Management of Hypertension and Consequences of non-compliance

Colin Edwards
CARDIOLOGIST AHG
May 2016
Outline

1. Consequences of poorly controlled hypertension

2. BP targets and anti-hypertensive drugs and hypertension management guidelines.

3. Medical management of Hypertension CASES – young, elderly and resistant hypertension.

History

Diagnosis and management of Hypertension has challenged famous physicians for centuries.

1733 - Clergyman Stephen Hales made the 1st published measurement of blood pressure

1896 – Invention of the sphygomanometer.

1905 - Nikolai Korotkoff described the Korotkoff sounds

1925 - Otto Frank – essential versus secondary hypertension

1928- Mayo clinic classification - benign or malignant hypertension

Importance of severe hypertension was appreciated but the importance of mild and moderate hypertension was questioned.

1931 – John Hay - Prof of Medicine in Liverpool
“the greatest danger to man with a high BP lies in its discovery, because then some fool is certain to try and reduce it”
1937 - Paul White (Harvard Cardiologist) suggested that "hypertension may be an important compensatory mechanism which should not be tampered with, even if we were certain that we could control it"

1949 - Charles Friedberg's classic textbook "Diseases of the Heart", stated that "people with 'mild benign' hypertension ... (defined as blood pressures up to levels of 210/100 mm Hg) ... need not be treated".

From the 1950's – tide was turning – longitudinal studies such as Framingham Heart Study and other actuarial reports – demonstrated that benign hypertension increased death and cardiovascular disease.

More than 70 million people in the United States and more than 1 billion worldwide have hypertension — defined by a systolic blood pressure of at least 140 mmHg and a diastolic blood pressure ≥90 mmHg
Consequences of not treating Hypertension?
Ischaemic Heart Disease

Heart Failure

Angina
Atrial Fibrillation

![EKG waveform](image)

![Pie chart showing causes of AF](image)

- Cardioembolic: 25.8%
- Large Artery: 21.1%
- Cause unknown: 22.8%
- Carotid atherosclerosis
- Hypertension

**SILENT AF?**
Hypertensive Aortopathy
Cerebrovascular Disease
Renal Disease
HYPERTENSION ‘SILENT ASSASIN’

Hypertension is a Risk Factor for Cardiovascular Disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Normotensive</th>
<th>Hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAD</td>
<td>22.7</td>
<td>45.4</td>
</tr>
<tr>
<td>Stroke</td>
<td>3.3</td>
<td>12.4</td>
</tr>
<tr>
<td>PAD</td>
<td>5.0</td>
<td>9.9</td>
</tr>
<tr>
<td>CHF</td>
<td>3.5</td>
<td>13.9</td>
</tr>
</tbody>
</table>

| Women     |              |              |
| CAD       | 9.5          | 21.3         |
| Stroke    | 2.4          | 6.2          |
| PAD       | 2.0          | 7.3          |
| CHF       | 2.1          | 6.3          |

Biennial age-adjusted rate per 1000 patients at risk

Risk ratio

Adapted from Kannel WB. JAMA. 1998;275:1571-1576.
Hypertension Control

12.5% achieve BP targets

Cruickshank et al. J Hypertens 2001
Hypertension is Silent Disease Process
Need to Achieve Patient and Doctor
Buy In

Trials → 35-40% mean reduction in stroke
   20-25% reduction in MI
   50% reduction in heart failure

Pt with BP 159/95 mmHg (stage 1)
on treatment for 10 yrs
12mmHg ↓
prevent 1 death for every 11 pts treated

Helps Achieve
Patient ‘Buy In’
Hypertension Targets:

BP targets (recent BPAC guidelines)

<table>
<thead>
<tr>
<th></th>
<th>Normal &lt;80yrs</th>
<th>Diabetic CKD</th>
<th>Vascular Disease</th>
<th>Elderly &gt;80 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td>&lt;140/90</td>
<td>&lt;130/80</td>
<td></td>
<td>&lt;150/90</td>
</tr>
</tbody>
</table>
# BP Targets Challenged

## Key Clinical Trials in Hypertension

<table>
<thead>
<tr>
<th>Should we treat HBP?</th>
<th>What is the goal of treatment?</th>
<th>Should we treat DBP in older persons?</th>
<th>What is the best drug for HBP?</th>
<th>Should we treat ISH?</th>
<th>What are the best combinations?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>HOT UKPDS</td>
<td></td>
<td>2000-03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2004-10</td>
</tr>
</tbody>
</table>

**Build Sequence**

- VA Cooperative Studies
- EWPHE MRC-1 ANHBP-1
- SHEP
- Syst-Eur Syst-China
- HOT UKPDS
- HYVET
- CAPP2
- INSIGHT NORDIL
- CONVINCE ALLHAT
- ANBP2 LIFE
- SCOPE
- VALUE ASCOT ACCOMPLISH
- ONTARGET TROPHY
- ACCORD BP

Adapted from Black H, 2003.
New Guidelines – JNC 8 plus others

### BP Thresholds for the USA-2014

<table>
<thead>
<tr>
<th>Population</th>
<th>JNC 8</th>
<th>ASH/ISH</th>
<th>ADA</th>
<th>NKF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 60 years</td>
<td>≥ 150/90</td>
<td>&gt; 140/90</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>(* &gt; 80)</td>
<td>&gt; 150*/90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt; 60 years</td>
<td>&gt; 140/90</td>
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</tr>
<tr>
<td>Diabetics</td>
<td>&gt; 140/90</td>
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<td>N.A.</td>
</tr>
<tr>
<td>With CKD</td>
<td>&gt; 140/90</td>
<td>&gt; 140/90</td>
<td>N.A.</td>
<td>&gt;140/90</td>
</tr>
<tr>
<td>With CVD</td>
<td>&gt; 140/90</td>
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<td>N.A.</td>
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References:
A Randomized Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group*

Nov 2015

The most appropriate targets for systolic blood pressure to reduce cardiovascular morbidity and mortality among persons without diabetes remain uncertain.

METHODS:
Randomised 9361 persons SBP >130 mm Hg or higher
Mean age 67 years
70% 10 CV risk >15%
No diabetics, to a
SBP blood target of <120 mm Hg (intensive treatment)
SBP target of <140 mm Hg (standard treatment) – JNC 8.
Figure 2. Systolic Blood Pressure in the Two Treatment Groups over the Course of the Trial.

The systolic blood-pressure target in the intensive-treatment group was less than 120 mm Hg, and the target in the standard-treatment group was less than 140 mm Hg. The mean number of medications is the number of blood-pressure medications administered at the exit of each visit. Error bars represent 95% confidence intervals.
## Results

### Consequences of tight control

<table>
<thead>
<tr>
<th>Secondary outcomes</th>
<th>Intensive</th>
<th>Standard</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial infarction</td>
<td>97 (2.1)</td>
<td>0.65</td>
<td>116 (2.5)</td>
<td>0.78</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
<td>40 (0.9)</td>
<td>0.27</td>
<td>40 (0.9)</td>
<td>0.27</td>
</tr>
<tr>
<td>Stroke</td>
<td>62 (1.3)</td>
<td>0.41</td>
<td>70 (1.5)</td>
<td>0.47</td>
</tr>
<tr>
<td>Heart failure</td>
<td>62 (1.3)</td>
<td>0.41</td>
<td>100 (2.1)</td>
<td>0.67</td>
</tr>
<tr>
<td>Death from cardiovascular causes</td>
<td>37 (0.8)</td>
<td>0.25</td>
<td>65 (1.4)</td>
<td>0.43</td>
</tr>
<tr>
<td>Death from any cause</td>
<td>155 (3.3)</td>
<td>1.03</td>
<td>210 (4.5)</td>
<td>1.40</td>
</tr>
</tbody>
</table>

### Serious adverse event only

<table>
<thead>
<tr>
<th>Event</th>
<th>Intensive</th>
<th>Standard</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotension</td>
<td>110 (2.4)</td>
<td>66 (1.4)</td>
<td>1.67</td>
<td>0.001</td>
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<tr>
<td>Syncope</td>
<td>107 (2.3)</td>
<td>80 (1.7)</td>
<td>1.33</td>
<td>0.05</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>87 (1.9)</td>
<td>73 (1.6)</td>
<td>1.19</td>
<td>0.28</td>
</tr>
<tr>
<td>Electrolyte abnormality</td>
<td>144 (3.1)</td>
<td>107 (2.3)</td>
<td>1.35</td>
<td>0.02</td>
</tr>
<tr>
<td>Injurious fall</td>
<td>105 (2.2)</td>
<td>110 (2.3)</td>
<td>0.95</td>
<td>0.71</td>
</tr>
<tr>
<td>Acute kidney injury or acute renal fail</td>
<td>193 (4.1)</td>
<td>117 (2.5)</td>
<td>1.66</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
SPRINT results suggest that a target blood pressure <150mmHg is too high for elderly patients.

Achieving stricter blood-pressure goals will probably require more careful titration of medications, greater use of combination drug preparations, more monitoring for adverse effects, and more frequent patient visits than currently occur.

The SPRINT results highlight the need for nurse practitioners to help monitor BP’s and electrolytes and up titrate antihypertensive therapy.
Management of Hypertension

Step 1: Measure BP – clinic, home, ambulatory

Step 2: CV risk assessment

Step 3:
  a) diet, exercise and lifestyle – ALL PATIENTS
  b) medication

Step 4: if resistant to therapy - refer
# Lifestyle Modification

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<tr>
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<th>Expected BP change</th>
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<td>BMI &lt; 25 kg/m²</td>
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</tr>
<tr>
<td>Alcohol reduction</td>
<td>&lt; 2 drinks/day</td>
<td>-5 / -2</td>
</tr>
<tr>
<td>Exercise</td>
<td>4+ times/week</td>
<td>-5 / -4</td>
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</table>
British Guidelines

Care pathway

If target organ damage present or 10-year cardiovascular risk > 20%
If younger than 40 years
Consider specialist referral
Offer lifestyle interventions
Offer patient education and interventions to support adherence to treatment
Offer annual review of care to monitor blood pressure, provide support and discuss lifestyle, symptoms and medication
Drugs for the Treatment of Hypertension

Development of Hypertension Guidelines: the JNCs and Drug Therapy

Earliest Guidelines  1972
JNC I  1973
JNC II  1976
JNC III  1980
JNC IV  1984
JNC V  1988
JNC VI  1993
JNC VII  1997
JNC VII  2003
JNC VIII  2013

NHBPEP Starts

28 drugs Diuretics
34 drugs Diuretics
43 drugs Diuretics, ACEI, CAs added
50 drugs Low dose diuretics, β-blockers added
68 drugs 7 options
>125 drugs Diuretics

8th Report December 18, 2013
ADD B-BLOCKER IF THERE IS A COMPELLING INDICATION

4th line: Aldosterone blocker
SPIRONOLACTONE
EPLERENONE

Chlorthalidone
Bendrofluthiazide
Indapamide

Accupril, Cilazapril, Enalapril
Captopril, Lisinopril
Losartan, Candesartan

ACE inhibitors or ARBs

Calcium antagonists
Felodipine, Amlodipine
Diltiazem, Verapamil

Antihypertensive Drug Treatment Algorithm

**NICE 2011**

**Step 1**
- **Age <55 yrs**: A
- **Age ≥55 yrs or black***: C†

**Step 2**
- A + C†

**Step 3**
- A + C + D

**Step 4**
- **Resistant Hypertension**: A + C + D + further diuretic‡
  - Consider specialist advice

---

*A = angiotensin-converting-enzyme inhibitor or angiotensin receptor blocker
C = calcium channel blocker
D = thiazide-like diuretic

*Of African or Caribbean family origin
†CCB preferred but D is an alternative in people intolerant of C or at high risk of heart failure
‡Consider low-dose spironolactone or higher-dose thiazide

Case 1

Young Hypertensive
Case 1

25 year old Maori female – competitive netball player

Found to be hypertensive by GP when presented with URTI and headache
BP 150/ 95mmHg
Mildly overweight

No recreational drugs or steroids, non smoker

Both parents are hypertensive – father had a stroke aged 55 years
Next Step

1. Start treatment with thiazide or ACE

2. Refer cardiology for an echo

3. Perform 24 hr ambulatory BP monitoring

4. Check BP daily for next 10 days
Further Evaluation

24 hr ABPM – sustained daytime hypertension (mean 145/95 mmHg) with normal nocturnal dipping

Urinalysis, electrolytes (normal Na, K+, Ca; creat-normal)
TC 4.8, LDL 2.5, HDL 1.3
Glucose-normal

ECG-generous voltages, otherwise normal

Echo – definite mild concentric LVH. Normal aortic dimensions.

Renal U/S - normal
Most likely explanation for hypertension

1. Dietary-excess Na intake

2. Essential hypertension – based on a parent with hypertension ✓

3. Metabolic Syndrome

3. Renal artery stenosis
Initial Therapy

Weight loss, diet and Exercise ✓

Amlodipine 5mg/d ✓

Metoprolol 47.5mg/d

ACE inhibitor-Lisinopril 10mg/d

DISCUSSION:

She has got LVH – so probably want more than lifestyle alone

Always stress the importance of exercise and low salt diet
Avoid B-Blockers in sportsman
She is in child bearing age – so want to avoid ACE – numerous fetogenic effects
Discussion

The younger the patient and the higher the BP – more likely the hypertension is secondary.
CASE 3

Resistant Hypertension
History

52 year old Indian female

GP referral – poorly controlled hypertension and breathlessness – **SBP often >170mmHg**.

Diagnosed with hypertension 6 years previously – presumed essential

**Medication:**

- Bendrofluazide 2.5mg/d
- Atacand 16mg/d
- Amlodipine 5mg/d

No diabetes
Raised BMI – 30kg/m2
TC 5.2 HDL 2.2 LDL 2.6
Non-smoker
Father had CABG @ 69yrs

**INTERMEDIATE CV RISK**
EXAMINATION:

Raised BMI

PR 70 bpm all pulses present, no radio-femoral delay. **BP 170/80mmHg** right arm sitting – 2 readings 5 min apart

Fundoscopy – mild A-V nipping

CVS-normal heart sounds, no murmurs, no aortic coarctation

Chest – normal

Abdomen- no bruits

END ORGAN DAMAGE
Normal ECG and CXR
Lab

Renal and electrolytes:
Na – 137
K – 3.5
Cr- 76
Ca- 2.17
HbA1c-normal

Urine:
Urine microalbumin - 36mg/l (0-30)
Albumin:Creat - 4.1 (0-2.5)

Renal US - normal
Important Questions in Hypertensive Non-responders

White Coat – 24 hr ABP monitoring

Compliance

Stress – work, family, financial

Exercise

Diet – salt, alcohol

Meds - NSAID, COX-2, OCP, decongestants

Sleep - OSA – Epworth Sleepiness Scale

When to Suspect OSA (Obstructive Sleep Apnea)

- Loud snoring
- Snore arousals (waking with snorting, gasping)
- Apnea or crescendo breathing witnessed by bed partner or family member
- Complaints of daytime sleepiness
- All patients with resistant hypertension

If OSA is suspected, patient should be referred to sleep specialist for consideration of overnight polysomnography
Management

TARGET BP ≤ 140/90

Lifestyle Intervention
Aerobic exercise program-30 min /d
Weight loss-10% body weight
Diet – low salt, low CHO

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<tr>
<td>Exercise</td>
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</tbody>
</table>

Investigations:
- Ambulatory BP
- Echo – left ventricular hypertrophy, aortic dimensions, rule out aortic coarctation
Results

ABPM – average 24-hour 163/95mmHg
daytime average 166/99mmHg
nocturnal average 158/85mmHg

Echo – normal LV size and function – LVEF 60%
borderline LV hypertrophy and mild diastolic dysfunction
mild left atrial dilatation
Treatment

STEP 1:
Amlodipine 5mg/d – 10mg/d
Atacand 16mg/d
Continue Bendrofluazide 2.5mg/d

STEP 2: 2 weeks later still hypertensive
Amlodipine 10mg/d
Atacand 16 - 32mg/d
Increased to top dose over 1 month period

STEP 3: 1 month later
Average of 2 seated BP’s 5 min apart 164/95mmHg
c/o palpitations – Bisoprolol 2.5mg/d added

STEP 4: 3 months later
Atacand 32mg/d
Felodipine 10mg/d
Bendro 2.5mg/d
Bisoprolol 5 mg/d
Average of 2 seated BP’s 5 min apart 165/90mmHg

Patient admitted to good compliance

RESISTANT HYPERTENSION
Exclude secondary causes of hypertension

EXCLUDE RENAL FAILURE AND RENAL ARTERY STENOSIS:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>139 mmol/L</td>
<td>135 - 145</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.4 mmol/L</td>
<td>3.5 - 5.2</td>
</tr>
<tr>
<td>Creatinine</td>
<td>62 umol/L</td>
<td>45 - 90</td>
</tr>
<tr>
<td>eGFR</td>
<td>87 mL/min/1.73m2</td>
<td>&gt; 80</td>
</tr>
</tbody>
</table>

Normal renal US

24 hour urine catecholamines

<table>
<thead>
<tr>
<th>Duration</th>
<th>24 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>1.69 L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>9.0 mmol/d</td>
</tr>
<tr>
<td>Adrenalin/Creatinine Ratio</td>
<td>2.1 nmol/mmol creat</td>
</tr>
<tr>
<td>Urine Adrenalin</td>
<td>19 nmol/d</td>
</tr>
<tr>
<td>Noradrenalin/Creatinine Ratio</td>
<td>23 nmol/mmol creat</td>
</tr>
<tr>
<td>Urine Noradrenaline</td>
<td>200 nmol/d</td>
</tr>
<tr>
<td>Dopamine/Creatinine Ratio</td>
<td>0.15 umol/mmol creat</td>
</tr>
<tr>
<td>Urine dopamine</td>
<td>1.4 umol/d</td>
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</tbody>
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EXCLUDE PHAEOCHROMOCYTOMA

EXCLUDE CUSHINGS DISEASE

24 hr urine Cortisol

<table>
<thead>
<tr>
<th>Duration</th>
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</tr>
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<tbody>
<tr>
<td>Volume</td>
<td>1.48 L</td>
</tr>
<tr>
<td>Cortisol (free) Urine</td>
<td>110 nmol/d</td>
</tr>
<tr>
<td>Cortisol</td>
<td>11.0 mmol/d</td>
</tr>
</tbody>
</table>

Cortisol (free) Urine

*Patients with Cushings syndrome usually have levels >380nmol/d. This test is not indicated in the diagnosis of cortisol deficiency.*
**ALDOSTERONE/RENIN RATIO**

<p>| | | | |</p>
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<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Plasma Aldosterone</td>
<td>399</td>
<td>pmol/L</td>
<td>60-1000</td>
</tr>
<tr>
<td>Active Renin</td>
<td>4</td>
<td>mU/L</td>
<td>4-46</td>
</tr>
<tr>
<td><strong>Aldosterone/Renin ratio</strong></td>
<td>100</td>
<td></td>
<td>H</td>
</tr>
</tbody>
</table>

**CONNS SYNDROME**

Elevated
Also serum

Conns
Progress

Struggled on for months with elevated BP’s and palpitations and breathlessness

Coronary angiogram as breathless- normal

Added Spironolactone as a 5th drug- nasty side effects- dizzy, flushing – therefore stopped.
Blood Pressure Response to Spironolactone in Subjects With Resistant Hypertension

Renal Denervation

CT renal angiogram – normal renal arteries- anatomically suitable for renal denervation.

BUT........ 2 possible adenomas of her right adrenal gland – likely Conns Syndrome
Conns Syndrome

<table>
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<th>Unit</th>
<th>Normal Range</th>
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<td>100</td>
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<td>H, See below</td>
</tr>
</tbody>
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*ve feedback*
Prevalence of Primary Aldosteronism in Subjects With Resistant Hypertension

<table>
<thead>
<tr>
<th>Location</th>
<th>Prevalence of PA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle¹</td>
<td>17</td>
</tr>
<tr>
<td>Birmingham²</td>
<td>20</td>
</tr>
<tr>
<td>Oslo³</td>
<td>22</td>
</tr>
<tr>
<td>Prague⁴</td>
<td>19</td>
</tr>
</tbody>
</table>
68 years, obese, post CABG, severe RESISTANT hypertension

Work-up for 2° causes

Na 142 K 5.4 SCR 157 umol/l 
RAISED serum renin levels 
1368 mUI/L (N 4-46)

Work-up for 2° causes

Na 139, K 3.5, Scr 62 umol/l 
SUPPRESSED serum renin level 
4 mUI/L 
(N 4-46) N Aldo level 
Aldo:renin raised >100

R adrenal adenomas on CT 
Confirmed by adrenal vein sampling
## Secondary causes

<table>
<thead>
<tr>
<th>Date</th>
<th>Sodium</th>
<th>Potassium</th>
<th>Creatinine</th>
<th>eGFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>23/08/11</td>
<td>141</td>
<td>4.9</td>
<td>100</td>
<td>48</td>
</tr>
<tr>
<td>13/04/12</td>
<td>145</td>
<td>5.2</td>
<td>105</td>
<td>46</td>
</tr>
<tr>
<td>20/12/12</td>
<td>142</td>
<td>4.8</td>
<td>100</td>
<td>48</td>
</tr>
<tr>
<td>24/04/13</td>
<td>141</td>
<td>4.4</td>
<td>102</td>
<td>49</td>
</tr>
<tr>
<td>24/08/13</td>
<td>140</td>
<td>4.3</td>
<td>106</td>
<td>47</td>
</tr>
<tr>
<td>15/11/13</td>
<td></td>
<td></td>
<td>104</td>
<td>48</td>
</tr>
<tr>
<td>20/12/13</td>
<td></td>
<td></td>
<td>97</td>
<td>52</td>
</tr>
<tr>
<td>22/04/14</td>
<td>141</td>
<td>4.7</td>
<td>157</td>
<td>29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Cortisol</td>
<td>224 nmol/L</td>
</tr>
<tr>
<td>Normetanephrine</td>
<td>799 pmol/L &lt; 900</td>
</tr>
<tr>
<td>Metanephrine</td>
<td>86 pmol/L &lt; 500</td>
</tr>
<tr>
<td>Plasma Aldosterone</td>
<td>273 pmol/L 60-1000</td>
</tr>
<tr>
<td>Active Renin</td>
<td>1368 mU/L 4-46</td>
</tr>
<tr>
<td>Aldosterone/Renin ratio</td>
<td>&lt; 1 See below</td>
</tr>
</tbody>
</table>
Raised serum renin

Causes:
1) Renin producing tumour – very rare
2) Severe renal artery stenosis – underperfusion of JGA.
3) Heart failure, liver failure, nephrotic syndrome – oedema is associated with relative intravascular hypovolemia.
4) Pseudohypoaldosteronism – aldosterone receptor problem
5) Bartter and Gitelman syndromes – renal tubular abnormalities → salt wasting.
Investigations

Renal U/S – moderate severe L renal artery stenosis
RESISTANT HYPERTENSION

Secondary ALDOSTERONISM

Work-up for 2° causes

Na142 K5.4 SCR 157umol/l
**RAISED** serum renin levels
1368mUI/L (N 4-46)

R adrenal adenomas on CT

Primary ALDOSTERONISM

Work-up for 2° causes

Na 139, K 4.4, Scr 62umol/l
**SUPPRESSED** serum renin level
4mUI/L (N 4-46)
N Aldo level
Aldo:renin raised >100
Renal Denervation

**SYMPPLICITY HTN-1:** Significant, Sustained BP Reduction to 3 Years

<table>
<thead>
<tr>
<th>Time</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Months (N = 144)</td>
<td>-22</td>
<td>-10</td>
</tr>
<tr>
<td>1 Year (N = 132)</td>
<td>-27</td>
<td>-14</td>
</tr>
<tr>
<td>2 Years (N = 105)</td>
<td>-29</td>
<td>-14</td>
</tr>
<tr>
<td>3 Years (N = 88)</td>
<td>-32</td>
<td>-14</td>
</tr>
</tbody>
</table>

$p < 0.01$ for all time points.

Data is reported only on the patients available at each time point.

Primary endpoint

- **RDN** (n = 364)
- **Sham procedure** (n = 171)

European Society of Cardiology Annual Meeting, 2013.

www.cardiosource.org
Reasons for failure

3 variables that may have affected the efficacy of the trial:

Drug changes - 40% had additional drug up titrations
‘SHAM ARM’ were advantaged by intensive drug Rx

Patient population – 1/3 were African-Americans
notoriously don’t respond to RDN for unknown reasons
Disadvantaged RDN group

Procedure related – too many inexperienced operators
– too few burns
Disadvantaged RDN

<table>
<thead>
<tr>
<th></th>
<th>HTN-1</th>
<th>HTN-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of operators</td>
<td>20</td>
<td>112</td>
</tr>
<tr>
<td>No. of procedures per operator</td>
<td>6.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>
RDN is here to stay:

- Selected patients (there are non-responders)
- Eligible patients enrolled in trials
- Better standardisation of equipment and technique
Non-Invasive Renal Denervation
(ULTRA SOUND)

External delivery of focused ultrasound energy to specific target tissue. Imaging and tracking of target

Less trauma to renal arteries - energy is delivered to sympathetic nerve on the outside of the vessel.
Conclusions

Clinic BP measurements:
Relaxed, empty bladder, abstain from stimulants
Seated: 5 min, back supported, arm supported level of heart
Average of 2 readings 1-2 min apart
Elderly- measure BP in standing position

DIAGNOSIS:
ABPM and Home BP monitoring are important in confirming the diagnosis of hypertension.

Measure the heart rate and rhythm – screen for atrial fibrillation in hypertensives

Hypertensive Patient not responding to treatment
Compliance
White coat hypertension
Alcohol
NSAID
Stress
OSA
Exercise
CONCLUSIONS

TARGETS:
<140/90mmHg for most pts
<130/80mmHg for severe diabetics
<150/90mmHg elderly

‘HOLY TRINITY Treatment:
ACE/ARB,
Ca antagonist and
thiazide diuretic (chlorthalidone)

Spironolactone (12.5-25mg/d – useful 4th line agent)

Few important things to remember
- Avoid dehydration – postural hypotension and dizziness
- Subgroup of patients get hyponatraemia from the thiazide diuretics
- Combination ACE inhibitor and Spironolactone- hyperkalaemia – life threatening
Conclusion

Well treated Hypertension:
35-40% mean reduction in stroke
20-25% reduction in MI
50% reduction in heart failure

- Need nurse practitioners with an interest in hypertension.
- To educate patients
- To up titrate antihypertensive therapy and
- To monitor side effects and electrolytes.
THANK YOU

Colin Edwards
May 2016