How Should We Investigate the Young Person with Hypertension?

Dr Aled Lewis
Consultant Nephrologist
BCULHB
Why Investigate?

1. Confirm correct diagnosis of hypertension
2. Identify end organ damage
3. Evaluate the cardiovascular risk
4. Exclude secondary causes
1. Confirm Correct Diagnosis

- Trained professional
- Validated machine and appropriate cuff size
- Temperate, relaxed environment
- Quiet, seated with arm outstretched and supported
- Both arms, repeat reading in arm with highest BP
- If BP >140/90 offer automated BP monitor
Automated Blood Pressure Monitor (ABPM)

- 2 readings per hour in usual waking hours
- Average of at least 14 measurements
- If unable to perform ABPM, offer Home BPM
  - 2 consecutive readings, 1 minute apart
  - Repeat morning and evening, 4 to 7 days
  - Ignore first day readings then average all other readings
What is Hypertension?

- **NICE CG127 (2011)**
  - Stage 1  BP 140/90 or 135/85
  - Stage 2  BP 160/100 or 150/95
  - Stage 3  BP >180/ or > /110

- **JNC 7 (2004)**
  - Normal  <120 <80
  - Pre Hypertension  120-139 80-89
  - Stage 1  140-159 90-99
  - Stage 2  >160 >100
2011 population >16 years: 2,507,917 (StatsWales)= 19.6% hypertensive
2010 'Health Survey for England‘ hypertension prevalence= 31.5% in men and 29.0% in women.
What is a Young Person?
2. Identify End Organ Damage

- Urine Dipstick
- Blood urea and electrolytes +/- eGFR
- 12 lead ECG
- Fundoscopy
- Blood glucose
- Serum total and HDL cholesterol
- Age, sex, smoking, family history
3. Cardiovascular Risk Prediction

• Diastolic pressure
• Systolic pressure
Diastolic Pressure

Does the Relation of Blood Pressure to Coronary Heart Disease Risk Change With Aging? The Framingham Heart Study
Stanley S. Franklin, Martin G. Larson, Shehzad A. Khan, Nathan D. Wong, Eric P. Leip, William B. Kannel and Daniel Levy

*Circulation*. 2001;103:1245-1249
doi: 10.1161/01.CIR.103.9.1245

*Circulation* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2001 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539
• Lancet 2002; 360 (9349): 1903-1913
  • BP reduction of 20/10 reduced death from cerebro- and cardiovascular disease by 50%

• Lancet 1990; 335 (8692): 765-774
  • Diastolic BP reduction of 5mmHg reduced cerebrovascular accidents by 34% and coronary events by 21%

• Lancet 1990; 335 (8693): 827-838
  • Diastolic BP reduction by 5-6mmHg reduced cerebrovascular accidents by 42% and coronary heart disease by 14%
Figure 2: Stroke mortality rate in each decade of age versus usual blood pressure at the start of that decade. Rates are plotted on a floating absolute scale, and each square has area inversely proportional to the effective variance of the i.i.d. diastolic blood pressure, each age-specific regression line ignores the left-hand point (ie, at slightly less than 75 mm Hg), for which significantly above the fitted regression line (as indicated by the broken line below 75 mm Hg).

Figure 4: Ischaemic heart disease (IHD) mortality rate in each decade of age versus usual blood pressure at the start of that decade.
Cardiovascular Risk

BMJ RESEARCH

Derivation, validation, and evaluation of a new QRISK model to estimate lifetime risk of cardiovascular disease: cohort study using QResearch database

Julia Hippisley-Cox, professor of clinical epidemiology and general practice,¹ Carol Coupland, associate professor in medical statistics,¹ John Robson, senior lecturer general practice,² Peter Brindle, research and evaluation programme director³

¹Division of Primary Care, University Park, Nottingham NG2 7RD, UK
²Centre for Health Sciences, Queen Mary’s School of Medicine and Dentistry, London E1 2AT, UK
³Avon Primary Care Research Collaborative, NHS Bristol, South Plaza, Bristol BS1 3NX, UK

Correspondence to: Julia Hippisley-Cox juliahippisleycox@gmail.com

Cite this as: BMJ 2010;341:c6624
doi:10.1136/bmj.c6624
4. Exclude Secondary Causes

- <40 years
- Sudden worsening
- Uncontrolled on 3 medications
- Accelerated hypertension
  - $>180/110 +$ papilloedema or haemorrhage
- CVA <50 years
Medications

- Immunosuppressants
- NSAIDs and COX-2
- Oestrogens and testosterone
- Fludrocortisone
- Bromocriptine
- Carbamazepine, Fluoxetine, Lithium, TCAs
- Sodium bicarbonate
- Erythropoietin
- Nicotine, amphetamines, cocaine
- Ephedra/ma huang, ginseng
History

- Palpitations, facial flushing, headache, sweating, constipation
  **Phaeochromocytoma**
- Oedema, palpitations, muscle weakness
  **Conn’s**
- Weight gain, weakness, fatigue, backache, thirst, depression, hyperpigmentation
  **Cushing’s**
- Lethargy, fatigue, weight gain, hair loss
  **Hypothyroid**
- Palpitations, oedema, dry skin, hair loss
  **Hyperthyroid**
- Sweating, tiredness, weakness, arthralgia
  **Acromegaly**
Other Symptoms

• Nocturia, oliguria
• Somnolence, snoring
Examination
Examination 2

- Renal bruits
- Radio-femoral delay
Probability of Disease

- 5% drugs
- 5% renal/renovascular disease
- <1% endocrine
  - Thyroid
  - Conn’s (0.01-0.03%)
  - Cushing’s (0.1-0.6%)
  - Phaeochromocytoma (0.1%)
  - Acromegaly (<0.1%)
Investigation 1

- Thyroid Function Tests
- Aldosterone : Renin ratio
- 24hr urinary metadrenaline/normetadrenaline
- 24hr urinary free cortisol and dexamethasone suppression test
- Glucose tolerance test
Concurrent Medications

• Aldosterone : Renin ration
  – ACEI/ARBs- decrease ARR (raised renin)
  – Beta blockers- elevate ARR (suppress renin>aldosterone)
  – Calcium channel blockers- decrease aldosterone and renin variably
  – Diuretics- increase aldosterone and renin in parallel
Investigation 2

- Ultrasound renal tract
- MRA Renal Arteries +/- angiogram
- Polysomnograph
<table>
<thead>
<tr>
<th>Potential secondary cause and diagnostic tests</th>
<th>Positive likelihood ratio</th>
<th>Negative likelihood ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aldosteronism</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aldosterone/renin ratio &gt; 20*</td>
<td>4.6</td>
<td>0.27</td>
</tr>
<tr>
<td>Aldosterone/renin ratio &gt; 30*</td>
<td>28.0</td>
<td>0.16</td>
</tr>
<tr>
<td><strong>Coarctation of the aorta</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echocardiography</td>
<td>47.0</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Cushing syndrome</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-hour urinary free cortisol</td>
<td>10.6</td>
<td>0.16</td>
</tr>
<tr>
<td>Late-night salivary cortisol</td>
<td>8.8</td>
<td>0.07</td>
</tr>
<tr>
<td>Low-dose dexamethasone suppression</td>
<td>11.6</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Obstructive sleep apnea</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overnight polysomnography†</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sleep Apnea Clinical Score with nighttime pulse oximetry</td>
<td>5.2</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Pheochromocytoma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-hour urinary total metanephrines</td>
<td>8.0</td>
<td>0.13</td>
</tr>
<tr>
<td>Plasma free metanephrines</td>
<td>5.5</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Renal artery stenosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captopril (Capoten)-augmented renography</td>
<td>1.4</td>
<td>0.76</td>
</tr>
<tr>
<td>Computed tomography angiography</td>
<td>13.4</td>
<td>0.06</td>
</tr>
<tr>
<td>Magnetic resonance imaging with gadolinium contrast media</td>
<td>13.9</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Renal parenchymal disease</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal ultrasonography</td>
<td>2.9</td>
<td>0.32</td>
</tr>
</tbody>
</table>

**NOTE:** When likelihood ratios were not supplied in referent article, they were calculated based on sensitivity and specificity data provided.

*—When plasma aldosterone is reported in ng per dl and plasma renin activity is reported in ng per mL per hour and accompanied by an aldosterone level greater than 15 ng per dl (416.10 pmol per L).

†—Diagnostic standard.
‘Common’ Causes

• Renal Disease
  – Chronic Glomerulonephritis
  – Fibromuscular dysplasia
  – Polycystic kidney disease

• Endocrine
  – Thyroid disorders
  – Conn’s Syndrome
A Prospective Study of the Prevalence of Primary Aldosteronism in 1,125 Hypertensive Patients

Gian Paolo Rossi, MD, FACC, FAHA, Giampaolo Bernini, MD, Chiara Caliumi, MD, Giovambattista Desideri, MD, Bruno Fabris, MD, Claudio Ferri, MD, Chiara Ganzaroli, MD, Gilberta Giacchetti, MD, Claudio Letizia, MD, Mauro Maccario, MD, Francesca Mallamaci, MD, Massimo Mannelli, MD, Mee-Jung Mattarello, MD, Angelica Moretti, MD, Gaetana Palumbo, MD, Gabriele Parenti, MD, Enzo Porteri, MD, Andrea Semplicini, MD, FAHA, Damiano Rizzoni, MD, Ermanno Rossi, MD, Marco Boscaro, MD, Achille Cesare Pessina, MD, PhD, Franco Mantero, MD, for the PAPY Study Investigators

Padova, Ancona, Reggio Emilia, Pisa, L'Aquila, Palermo, Legnano, Roma, Firenze, Torino, and Reggio Calabria, Italy

1180 patients: 54 had adenoma (4.6%)
72 had idiopathic hyperaldosteronism (6.4%)
Primary Aldosteronism and Hypertensive Disease
Lorena Mosso, Cristian Carvajal, Alexis González, Adolfo Barraza, Fernando Avila, Joaquín Montero, Alvaro Huete, Alessandra Gederlini and Carlos E. Fardella

*Hypertension*. 2003;42;161-165; originally published online June 9, 2003;
doi: 10.1161/01.HYP.0000079505.25750.11

*Hypertension* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2003 American Heart Association, Inc. All rights reserved.
Print ISSN: 0194-911X. Online ISSN: 1524-4563

PA suggested in 63 of 609, confirmed in 37 (6.1%) 
K+ normal in 36 of 37. 
CT showed bilateral adrenal hyperplasia in 7 and nodule in 2
Summary

• Investigate:
  – Lifetime cardiovascular risk high
  – Diagnosis can guide treatment
  – Could offer cure

• Tailor investigations dependent on cause
A. Accuracy; Apnea; Aldosteronism
B. Bad kidneys; Bruits
C. Catecholamines; Coarctation; Cushing’s
D. Drugs; Diet
E. Endocrine disease
Any Questions?

aled.lewis@wales.nhs.uk
References

• National Institute for Health and Clinical Excellence. NICE CG127 Hypertension- the clinical management of primary hypertension in adults, August 2011