadequate Diuretic Therapy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug-Induced/Other Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncompliance</td>
</tr>
<tr>
<td>Inadequate Doses</td>
</tr>
<tr>
<td>Inappropriate Combos</td>
</tr>
<tr>
<td>NSAIDS; COX 2 inhibitors</td>
</tr>
<tr>
<td>Cocaine, amphetamines, other illicits</td>
</tr>
<tr>
<td>Sympathomimetics (decongestants etc.) EtOH</td>
</tr>
<tr>
<td>OCPs</td>
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<tr>
<td>Cyclosporine and tacrolimus</td>
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<table>
<thead>
<tr>
<th>Secondary Causes</th>
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<tbody>
<tr>
<td>Renal Artery Stenosis</td>
</tr>
<tr>
<td>Phenyl Chromocytoma</td>
</tr>
</tbody>
</table>

### Additional Challenge in Treatment of Hypertension: Medication Adherence

- Adherence to a drug regimen is an important component of BP control
  - Approximately 50% of patients with poor BP control have adherence problems (defined by taking <80% of medication)

- Several drug-related factors can influence medication adherence, including:
  - Adverse events
    - Frequency of adverse events has been inversely correlated with adherence rates
  - Dosing frequency
    - Reduction in dose frequency can lead to improved adherence

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Strategies to Improve Management of Patients With Hypertension and Diabetes

ACC/AHA HF Guidelines

- Clinical trial evidence incorporated into recommendations for patient care
- Implement evidence-based care and therapies
- Majority of patients eligible for treatment
- Early benefit of therapy not missed
- Higher persistence rates post discharge

Increasing Outpatient Compliance

- Improve quality of care and outcomes

Improved Adherence Has Been Associated With Improved Outcomes

- In the BHAT trial, patients who took ≤75% of their prescribed β-blocker regimen were 2.6 times more likely to die within the first year of follow-up, compared with more compliant patients

- In the COMPASS study, patients treated with oral nitrates had better efficacy with once-daily dosing
  - Mean weekly number of chest pain episodes:
    - 94% decrease in once-daily group
    - 30% decrease in twice-daily group (P<.0001 compared to once-daily group)

Beta-Blocker Heart Attack Trial (BHAT): multicenter, randomized, double-blind trial comparing propranolol vs placebo in 3837 patients aged 30–69 years surviving acute MI. Patients 5–21 days post-MI were randomized to propranolol or placebo and were followed for an average of 25 months. Adherence data were available for 2175 patients (1081 randomized to propranolol).

Compliance With Oral Mononitrates in Angina Pectoris Study (COMPASS): open, nonblinded, randomized, parallel-group study in 101 patients aged 40–75 years; compared patient compliance (using electronic measurement) and treatment effectiveness in patients with stable angina pectoris treated with oral nitrates administered once daily vs twice daily.

Summary

- Every patient will be screened for hypertension.
- Hypertension is a significant risk factor for cardiovascular disease.
- Every patient should be treated to goal to decrease the risk of premature death due to cardiovascular disease.
- Treatment plans should always include helping patients adhere to lifestyle and medication changes.

References

References, cont.

References, cont.

• The ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group. Major Outcomes in High-Risk Hypertensive Patients Randomized to Angiotensin-Converting Enzyme Inhibitor or Calcium Channel Blocker vs Diuretic: The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). JAMA 2002;288:2981-997.