Hypertension is a chronic medical condition in which arterial blood pressure is elevated. It affects over 1 billion people worldwide, increasing in prevalence with age. It is one of the most important preventable risk factors for premature death, as it increases the risk of ischaemic heart disease, stroke, peripheral vascular disease, other cardiovascular disease and nephropathy. Grading schemes available for hypertensive retinopathy (Mitchell-Wong Scheme used below: Wong & Mitchell, New England Journal of Medicine, 2004;351(22):2310-7), but recent evidence suggests only a modest association between retinopathy and systemic organ damage.

**Vascular calibre changes** (Mild retinopathy)
- Thickening and loss of elasticity of the arterial wall
- Broadening of light reflex masking the blood vessel column, represents chronic arterial changes

**Copper vs. silver wiring** (A)
- Changes start off as “copper wiring” (slight broadening of light reflex) (top)
- “Silver wiring” represents greater broadening of reflex (more “silver” within the vessel) (bottom)
- May be more useful to quantify broadening
- Can be focal or generalised

**A/V “nicking”** (US) or **“nipping”** (UK) (B)
- Thickened arteriole can impinge upon the retinal veins, leading to potential vein occlusions (below)
- Salus’s sign: Vein deflected by arteriole (yellow)
- Bonnet sign: Vein banked (course changed) (blue)
- Gunn sign: 90 degree vein banked and tapered (black)
- Note: arterial tortuosity is not typically expected due to stiffening, but banking may cause venous tortuosity

**FLAME HAEMORRHAGE**
- Originate from superficial capillary bed or radial parapapillary capillaries
- Appearance due to RNFL orientation
- Resolves in around 6 weeks

**COTTON WOOL SPOTS** (Moderate retinopathy)
- Due to ischaemia of the RNFL
- Disruption of axoplasmic flow manifests as a grey-white lesion along the RNFL bundles
- Usually appears within 3 disc diameters of the ONH
- Typically resolves in 5-7 weeks
- May have resultant microvascular infarcts with loss of retinal tissue and visual field changes

**DOT/BLOT HAEMORRHAGE**
- Originate from deep capillary bed (INL, ONL, or OPL)
- Displaces retinal structures, takes longer to resolve

**Optic neuropathy “hypertensive papillopathy”** (Malignant retinopathy)
- In acute hypertension, vasoconstriction and choroidal ischaemia results in optic neuropathy and oedema (blue arrow) as a result of axoplasmic flow stasis, due to the lack of autoregulation of choroidal vasculature (this is because the ONH blood supply is through the short posterior ciliary arteries)
- In the chronic phase, the oedema resolves, leaving ONH pallor/atrophy
- Strongly associated with hypertensive emergency (BP: systolic ≥180 or diastolic ≥110, and should be managed as such)

**Hard exudates and macular oedema** (Moderate retinopathy)
- Compromised vessels in the macula leak lipids (hard exudates; hyper-reflective on OCT, red arrow) from the deep capillary bed, depositing in the OPL. Deposition within Henle’s fibre layer forms a “macular star”
- Appear white-yellow waxy, with a glitter due to cholesterol
- Leakage also produces macular oedema (hyporeflective on OCT, yellow arrow)

**Optic neuritis** (Rare; follows acute hypertensive crisis: systolic ≥180 mmHg)
- Elschnig spots (right)
  - Changes in RPE due to choriocapillaris infarcts
  - Appear as small, black atrophic spots, surrounded by yellow haloes
  - Accelerated hypertension causes choroidal ischaemia
- Siegrist streaks (right)
  - Linear hyperpigmented streaks over choroidal arteries
  - Indicative of fibrinoid necrosis, which then leads to fibrinous exudation

**SEQUELAE OF HYPERTENSION IN THE EYE**

**Hard exudates and macular oedema** (Moderate retinopathy)
- Venous: due to impingement by thickened artery, intraretinally (branch occlusion) or posterior to lamina (central occlusion)
- Check for causative artery

**Vascular occlusions** (right)
- Venous due to compression by thickened artery, intraretinally (branch occlusion) or posterior to lamina (central occlusion)

**Image unavailable, though note that the presence of these are typically accompanied by systemic symptoms and signs**

**Stage 3 (hypertensive emergency)**

- Requires emergency referral to the patient’s general practitioner and/or local hospital, whichever can provide the most urgent care
Chair-side Reference: Hypertension

Hypertension is a commonly seen and self-reported condition in optometric practice. In cases where there are signs of retinopathy, an optometrist should have the skills to screen blood pressure in their office, as part of the core competencies of the profession (Kiely & Slater. Clin Exp Optom. 2014;98:65-89, Appendix 4: 3.8.1). The information below is intended as a guide for measurement of blood pressure status in an optometric practice, and should not be used as a replacement for cardiovascular assessment by a suitably trained general physician and/or cardiologist.

### ESTABLISHING BLOOD PRESSURE STATUS IN YOUR OFFICE

**Entering medical history:**
- +/- hypertension
- Any anti-hypertensive medications?
- Any cardiovascular (DM, cholesterol) co-morbidities?
- Other organ damage? E.g., kidney, heart
- Obesity (BMI ≥30 kg/m²)

**Entering family history:**
- FHx of hypertension and/or cardiovascular co-morbidities
- Cause of death of family members? (esp. if premature (<60 years) death)

**Entering ocular history:**
- Any history of vascular diseases of the eye?
- Any previous injections for the eye?

**NOTE:**
- Optometric office screening of blood pressure should not be a replacement for evaluation by a trained general physician and/or cardiologist
- Blood pressure taken at the arm is just one method for determining blood pressure, and does not exclude other cardiovascular diseases
- Ongoing communication and comanagement with the patient’s general physician is recommended

**Cut-off blood pressure levels for referral to GP:**
- 140-159/90-99: routine referral
- 160-179/100-109: within 2 weeks
- ≥180/110: emergency referral

### TIPS FOR MEASURING BLOOD PRESSURE IN OFFICE

**Equipment:**
- Check to make sure equipment working properly
- Check against another model for accuracy
- Check cuff size appropriate (bladder length should be approximately 80% of arm circumference (note manufacturer recommendation), especially if circumference >30cm)

**Patient:**
- Patient should be well-rested and comfortable prior to exam
- Patient should be seated straight, feet on the ground, with arm supported at heart level
- Similar to blink rate, consider performing blood pressure whilst engaging in relaxing activities

**Measurement:**
- An average of 3 readings should be taken, each 2 minutes apart
- Sleeves should not be rolled tightly; if thin clothing, screening blood pressure can be taken over the top, otherwise, removal of sleeved clothing should be considered

**STABLE**
- Measure in-office BP*
- BP <180/110
- BP ≥180/110

**Immediate referral to GP and/or local hospital (whichever sooner) and ophthalmologist**
- Irrespective of BP**
- Refers to ophthalmologist urgently (same day if possible) to rule out potentially sinister pathologies that may present similarly

**NOTE:**
- Optometric office screening of blood pressure should not be a replacement for evaluation by a trained general physician and/or cardiologist
- Blood pressure taken at the arm is just one method for determining blood pressure, and does not exclude other cardiovascular diseases
- Ongoing communication and comanagement with the patient’s general physician is recommended

**Patient:**
- Has HTN been diagnosed?
- Is BP well-controlled?
- Is the patient low-risk (no other risk factors/comorbidities?)

**YES**
- Routine eye exam every 6-12 months and ongoing communication with GP

**NO**
- Communicate with associated practitioners and titrate a scheduled review as appropriate

**STABLE**
- Maintain specialist care until stable

**Additional notes:**
- * If in-office BP measurement unavailable or cannot be performed, prompt referral to GP is recommended
- ** These ophthalmic signs may not just be due to hypertensive retinopathy (e.g. papilledema), hence, urgent referral is warranted

### Management tree when seeing signs suggestive of hypertensive retinopathy

**Noted on clinical examination:**
- Arteriolar narrowing
- A/V crossing changes
- Copper or silver wiring
- Cotton wool spots
- Flame haemorrhages

**Measure in-office BP***

**BP <180/110**

**BP ≥ 180/110**

**Consult with GP**
- Has HTN been diagnosed?
- Is BP well-controlled?
- Is the patient low-risk (no other risk factors/comorbidities?)

**YES**
- Routine eye exam every 6-12 months and ongoing communication with GP

**NO**
- Communicate with associated practitioners and titrate a scheduled review as appropriate

**STABLE**
- Maintain specialist care until stable

**Immediate referral to GP and/or local hospital (whichever sooner) and ophthalmologist**

**Refer to ophthalmologist urgently (same day if possible) to rule out potentially sinister pathologies that may present similarly**

**Acknowledgements:** Dr Katherine Kalloniatis and Dr Chris Gilbert for their advice regarding measuring blood pressure and medical review periods

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Chair-side Reference: Hypertension

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