Hard to control hypertension
Pittsburgh
Where are my peeps?

People Cheering for the Falcons this Super Bowl

- Falcons Fans
- People who hate the Patriots
If 30% of Americans have hypertension
  - 75 million
And 50% are not at goal
  ~ 35 million
THEN *essential* hypertension appears to be “hard to control hypertension”
We are here to explore why
Let’s start with the basics

- Blood pressure =
  - Volume x
  - Heart rate x
  - Peripheral resistance

- Peripheral resistance is the balance of vasoconstriction and vasodilation
  - Maintains organ perfusion
Peripheral resistance

- **Vasodilation**
  - Nitrous oxide - blood vessel lining

- **Vasoconstriction**
  - endothelin – blood vessel lining
  - angiotensin II - renin system
  - catecholamines – Sympathetic NS
Stress

- Decreases Nitrous Oxide
- Increases vasoconstriction
- Increases oxidation

Mister Rogers did not adequately prepare me for the people in my neighborhood.

THERE'S THE PROBLEM

I JUST FIXED IT!
Feedback loops

Brainstem

Blood vessel
- a receptor
  - vasoconstriction

RAAS (see next diagram)

Adrenal

Kidney

Internal carotid a.

Aortic arch

Heart

\[\text{contractility cardiac output}\]

\[\beta\text{ receptor}\]

\[\text{sends feedback info}\]
Good news!
Renin-angiotensin system

- Controls volume and peripheral resistance
- Renin produces angiotensin II
- Angiotensin II increases BP
  - Strong vasoconstrictor
  - Causes the adrenal gland to make aldolase
  - Causes the kidney to hold onto Na and water
    - increased volume
Screening for HT

- BP should be taken:
  - Seated
  - After 5 minutes rest
  - Arm at heart level
  - Correct cuff size
    - 30-50% need large size
  - Bilateral on the first visit
To Diagnose Hypertension

- 2-3 blood pressures > 140/90 *
- PLUS confirmation with ambulatory or home monitoring
  - USPSTF grade A recommendation
  - Up to 60% were not confirmed on home monitoring
  - Finds white coat HT
  - also allows unmasking of HT in high normal BP
White coat HT

- Elevated BP in office but not home
- No target organ damage
- Confirmed by home/ambulatory testing

- Consider leaving the room and letting the patient push the button
- We make them nervous
Some white coats are scarier than others...

This is about to get real...
Ambulatory BP monitoring

- Portable blood pressure cuff worn 24 hours
- Measures every 30 minutes
- Normals are less than in-office readings
  - 130/80 average
  - 135/85 day
  - 120/70 night (dipping)
I’ve heard they exist but I’ve never seen one
I contacted cardiac testing, cardiology offices, renal offices, Hospitals and Google
A renal doctor recommended an ASH certified hypertension specialist (ash-us.org)
Home BP monitor

- Prescribe for ALL your patients
- Cost $25-$75 –usually covered
- 1/3 will need large cuff –readily available
Home BP monitor

- Coordination
- Wrist cuff is easier but less accurate
Definition of hypertension

- By JNC 7 plus 8 and ESC/ESH
- BP greater than 140/90 *
- IF repeated 2-3 times
- IF confirmed with home monitoring

- OR anyone being treated for HT with meds
Hypertension: Classification by JNC 7

<table>
<thead>
<tr>
<th></th>
<th>Systolic BP</th>
<th>Diastolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Pre-hypertension</td>
<td>120-139</td>
<td>or 80-89</td>
</tr>
<tr>
<td>Stage I</td>
<td>140-159</td>
<td>or 90-99</td>
</tr>
<tr>
<td>Stage II</td>
<td>≥160</td>
<td>or ≥100</td>
</tr>
</tbody>
</table>

JNC 7, 2002
Look for potentially reversible causes

- Can’t change age, race or family history
- Potential changes
  - Alcohol use
  - Sleep apnea
  - Obesity
  - Salt intake *
  - Depression and stress
  - Medications
Common Medications

- Alcohol
- NSAIDs
- Decongestants
- High-dose caffeine
- SSRI/SNRI/tricyclics
- Contraceptives – rare if normal dose
- Stimulants, cocaine and meth *
Initial workup

- Personal and family history of HT, heart and renal disease
- Exam
  - Bilateral blood pressure
  - Pulses especially femoral (coarctation)
  - Bruits - especially epigastric
    - 2-2-2
Initial Lab

- Complete blood count
- BMP
- Lipids
- 12-lead electrocardiogram
- Urinalysis and/or microalbumin *
- Uric acid * (for thiazide use)
Cardiovascular risk assessment

- Pooled cohort to assess cardiac risk - flawed
- If greater than 10%
  - statin - if 45-75 yo
  - aspirin - if 50-59 yo *
- If greater than 7.5 - discuss
- Comorbidities
  - IF CAD, CVD, DM, CKD screen for target organ damage
Target organ damage
Further testing

- If OSA symptoms - get sleep study
- If LVH – get echo
- If abnormal urine - get a renal ultrasound
- If PVD - get ABI
- If epigastric bruit - consider RAS workup*
- If angina - get stress test
Treatment - Lifestyle

- Weight loss and exercise
- Stress reduction
- Meditation
  - You Tube
DASH-S diet
- Whole grains, fresh fruits and vegetables
- Dairy, nuts and lean meats
- Limit fats and sweets
- Less than 2.3 g sodium per day
  - I eat that by noon
YOU DISGUST ME RONALD!
YOU'RE NOT EVEN SCARY!

I'VE KILLED MORE PEOPLE THAN YOU
Treatment goals

- ‘The guidelines reflect a crisis of uncertainty’
- ‘It is time for the NIH to embark on an evidence generation binge’
- ‘We need to be honest with our patients about the uncertainty and make the best decision we can with the current evidence’
Historically, we treated patients with DM or CVD to an ever changing lower goal.

Several studies did not confirm an outcome difference.

JNC 8 (2014), ESC/ESH (2013), and ACP/AAFP (2016) all recommend less aggressive goals.

The greatest benefit was seen in getting bp over 160s down to treatment range.
Treatment goals

- My best understanding is:
  - < 60 140/90
  - > 60 150/90
  - > 60 with comorbidities – probably 140/90
    - Weak to moderate evidence
  - Even with comorbidities, there is not enough evidence to treat lower than this at this time (i.e. to 120/80)
Treatment goals

- You will always find someone to disagree with these concepts
- I look at the uncertainty as permission to have some latitude in treatment
- First let’s get them all to the minimum acceptable goal
- we aren’t at 50% for that yet
Any given drug will reduce BP to target in 30-50% of people
Most of the benefit for mild-moderate HT is at the lowest dose
Monotherapy or combination therapy is fine for initial treatment
Nighttime dip

- BP is supposed to drop 15% at night
- Nondippers have higher M&M
- Give at least one med at night
Medications

- Consider risk/benefit ratio and outcomes

- JNC8 (and ACP/AAFP) prefer (in no order)
  - Thiazide
  - Calcium channel blockers
    - Amlodipine, diltiazem, verapamil
  - ACE/ARB
- European group says use anything
Drugs of choice

- African-Americans - low renin state
  - Thiazide or CCB
  - ACE/ARB less effective BUT
  - Thiazides take away the low renin state
    - So OK to use ACE with a thiazide if needed

- Elderly with isolated systolic hypertension
  - Thiazide or CCB
Cost and convenience

- $4 drug combos
- Lisinopril/hydrochlorothiazide is free at GE
- Twofers
  - Beta blockers post MI or in migraine
If the blood pressure is initially greater than 20/10 from goal start with 2 medications
One of the meds should be a thiazide
Longer acting thiazides are more effective
- Chlorthalidone or indapamide
- Higher K loss
Side effects of common meds

- ACE/ARB
- Beta blockers
- CCB
  - Amlodipine
  - Diltiazem
  - verapamil
- ‘Diuretics’
- Other
  - Spironolactone
  - Hydrazazine
  - Clonidine
- Cough, K
- Bradycardia
- Edema
- Brady
- Constipation, brady
- Low K, gout
- K, DUB, gynecomastia
- ANA, tachycardia
- Sedation, rebound
When giving a category D drug

WHEN IS IT OKAY TO ASK A WOMAN IF SHE IS PREGNANT?
If actually controlled

- See q 3-6 mo
- Check BMP and Urine yearly
- Pooled cohort yearly
- I am bad at the yearly reassessment
Why is it hard to treat to goal?

- Adherence - it’s asymptomatic
- Worsening obesity
- Not there for a ‘BP check’
- Silos
Digital medicine

- Does digital medicine help?
  - No good studies
  - CDC study – Control/adherence increased 4%
- Apps – mostly graphs and reminders
  - Small effect
  - ‘smart BP tracker’
  - ‘Personal care for iPad bundle’
It’s a complex issue

COULD BE ANYTHING.

WAY TOO GENERAL PRACTITIONER
When do we get to resistant HT?

YOU JUST NEED TO BE PATIENT, SON.
Resistant HT (finally!)

- Above goal on 3 meds
  - one of which is a thiazide
  - Meds dosed to at least 50% max
- OR controlled with 4 meds
- Refractory HT - Not at goal on 4 meds or at goal on 5
Resistant HT

- Higher morbidity and target organ damage
- Higher likelihood of secondary causes
Resistant HT Evaluation

- Confirm the Dx
  - 45% were not confirmed
  - White coat, poor adherence, Na, cuff size
- Fine tune the treatment
  - Salt restriction - 24 hour urine for na/cr
  - The right meds at 50% max or more
  - One long acting thiazide
  - One night time dose
Resistant HT Evaluation

- Recheck
  - Alcohol
  - OSA
  - Meds
- Exam
  - Recheck with attention to vascular
  - Bruits and bilateral pulses
  - Recheck renal lab and proteinuria
Resistant HT Treatment

- Diuretic
  - Increased volume is more common in resistant HT
  - Thiazide
  - If creatinine is > 2, change to a loop
    - All work, but torsemide is longer acting (better for BP)
Resistant HT treatment

- Add spironolactone
  - Low dose -12.5-25 daily
  - Pt is frequently also on ACE/ARB
    - Watch K
  - Higher dose can cause gynecomastia or DUB
- Epleronone
  - More specifically bound
  - But costly
Secondary HT

- Primary hyperaldosteronism
- Renal artery stenosis
- Renal disease
- OSA
- Rarer
  - Pheochromocytoma
  - Coarctation
  - Cushings
Hyppaldosteronism

- Adrenal hyperplasia or adenoma
  - Unilateral or bilateral
- Half will have hypokalemia into the 2s
- ‘Triad’-rare
  - HT, Hypokalemia, Bicarb > 35 (met alk)
- Incidentaloma on CT
Hyperaldosteronism

- **Diagnosis**
  - Spot renin /aldo ratio
  - Urine or plasma
  - Special conditions

- **Treatment**
  - Medical management first
  - Spironolactone
  - Surgery - if unilateral and HT in poor control
Renovascular Disease

- 2 types
  - Renal artery stenosis and Fibromuscular dysplasia

- Consider a workup if:
  - 30% increase in creatinine with ACE
  - Asymmetric kidney size
  - Epigastric bruit with HT
  - < 30 year old woman
  - Recurrent flash pulmonary edema
Renovascular disease Work-up

- Don’t screen unless you’ll intervene
- ‘little benefit is gained from renal revascularization if the BP is well controlled and renal function is stable’

- Imaging
  - Renal duplex/doppler - renal
  - CTA - radiologist
Intervene if:
- Recurrent flash pulmonary edema on treatment
- Single kidney or transplant
- Failed medical treatment/target organ damage

Treatment
- Better if early
- Stenting
Renal disease

- If creatinine /GFR is worsening
- If microalbuminuria or hematuria are seen
- Do renal US
  - if renal size is shrinking
- Referral to renal
- Up to 80% of resistant HT has OSA
- Treatment won’t always reverse HT
- Adherence
Rare

- Pheo
  - Episodic HT/ sweating/palpitations/anxiety/HA
  - Only screen if pt has symptoms
  - Urine for metanephrines-special conditions
- Coarctation
  - Femoral pulses
  - Neonatal screening
- Cushings – urine cortisol
Experimental treatments

- Renal denervation
- Electrical stimulation of the carotid sinus
Recap - essential HT

- Confirm with home monitoring
  - Rx for all
- Low risk patients over 60 can treat to 150/90
- Treat at night (dipping)
- If the patient is not responding
  - 3 meds/one diuretic/at 50% max
- Repeat BMP and urine yearly *
Recap - resistant HT

- As above
- Confirm the diagnosis
- Good vascular and renal exam
- Use a long acting thiazide
- Add spironolactone 12.5
- Work up secondary causes
Million hearts initiative

- Started in 2011
- To prevent 1 million heart attacks or strokes
- by getting 10 million hypertensives to treatment goal
- By 2017...😔
We can do better

Your options according to Yoda.

- Do.
- Do not.
- Try.

Source: GraphJam.com
To all of you who stayed...

WELL PLAYED