Hypertension and The Eyes
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Prevalence of hypertension

- Most common reason for use of prescription drugs
- ~ 30% of adults in US
- ~ 60 million
- Likely to grow

Definition

<table>
<thead>
<tr>
<th>Classification</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>&lt;80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
<td>Or 80-89</td>
</tr>
<tr>
<td>Stage 1</td>
<td>140-159</td>
<td>Or 90-99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>&gt;160</td>
<td>Or &gt;100</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt;180</td>
<td>&gt;120</td>
</tr>
</tbody>
</table>

- >50 yo: systolic BP > 140 mmHg predicts mortality
- <50 yo: diastolic pressure is a better predictor of mortality

White coat hypertension & ambulatory monitoring

- ~20-25% of patients
- More common in the elderly
- Repeat the measurement

- Ambulatory blood pressure monitoring (ABPM)
  - Every 15-20 min
  - Confirm or exclude white coat hypertension

Target Blood Pressure

- <140/90
- <130/80 with diabetes or renal disease
  - 35-40% reduction in stroke
  - 20-25% reduction in MI
  - >50% reduction in heart failure

The distribution of drugs being used by the patients

Clinical and Experimental Hypertension, 2012; 34(6): 397–401
Lifestyle modification

Lifestyle modifications in the management of hypertension

<table>
<thead>
<tr>
<th>Modification</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight reduction</td>
<td>Maintain recommended weight (BMI, 18.5 to 24.9 kg/m²)</td>
</tr>
<tr>
<td>Salt/sodium intake</td>
<td>Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced intake of processed and salted foods.</td>
</tr>
<tr>
<td>Exercise</td>
<td>Engage in moderate-intensity physical activity such as brisk walking (at least 30 minutes per day)</td>
</tr>
<tr>
<td>Medications</td>
<td>Limit calorie intake to no more than 300 calories/day (1.4 g of sodium or less)</td>
</tr>
</tbody>
</table>

Note: lifestyle changes should be tailored to individual needs.

Only half under control

<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary heart disease</td>
<td>Heart disease affecting the blood vesselssupplying the heart muscle</td>
</tr>
<tr>
<td>Stroke</td>
<td>Damage to the blood vessels supplying the brain</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>Chronic damage to the kidneys resulting from kidney disease</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>Failure of the heart to pump blood to the body</td>
</tr>
<tr>
<td>Ocular abnormalities</td>
<td>Visual problems affecting the eyes</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>Damage to the retina affecting vision</td>
</tr>
<tr>
<td>Optic neuropathy</td>
<td>Damage to the optic nerve affecting vision</td>
</tr>
</tbody>
</table>

Pathophysiology of hypertensive retinopathy

- Initial response: vasospasm & an increase in vasoconstrictor tone
  - Generalized retinal-arteriolar narrowing
- Chronic response: Intimal thickening, medial-wall hyperplasia, hyaline degeneration
  - Diffuse and focal areas of arteriolar narrowing, silver or copper wiring
  - Arteriovenous nipping or nicking
- Late response: blood-retinal barrier breaks down
  - Hemorrhages, exudates, cotton-wool spots, disc swelling

<table>
<thead>
<tr>
<th>Condition</th>
<th>Typical manifestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV Nicking</td>
<td>Arching of the retinal vein</td>
</tr>
<tr>
<td>Arching</td>
<td>Table 1 Distribution of observed vascular patterns according to anatomical relationship of artery and vein at sites of arteriolar occlusions (please refer to Table 1)</td>
</tr>
</tbody>
</table>
Classification of Hypertensive Retinopathy

Table 1. Classification of Hypertensive Retinopathy on the Basis of Recent Population-Based Data.

<table>
<thead>
<tr>
<th>Grade of Retinopathy</th>
<th>Retinal Signs</th>
<th>Systemic Associations</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>No detectable signs</td>
<td>None</td>
</tr>
<tr>
<td>Mild</td>
<td>Generalized arteriolar narrowing, focal arteriolar narrowing, arteriolar retinal aneurysm (&quot;copper wire&quot;) of arteriolar wall, or a combination of these signs</td>
<td>Mild association with risk of cardiovascular disease, cerebrovascular disease, heart failure, and death</td>
</tr>
<tr>
<td>Moderate</td>
<td>Hemorrhage (dot, disc, or flame-shaped), microaneurysms, cotton-wool spot, hard exudate, or a combination of these signs</td>
<td>Strong association with risk of cardiovascular disease, cerebrovascular disease, cognitive decline, and death from cardiovascular cause</td>
</tr>
<tr>
<td>Malignant</td>
<td>Signs of moderate retinopathy plus swelling of the optic disk</td>
<td>Strong association with death</td>
</tr>
</tbody>
</table>

- Prevalence: 2-14%

Associated Ocular Conditions

- Retinal macroaneurysms ~ 80%
- Ocular ischemic syndrome ~ 70%
- Retinal vascular occlusion ~ 50%
- Ischemic optic neuropathy ~ 50%
- Diabetic retinopathy
  - Every 10 mmHg increase in SBP increases risk of retinopathy by 10% and PDR by 15%

Examples of Mild Hypertensive Retinopathy

Examples of Moderate Hypertensive Retinopathy

Example of Malignant Hypertensive Retinopathy

3-year incident stroke

Figure 2: Relation between signs of hypertensive retinopathy and 3-year incident stroke.
HR severity and management

<table>
<thead>
<tr>
<th>Retinopathy</th>
<th>BP</th>
<th>RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>120-139/80-89</td>
<td>1 year</td>
</tr>
<tr>
<td>Moderate</td>
<td>140-159/90-99</td>
<td>3-6 months</td>
</tr>
<tr>
<td>Severe</td>
<td>160-179/100-109</td>
<td>3-6 months, PCP 2-4 weeks</td>
</tr>
</tbody>
</table>

Hypertensive crisis >180/120

<table>
<thead>
<tr>
<th>BP control</th>
<th>RTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent</td>
<td>1-3 mo</td>
</tr>
<tr>
<td>2-7 days</td>
<td></td>
</tr>
<tr>
<td>Urgent</td>
<td>1 mo</td>
</tr>
<tr>
<td>1-2 days</td>
<td></td>
</tr>
<tr>
<td>Emergent-ER</td>
<td>1 mo</td>
</tr>
<tr>
<td>BP control</td>
<td>&lt;2 h</td>
</tr>
</tbody>
</table>

Retinal Vein Occlusion

- A common, sight-threatening retinal-vascular disorder
  - Hemorrhages, CWS, Edema
- CRVO: 0.1-0.4%
  - Ischemic CRVO
  - Non-ischemic CRVO
- BRVO: 0.6-1.1%
  - Hypertension: 5X more likely to have BRVO

Retinal Emboli

- Asymptomatic retinal emboli are fairly common
  - 1.3% and 1.4%
  - 10-year incidence 2.9%
- Transient
- Hypertension: 2X higher risk, 6X higher risk with smoking
- RAO and thromboembolic stroke

Retinal Artery Occlusion

- RAO occurs commonly in patients with HTN
  - Hematological abnormalities and stroke
- Absolute risk of death
  - 8% per year
  - Visible emboli, higher mortality

Retinal Macroaneurysm

- Almost always seen in HTN
- Dilatation, hyperpermeability, rupture
- 20% bilateral
- Visual loss secondary to hemorrhages or exudation

Ischaemic Optic Neuropathy

- Anterior accounts for 90% of cases
  - Sudden visual loss & optic disc edema
- Arteritic form = GCA
- Nonarteritic AION strongly associated with HTN
  - 10.3 per 100,000 people
  - 50% with HTN
  - 25% with DM
Diabetic Retinopathy

- Less tight control (<180/105)
- Tight control (<150/85)
- 37% reduction in microvascular disease,
- 34% reduction in retinopathy progression
- 47% reduction in VA deterioration
- Each 10 mmHg reduction of SBP, the risk of retinopathy might fall by 10%.

Age-related macular degeneration

- Beaver Dam Eye Study
- raised SBP increases the 10-year risk of AMD
- Blue Mountain Study
- focal arteriolar narrowing was associated with AMD signs

Glaucoma

- Impair blood flow to the anterior optic nerve
- Interfere with autoregulation of the posterior ciliary circulation
- Antihypertensive treatment could induce hypotensive episodes

Hypertensive Retinopathy Associated with Preeclampsia

Summary on Hypertensive Retinopathy

- Most patients have primary HTN
- Race, genetics, diet, exercise
- Hypertensive retinopathy
- Other ocular complications
- Eye care providers play an important role

References