



# My cat is blind!

Feline retinal disease  
with focus on hypertensive retinopathy

Feline central blindness

Louise Baadsgaard Bruun  
DVM, ESE, MS CACS Ophth

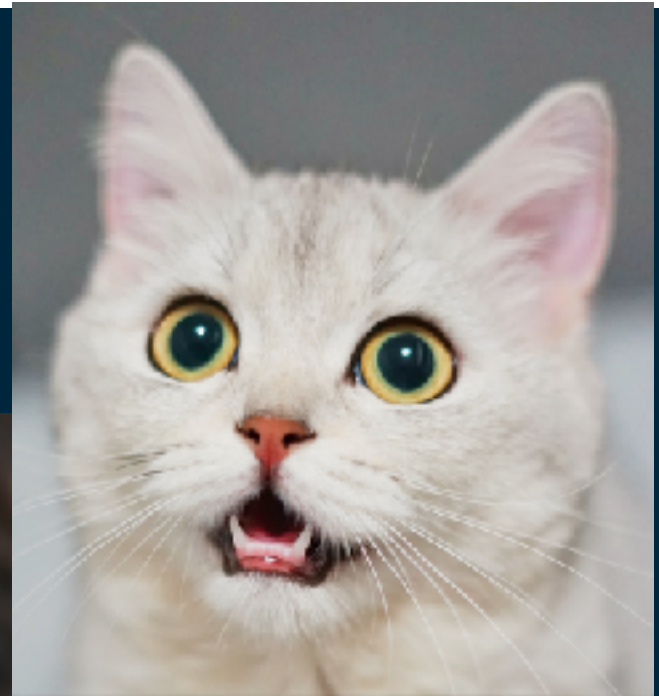
# Lecture outline



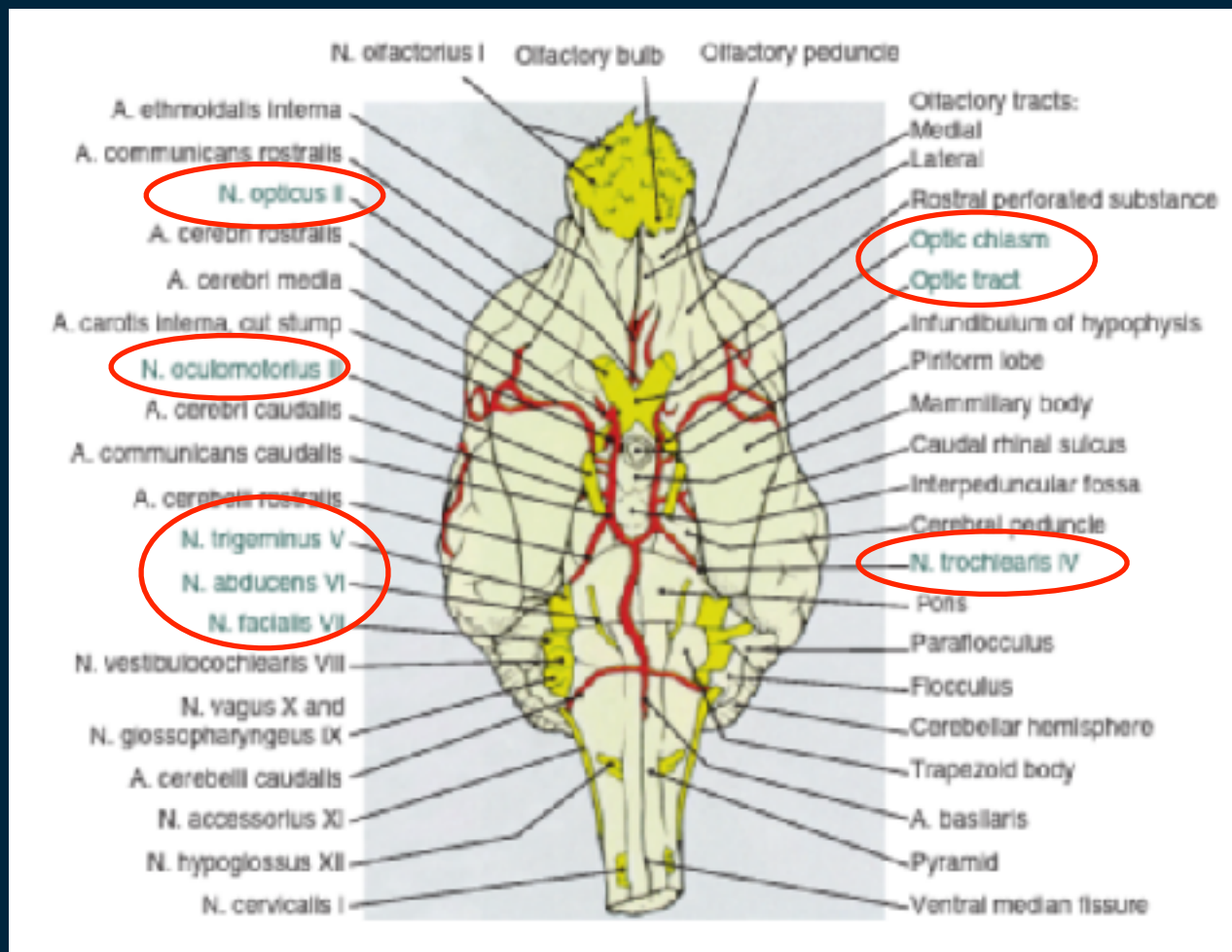
- ▀ Acute blindness
  - ▀ Symptoms
  - ▀ Neuro-ophthalmology work-up
- ▀ Hypertensive retinopathy
- ▀ Feline central blindness
- ▀ Caring for a blind cat
- ▀ Take home messages

# Symptoms

- ▀ Acute blindness
- ▀ Often bilateral (unilateral goes undetected)
- ▀ Change of behaviour
- ▀ Disorientation
- ▀ Feline pupil shape in light: vertical split -> sudden mydriasis -> apparent change in cats
- ▀ Sympathic nervous system strong in cats -> “fight or flight” -> Mydriasis



# Important cranial nerves



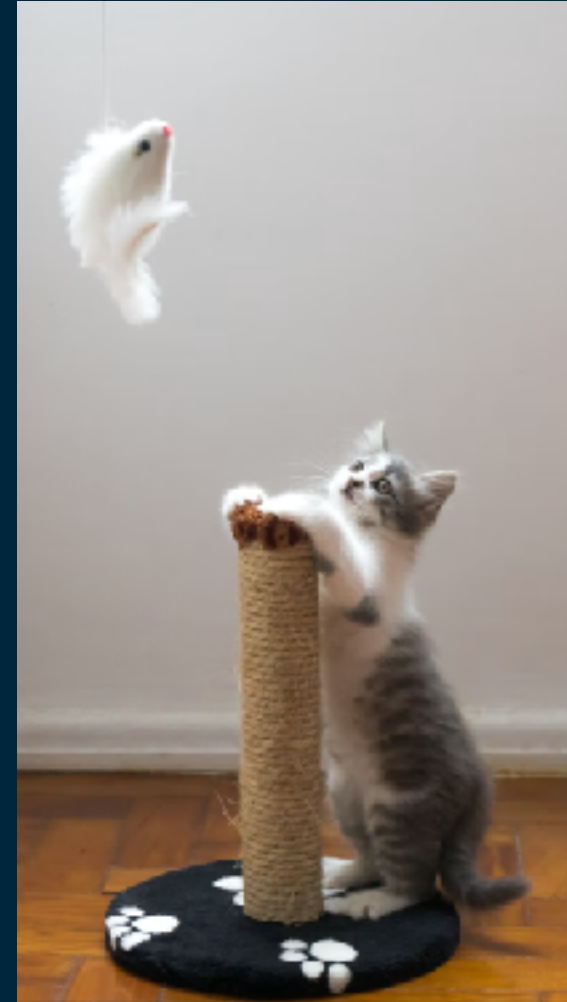
Slatter's Fundamentals of Veterinary Ophthalmology

## ▀ Cranial nerves with direct relation to the eye

- ▀ CNII - N. opticus (afferent)
- ▀ CNIII - N. oculomotorius (efferent/parasympathic)
- ▀ CNIV - N. trochlearis (efferent)
- ▀ CNV – N. trigeminus (afferent/sensation/(motor))
- ▀ CNVI – N. abducens (efferent)
- ▀ CNVII - N. facialis (efferent/parasympathic)
- ▀ CNVIII - N. vestibulocochlearis (afferent)
- ▀ CNX – N. vagus (sympathic trunk)

# Examination - Vision

- ▮ Full history
- ▮ Conscious perception of vision - hands off
- ▮ Behavior
- ▮ Activity
- ▮ Alertness
- ▮ Response to stimuli
- ▮ General clinical exam - the body is attached to the eyes -> detection of related problems



# Examination - Vision



- ▀ Visually-guided paw placement
- ▀ Tracking test , cotton ball -> test each visual field, repeat test
- ▀ Laser pointers in feline patients
- ▀ Maze test? Often inconclusive in cats
- ▀ Menace response (unilateral/bilateral blindness)
  - ▀ Learned response
  - ▀ Cover the opposite eye
  - ▀ Avoid touching facial hairs
  - ▀ Requires clear ocular media
  - ▀ Intact N. facials (CN VII) (and N. abducens CN VI)
  - ▀ Intact cerebellum
  - ▀ Learned response, kittens will have a positive response at 10-12 weeks of age



# Laser pointer



# Neuroophthalmology - key points

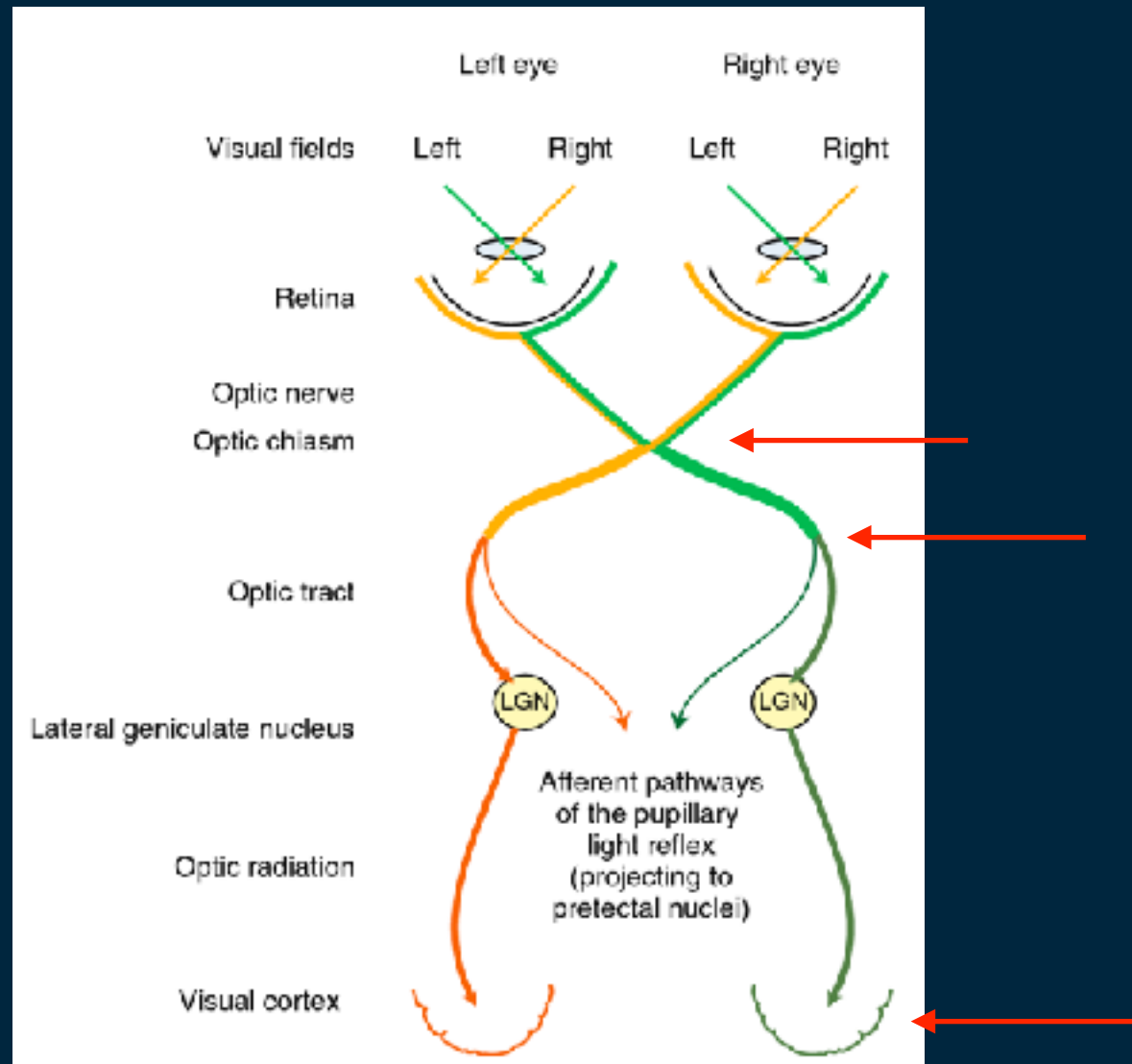
- ▮ Eye-brain pathway -> Vision requires functional eyes, optic nerve, optic tract and visual cortex
- ▮ Lesion localization
- ▮ Neuro-ophthalmic examination
  - ▮ Isocoria/anisocoria/dyscoria
  - ▮ PLR
    - ▮ Direct, ipsilateral pupil
    - ▮ Indirect, contralateral
    - ▮ Requires intact/functional iris
    - ▮ Swinging flashlight test
  - ▮ Dazzle reflex
  - ▮ Corneal and palpebral reflex



PLR does NOT test vision



Cross over in cats: 65 %  
Direct PLR greater than indirect



Slatter's Fundamentals of Veterinary Ophthalmology

Table 16-1 | Neuroophthalmic Reflexes and Responses

REFLEX	STIMULUS	RECEPTOR	AFFERENT NEURON	INTERNEURON	EFFERENT NEURON	EFFECTOR	RESPONSE
PLR	Light	Photoreceptors	II	Subcortical	III	Iris sphincter	Constrict pupil
Menace response	Hand motion	Photoreceptors	II	Cortical cerebellum	VII	OOM	Blink
Dazzle	Bright light	Photoreceptors	II	Subcortical	VI	RBM	Retract globe
Palpebral	Touch lids	Touch receptors skin	V (Ophth)	Subcortical	VII	OOM	Blink
Corneal	Touch cornea	Touch receptors cornea	V (Ophth)	Subcortical	VII	OOM	Blink
Doll's eye (VOR)	Head motion	Semicircular canals	VIII	Subcortical cerebellum	VI	RBM	Retract globe
					III, IV, VI	Extraocular muscles	Maintain line of sight

OOM, orbicularis oculi muscle; Ophth, Ophthalmic branch of the trigeminal nerve; PLR, pupillary light reflex; RBM, retractor bulbi muscles; VOR, vestibuloocular reflex.

Slatter's Fundamentals of Veterinary Ophthalmology

*Menace response: Cortical response -> does not test visual acuity*

*PLR and dazzle: Subcortical, reflex -> do not test vision*

# Eye or brain?



## Peripheral blindness

- Eye, N. opticus (CNII), optic chiasm or proximal optic tract

## Central blindness

- Distal optic tract, lateral geniculate nucleus, optic radiation, cerebral visual cortex

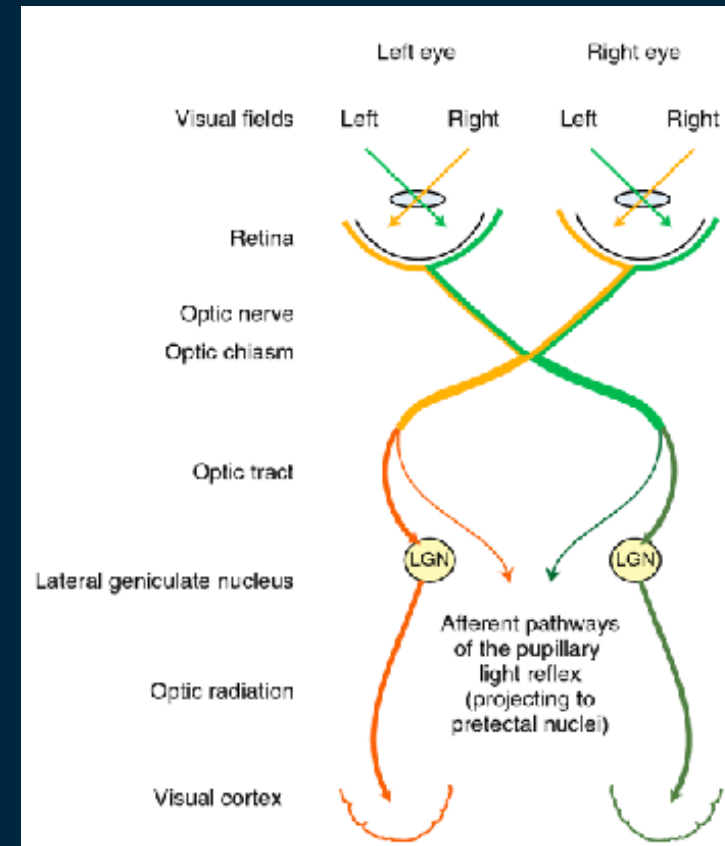
Blind cats with normal PLRs

Blind cats with abnormal PLRs

Visual cats with abnormal PLRs

True menace negative

Menace positive



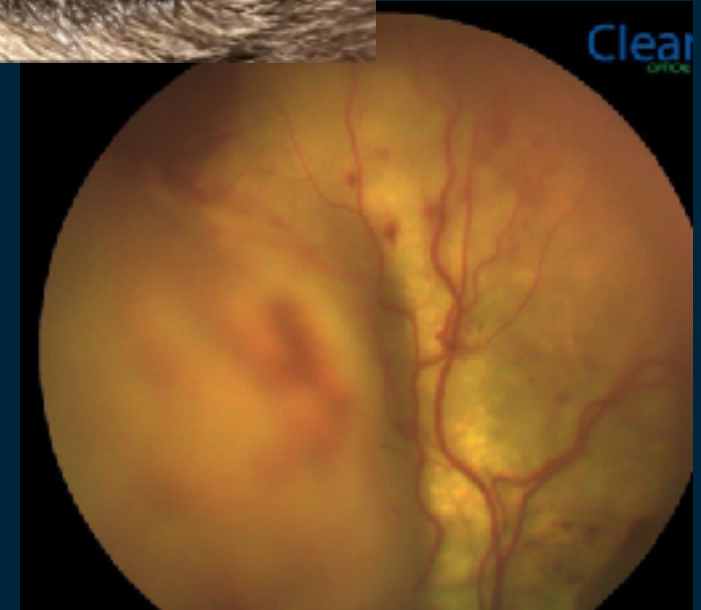
▀ Bilateral blindness in cats: Most common related the eye!

▀ Lesions in four different locations

1. Opacification of the clear ocular media
2. Failure of the retina to process the image
3. Impediment of transmission or relay of the message through the visual pathways  
(afferent neurons: N. Opticus, Chiasm, Optic tract)
4. Failure of the final processing of the image in the visual cortex

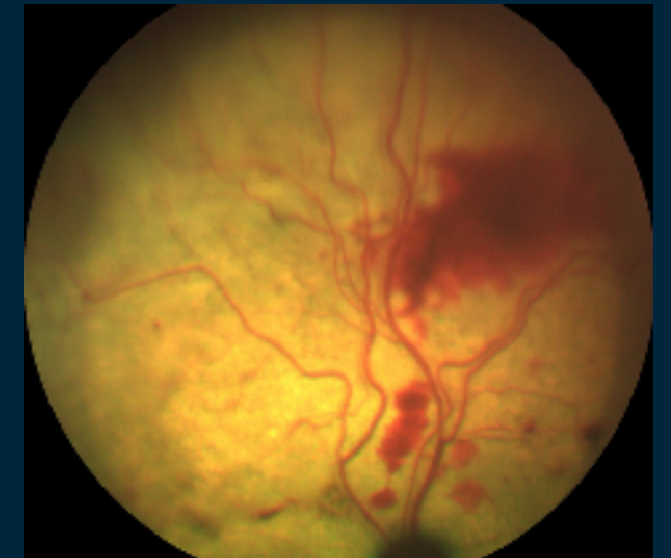
▀ Menace negative but visual?

Problems in the efferent neurons (midbrain, cerebellum, brainstem, n. facialis (CN VII) or n. abducens (CN VI))



# Ophthalmic examination

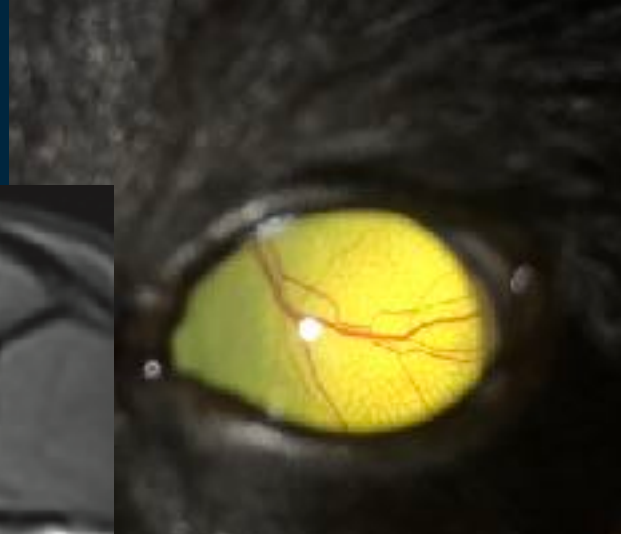
- ▀ Adnexa, cornea, AC and iris, lens, vitreous
  - ▀ Slit lamp
- ▀ Fundus
  - ▀ Indirect ophthalmoscopy, direct ophthalmoscope, panoptic
- ▀ Tonometry
- ▀ U/S
- ▀ ERG in cats? Majority of retinal diseases will cause visible ophthalmoscopic abnormalities



# Blind cat with abnormal PLR

## Unilateral lesions

- ▀ Retinal detachment
- ▀ Glaucoma
- ▀ Retrobulbar abscess or neoplasia
- ▀ ON trauma



## Bilateral lesions

- ▀ Retinal diseases
  - ▀ Retinal detachment
  - ▀ Hypertensive retinopathy
  - ▀ End-stage inherited retinopathies (PRA)
  - ▀ Chorioretinitis
  - ▀ Retinal degeneration (Taurin deficiency, enrofloxacin)
  - ▀ Retinopathy (Ivermectin toxicosis)
  - ▀ Trombocytopenia
- ▀ Glaucoma
- ▀ Optic neuritis
- ▀ ON trauma
- ▀ Neoplasia (Optic nerves, optic tracts, optic chiasm)
- ▀ Central pathology (intracranial pressure)

Primary Ophthalmology (2015) 11, 307-318

Acute postretinal blindness: ophthalmologic, neurologic, and magnetic resonance imaging findings in dogs and cats (seven cases)

Cristina Sanchez,\* Sergio Rodríguez,† Marta Latorre,\* Teresa Peña\* and Simón Arturç

# Feline uveitis and blindness



## ▀ Uveitis causes

- ▀ Chorioretinitis, bilateral -> FIV, FeLV, FIP, Toxoplasmosis , fungal diseases, idiopathic
- ▀ Chorioretinitis uveitis, unilateral -> neoplasia

## ▀ Uveitis - complications

- ▀ Cataract (lens depends on aqueous humor for metabolic support)
- ▀ Secondary glaucoma (Obstruction of ICA by cells and debris, synechia, iris bombé)
- ▀ Blindness (Retinal detachment, retinal degeneration)

# Anatomy

## 1. Outer fibrous layer

Sclera, cornea, limbus

## 2. Middle vascular layer - Uvea

Anterior: Iris and ciliary body

Posterior: Choroid

## 3. Inner neurosensory layer

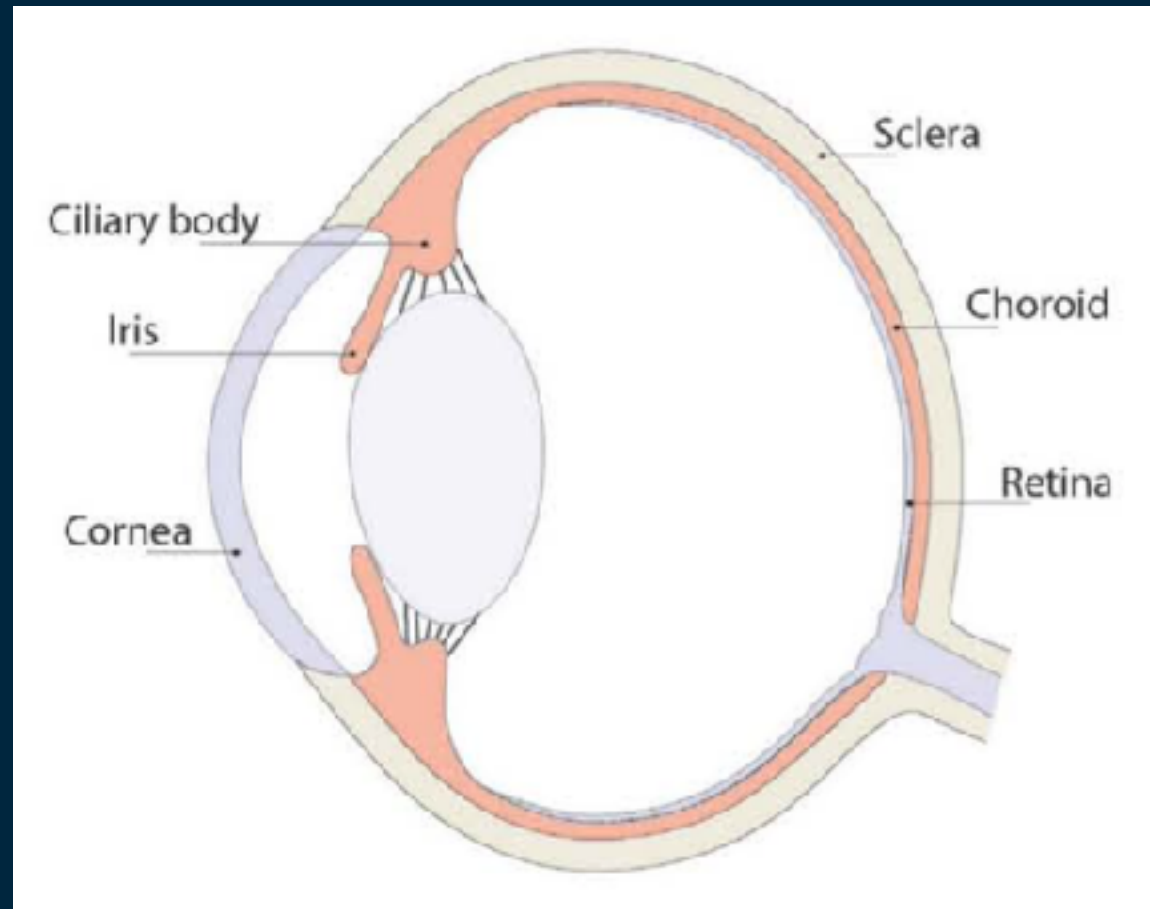
Retina, optic nerve head (ONH)

## 4. Inner optic media

Aqueous humor

Lens

Vitreous



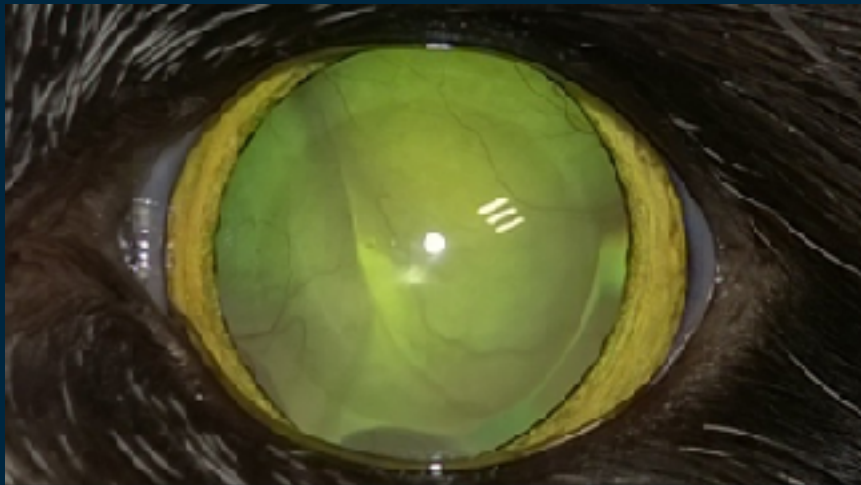
Ref.: Journal of Feline Medicine and Surgery (2009), 11, 167-182

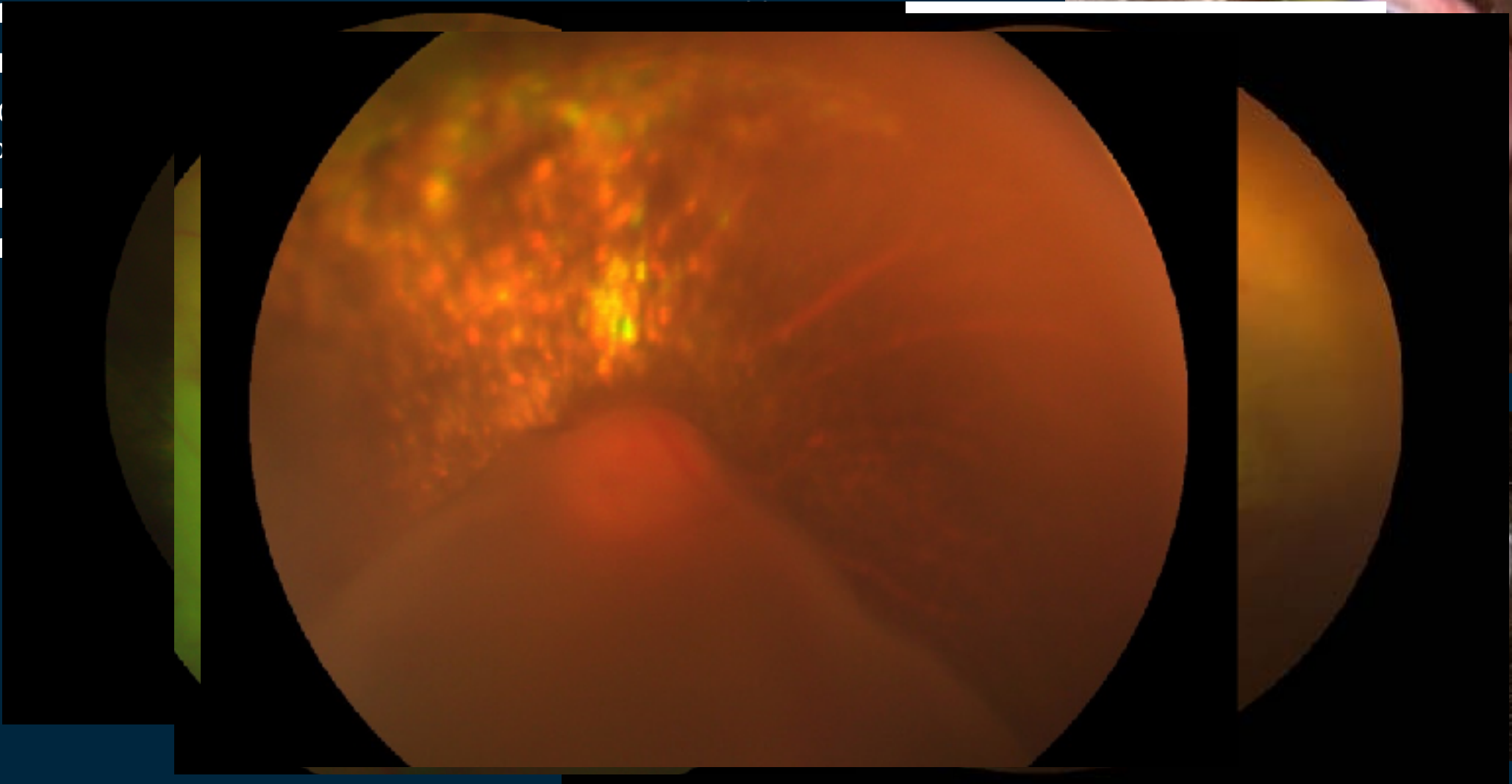
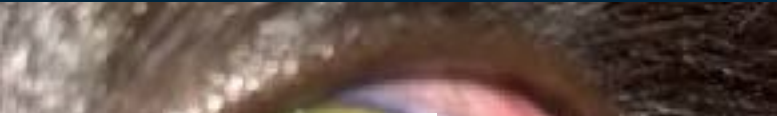


# Hypertensive retinopathy



- ▀ Older cats (> 10 years old)
- ▀ Sudden bilateral blindness
- ▀ Fixed and dilated pupils, abnormal PLR
- ▀ Retinal detachment, retinal bleeding
  - ▀ Initially edema and petechia
- ▀ Hyphema, vitreal hemorrhage
- ▀ Systemic symptoms related to kidney, heart, eye and brain (TOD), beha(glomerular sclerosis and interstitial fibrosis, hypertrophy of the left ventricle, intracranial haemorrhage and retinal detachment).
- ▀ 40-65 % of cats with systemic hypertension will develop retinopathy



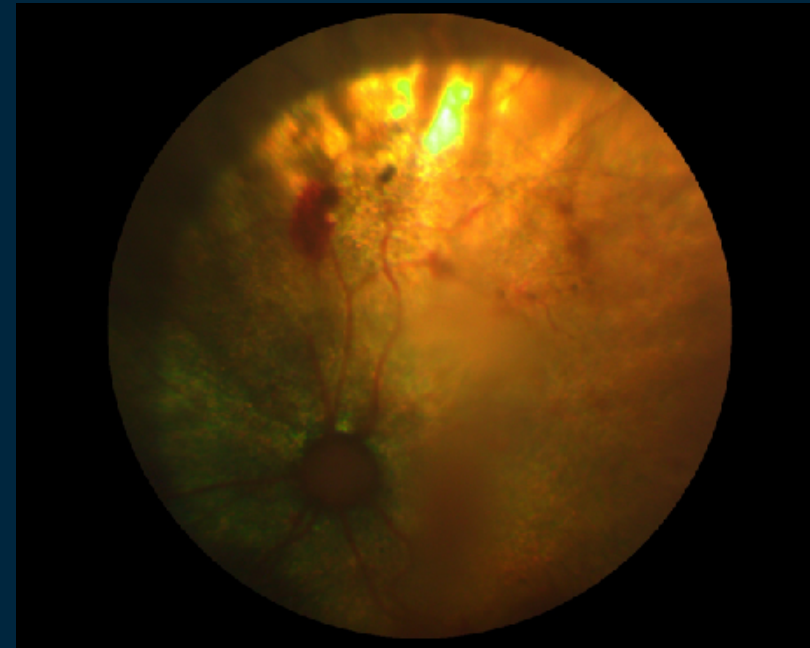




- ▀ Ultrasound of the eye
  - ▀ Retinal detachment - seagull sign
  - ▀ Especially useful in severe corneal edema, hyphema, cataract ect

# Ethiology

- ▮ Increased intravascular hydrostatic pressure
  - ▮ Primary/Idiopathic systemic hypertension (20 %)
  - ▮ Often secondary to other disease (80 %)
    - ▮ Chronic Kidney Disease (CKD)
    - ▮ Hyperthyroidism
    - ▮ Primary Hyperaldosteronism (PHA)
    - ▮ Hyperadrenocorticism (HAC)
    - ▮ Pheochromocytoma
    - ▮ Diabetes mellitus?

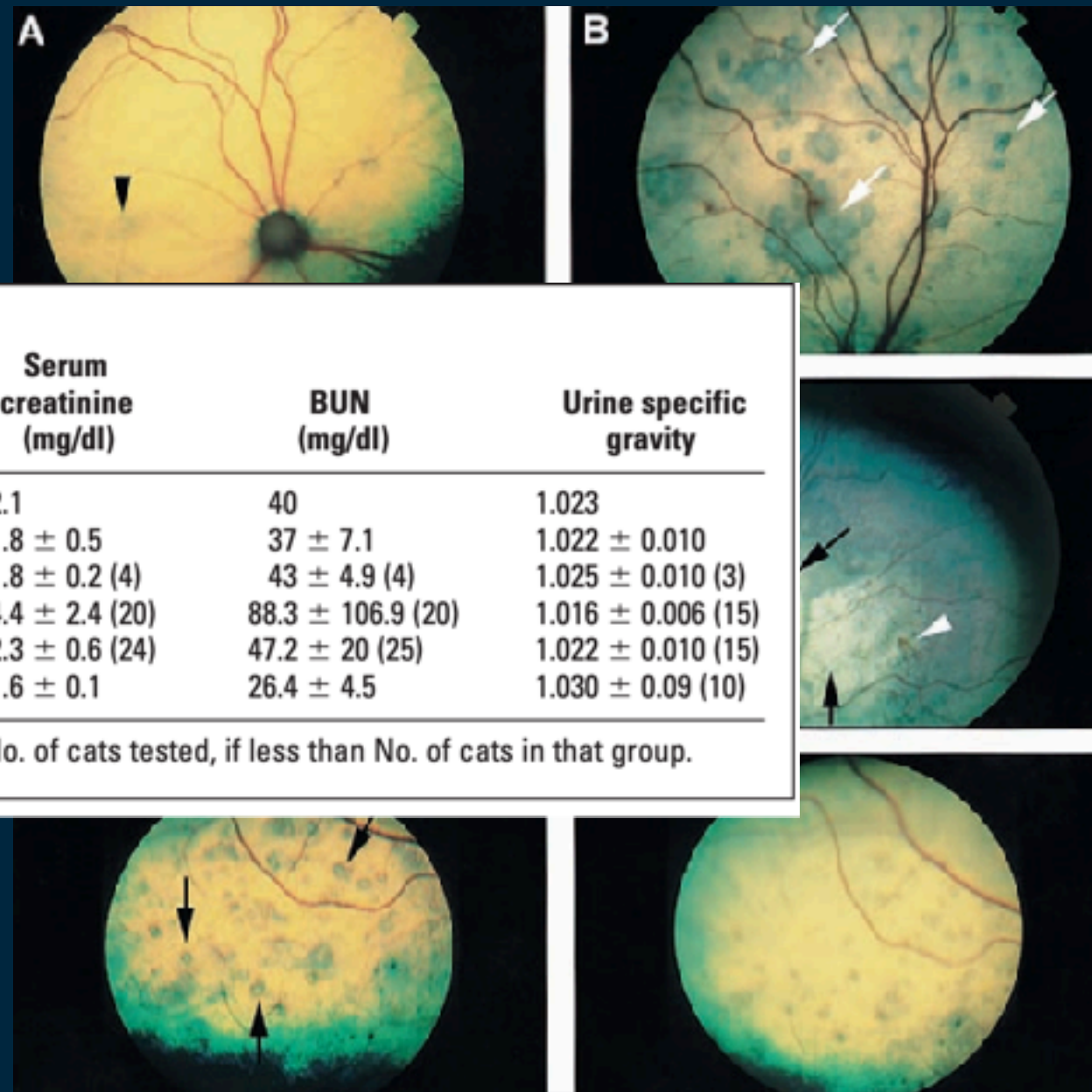


19-65% of cats with CKD have systemic hypertension  
Not affected by severity of CKD

10-23% of cats with hyperthyroidism have hypertension  
25% normotensive will develop hypertension

# Ocular lesions associated with systemic hypertension in cats: 69 cases (1985–1998)

Federica Maggio, DVM; Teresa C. DeFrancesco, DVM, DACVIM; Clarke E. Atkins, DVM, DACVIM; Stefano Pizzirani, DVM; Brian G. Gilger, DVM, MS, DACVO; Michael G. Davidson, DVM, DACVO



68%

Clinical finding

Hyperaldosteronism

Diabetes mellitus

Hyperthyroidism

Chronic renal failure

Mild azotemia

Normal renal function

54%

29%

Idiopathic

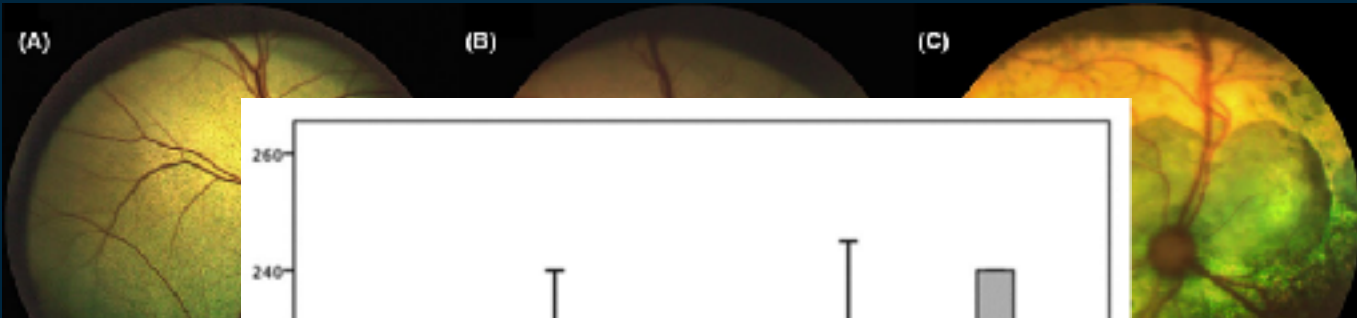
Bilateral 88% (different severity)

Mean indirect SBP  $232.8 \pm 37.7$  mmHg

93% cats were > 10 years of age

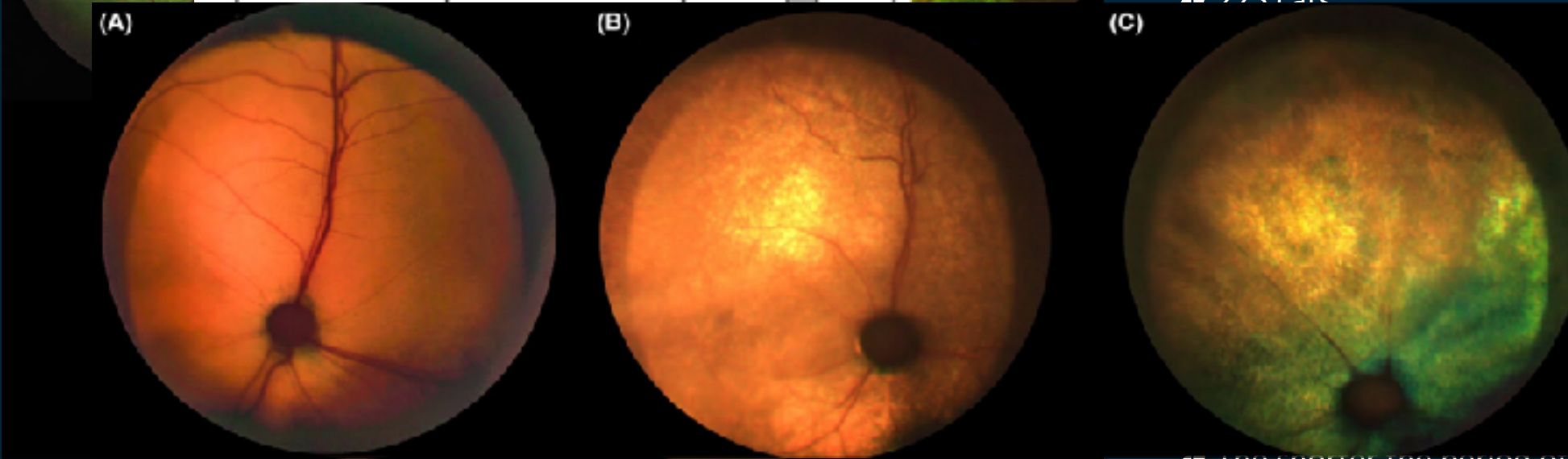
Clinical finding	No. of cats	Systolic blood pressure (mm Hg)	Serum creatinine (mg/dl)	BUN (mg/dl)	Urine specific gravity
Hyperaldosteronism	1	230	2.1	40	1.023
Diabetes mellitus	2	$190 \pm 0$	$1.8 \pm 0.5$	$37 \pm 7.1$	$1.022 \pm 0.010$
Hyperthyroidism	5	$223.1 \pm 24.9$	$1.8 \pm 0.2$ (4)	$43 \pm 4.9$ (4)	$1.025 \pm 0.010$ (3)
Chronic renal failure	22	$232.5 \pm 40.8$	$4.4 \pm 2.4$ (20)	$88.3 \pm 106.9$ (20)	$1.016 \pm 0.006$ (15)
Mild azotemia	26	$240.1 \pm 39.8$	$2.3 \pm 0.6$ (24)	$47.2 \pm 20$ (25)	$1.022 \pm 0.010$ (15)
Normal renal function	12	$230 \pm 34.3$	$1.6 \pm 0.1$	$26.4 \pm 4.5$	$1.030 \pm 0.09$ (10)

Data are mean  $\pm$  SD values. Values in parentheses indicate No. of cats tested, if less than No. of cats in that group.



**Ocular fundus abnormalities in cats affected by systemic hypertension: Prevalence, characterization, and outcome of treatment**

Alessandro Ciria<sup>1</sup> | Michele Drigo<sup>2</sup> | Valentina Andreani<sup>2</sup> | Giovanni Barsotti<sup>1</sup>



6%  
 hyperthyroidism 29%

removed fundus  
 rises at the 21-day

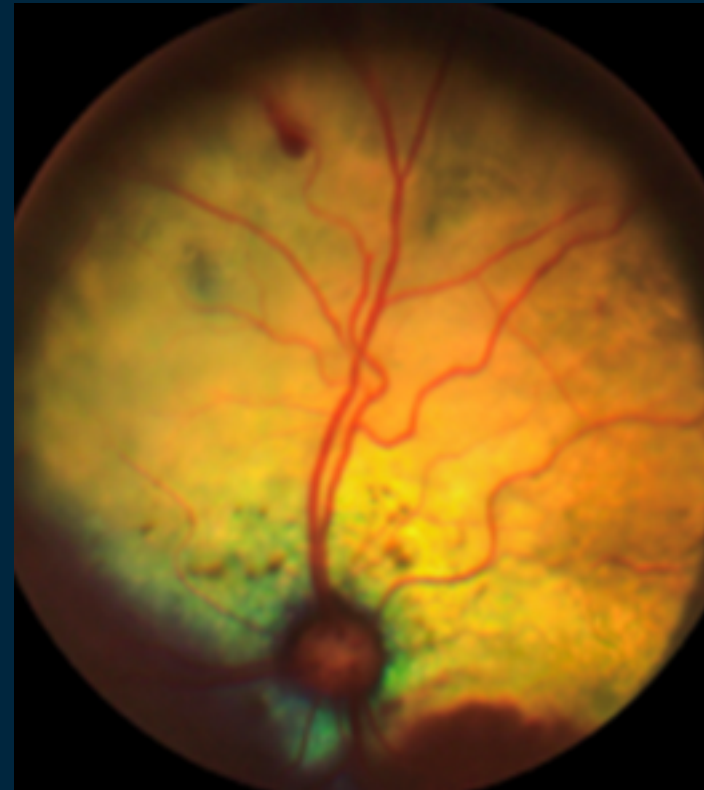
prognosis 53% visual

- ▀ The shorter the period of retinal detachment the better prognosis
- ▀ SBP correlated with severity of signs and age

## Visual outcome in cats with hypertensive chorioretinopathy

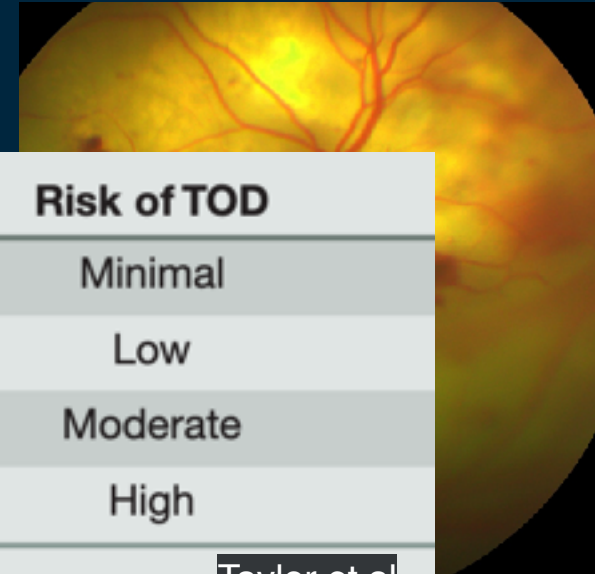
Whitney M Young<sup>1</sup> | Chaowen Zheng<sup>2</sup> | Michael G Davidson<sup>1</sup> | Hans D Westermeyer<sup>1</sup>

- ▀ 88 cats
- ▀ 61% cats blind
- ▀ 58% eyes regained vision
  - ▀ 51% in < 3 weeks
  - ▀ 29% in 3 weeks - 60 days
  - ▀ 20% > 60 days
- ▀ Complete retinal reattachment in 72% of eyes
- ▀ Amlodipin 0,625 or 0,125 mg
- ▀ Visual eyes at presentation good prognostic indicator!



# Diagnostic work-up

- ▮ Blod analysis
  - ▮ CBC, biochemistry, electrolytes
  - ▮ TT4
- ▮ Urin analysis inc
- ▮ Additional: U/S
- ▮ Indirect blood p
- ▮ SBP > 160 mmH
- ▮ Stress induced h
- ▮ SBP increases w
- ▮ Hypertensive re



SBP (mmHg)	Category	Risk of TOD
<150	Normotensive	Minimal
150–159	Borderline hypertensive	Low
160–179	Hypertensive	Moderate
≥180	Severely hypertensive	High

SBP = systolic blood pressure; TOD = target organ damage

Taylor et al



# Blood pressure



Taylor et al



Doppler

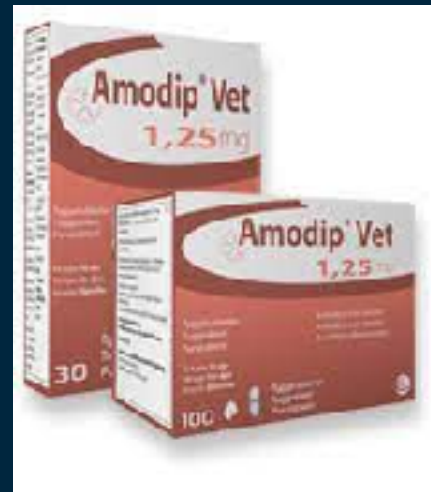
- ▀ Acclimatisation period in calm quiet room for 10 minutes, owner present Feliway diffusor. Heart rate?
- ▀ Cuff width: 30-40% of the circumference of the extremity (too big -> SBP low, too small -> SBP high)
- ▀ Reduce bias: Same technique, same person, same equipment, same place (leg, tail)
- ▀ 5-7 readings with 1 minute interval
- ▀ Discharge first reading
- ▀ Oscillometric measurement

**A comparison of CAT Doppler and oscillometric Memoprint machines for non-invasive blood pressure measurement in conscious cats**

Rosanne E Jepson<sup>1</sup>, Vivien Hartley, Michael Mendl, Sarah M E Caney, David J Gould

# Treatment Hypertensive Retinopathy

- ▀ Manage underlying disease
- ▀ Amlodipine (Amodip®) 0,625-1,25 mg/cat SID. If SBP > 200 mmHg use the higher end of the dose range
- ▀ If UPC > 0,4 or persistent hypertension → Telmisartan (Semintra®) 1,5-2,0 mg/kg SID
- ▀ ACE inhibitor (Benazepril – Fortekor® 0,25-0,5 mg/kg SID/BID)? Monitor electrolytes
- ▀ Steroids?



# Monitoring

- ▀ SBP > 200 mmHG and sign of TOD: Reevaluate after 24-72 hours, some cats needs hospitalisation
- ▀ No sign of TOD: Reexam after 7-10 days - ocular examination, clinical exam, lab
  - ▀ Goal: SBP 110-150 mmHG
  - ▀ If SBP > 150-160 mmHG
    - ▀ Increase dose of Amlodipin - can be doubled up to a maximum of 2.5 mg/cat
    - ▀ UPC > 0,4 Telmisartan add-on (Semintra® 4 mg/ml or 10 mg/ml)
    - ▀ ACE inhibitor ?
    - ▀ OR consider switching to the alternative drug
- ▀ Reexamination after again after 1 week
  - ▀ If SBP <150 mmHg monitor every 3-4 weeks initially and later on 6-8 weeks, interval can be increased to 3 months



# Prognosis



- ▀ SBP elevated -> Risk of Target Organ Disease (TOD)
- ▀ Many cats with severe hypertensive retinopathy and complete retinal detachments and/or intraocular haemorrhage -> irreversible damage
- ▀ Severe hyphema can lead to glaucoma
- ▀ Pathology not associated with an impaired menace response or abnormal PLR -> better prognosis for vision
- ▀ Early diagnosis and treatment of elevated SBP!

- ▀ Geriatric cats - base-line in young cats?
- ▀ Always SBP measurement in kidney disease (IRIS staging) and hyperthyrodism



## ISFM Consensus Guidelines on the Diagnosis and Management of Hypertension in Cats

Samantha S Taylor<sup>1</sup>, Andrew H Sparkes<sup>1</sup>, Katherine Briscoe<sup>2</sup>, Jenny Carter<sup>3</sup>,  
Salva Cervantes Sala<sup>4</sup>, Rosanne E Jepson<sup>5</sup>, Brice S Reynolds<sup>6</sup>, Brian A Scansen<sup>7</sup>

[J Vet Intern Med.](#) 2018 Nov-Dec; 32(6): 1803–1822.

PMCID: PMC6271319

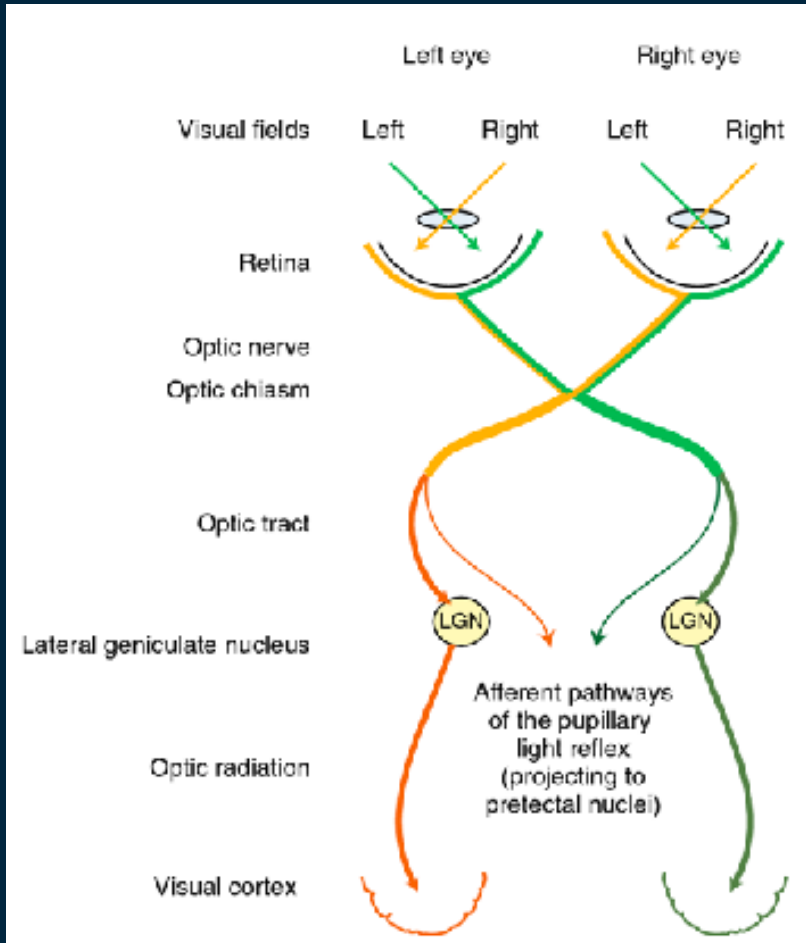
Published online 2018 Oct 24. doi: [10.1111/jvim.15331](https://doi.org/10.1111/jvim.15331)

PMID: [30353952](https://pubmed.ncbi.nlm.nih.gov/30353952/)

ACVIM consensus statement: Guidelines for the identification, evaluation, and management of systemic hypertension in dogs and cats

Mark J. Aciemo,<sup>1,1</sup> Scott Brown,<sup>2</sup> Amanda E. Coleman,<sup>2</sup> Rosanna E. Jepson,<sup>3</sup> Mark Parich,<sup>4</sup> Rebecca L. Stepien,<sup>5</sup>  
and Harriet M. Syme<sup>3</sup>

# Blind cat with normal PLR

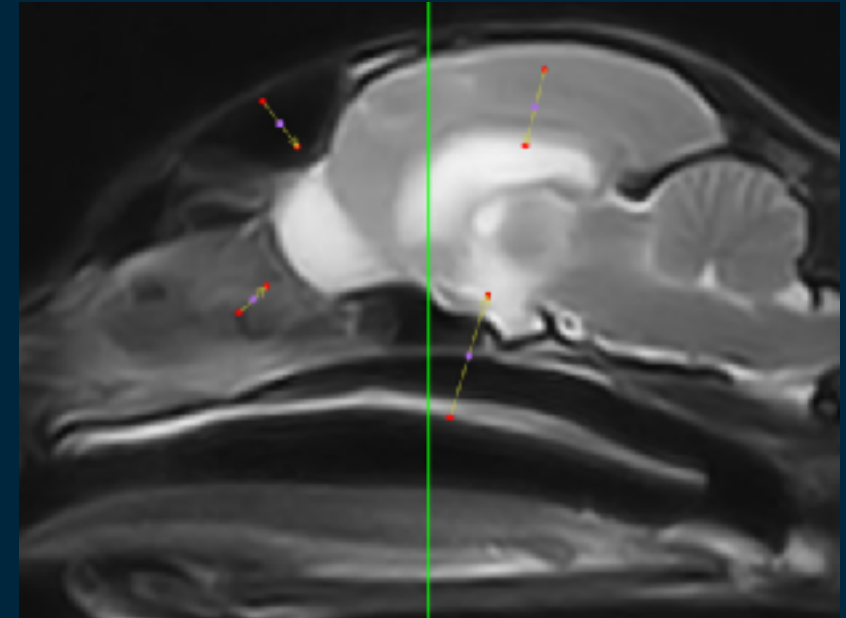


## Blind cats with normal PLR - localization

- ▀ Distal optic tract
- ▀ LGN
- ▀ Optic radiations
- ▀ Cerebral visual cortex

## Blind cats with normal PLR - Causes

- ▀ **Bilateral**
  - ▀ Contusion, edema (following trauma, postictal/anesthesia, neoplasia)
  - ▀ Multifocal CNS disease (FIP)
  - ▀ Poisonings
- ▀ **Unilateral**
  - ▀ Neoplasia
  - ▀ Infarction
  - ▀ Toxoplasma granulomas



# Blind cat with normal eye exam - Work-up



- ▀ Neurologic examination
- ▀ Blod and urine test
- ▀ Advanced imaging - CT/MRI
- ▀ CSF analysis
- ▀ Post-retinal blindness as the only neurologic deficit in cats are rare!

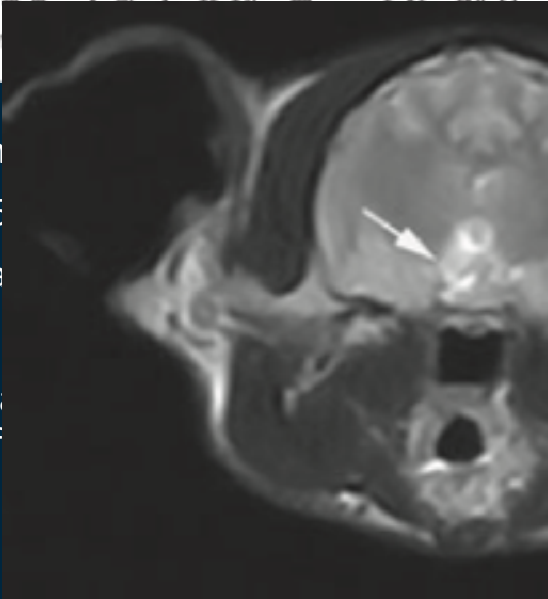


Look beyond the eyes

### Feline Intracranial Neoplasia: Retrospective Review of 160 Cases (1985-2001)

Mark  
Beltran

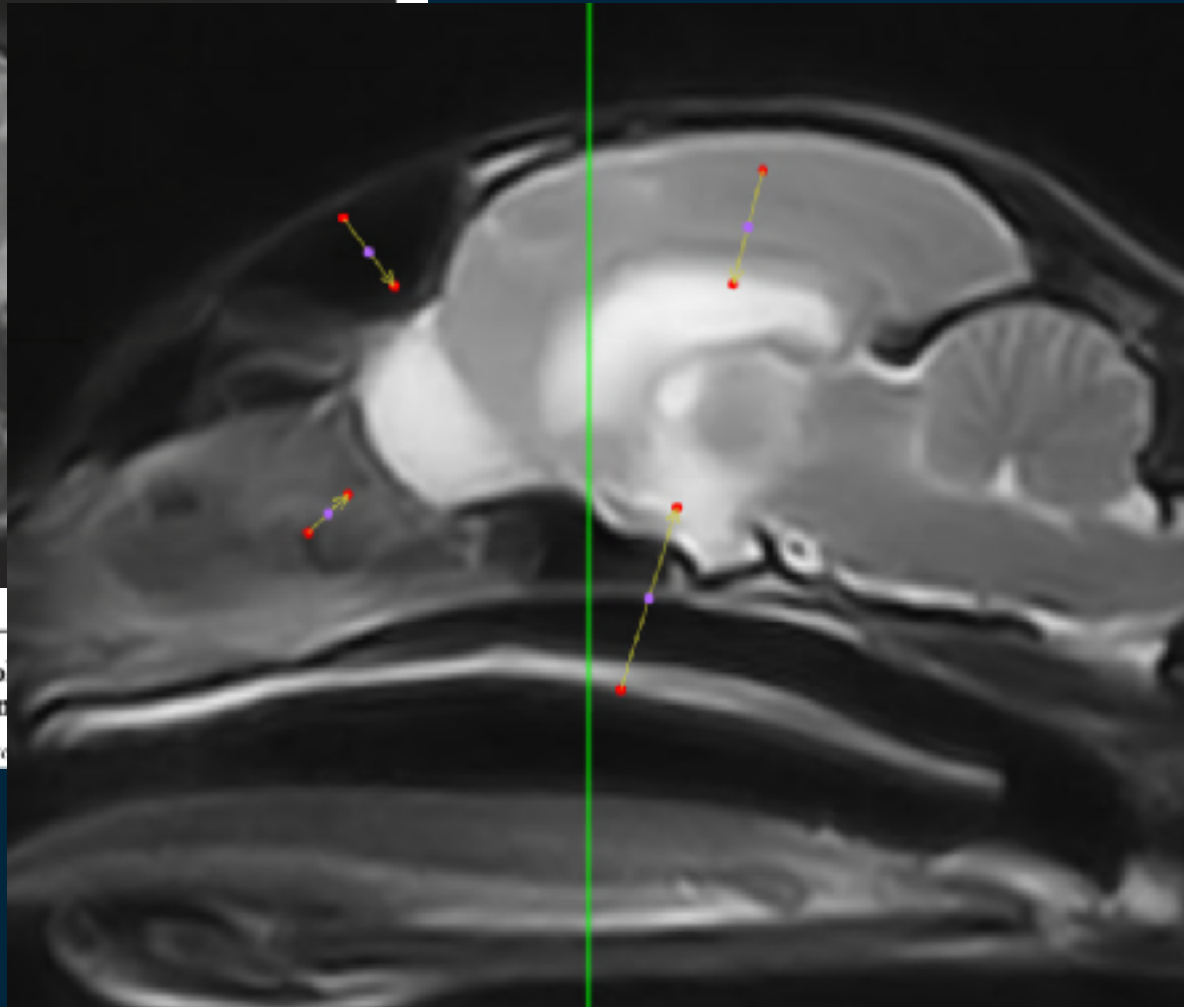
- ▀ Mean
- ▀ 16/16
- ▀ Prima
- ▀ Most
- ▀ Pituitary
- ▀ PLR af



February Ophthalmology (2008) 115, 5, 907-910

### Acute postretinal blindness: ophthalmologic and magnetic resonance imaging findings in

Cristina Senoz,\* Sergio Ródenas,† Maria Leiva,\* Teresa Po



### Magnetic Resonance Imaging of Ocularly Confirmed Neurologic Tonitis

Michaels, A.R., Fraser, and E. Beltran

S

ectable brain

/24)

with decreased to 25%.

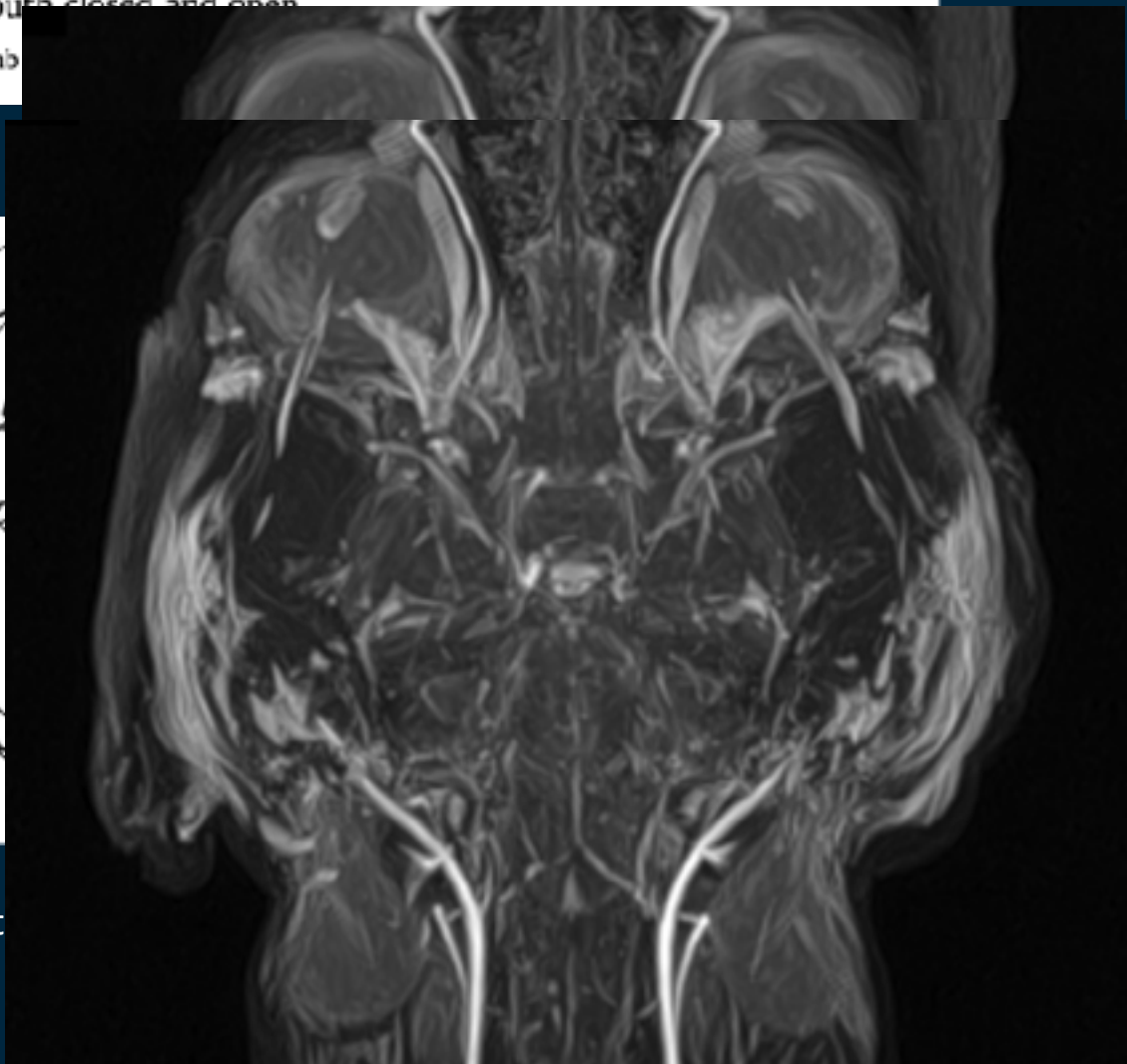


Evaluation of maxillary arterial blood flow in anesthetized cats with the mouth closed and open

A.L. Barton-Lamb  
J.W. Ludders<sup>a</sup>



External carot



Full and submaximal mouth opening with mouth gags in cats: implications for maxillary artery blood flow

Flores<sup>1,2,3</sup>, P.V. Scrivani<sup>2,1</sup>, E. Loew<sup>2</sup>, C.A. Gleed<sup>2</sup>, J.W. Ludders<sup>2</sup>

Mouth gags can result in cerebral ischemia -> blood flow is not normal.

External carotid artery is main source of blood supply to the retinae, brain, and middle ear in felines

Mouth gags generate constant force after placement -> this force compresses the soft tissues between the mandible and the tympanic membrane, resulting in compression of maxillary artery.

Plastic mouth gags -> safer. But even a 42 mm plastic gag (size of a standard adult cat) caused cerebral ischemia in 1 cat with abnormal bloodflow

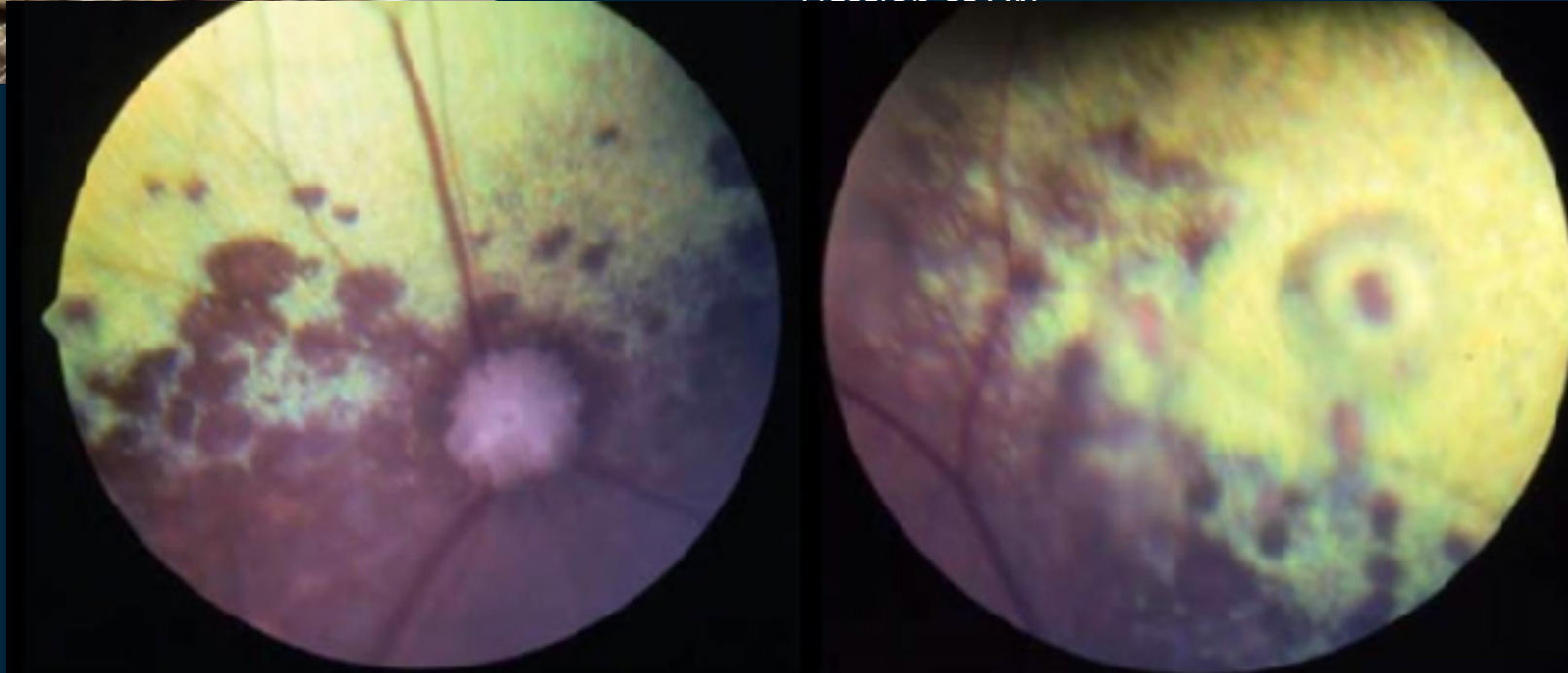


## Contralateral optic neuropathy and retinopathy associated with visual and afferent pupillomotor dysfunction following enucleation in six cats

David Donaldson,\* M<sup>á</sup>rian Matas Riera,\* Andrew Holloway,† Elsa Beltran‡ and Keith C. Barnett\*

- ▀ Mydriasis and/or visual deficits noted immediately following enucleation
- ▀ Absent or incomplete PLR

Ligation of ON



Progressions progressive ONH and

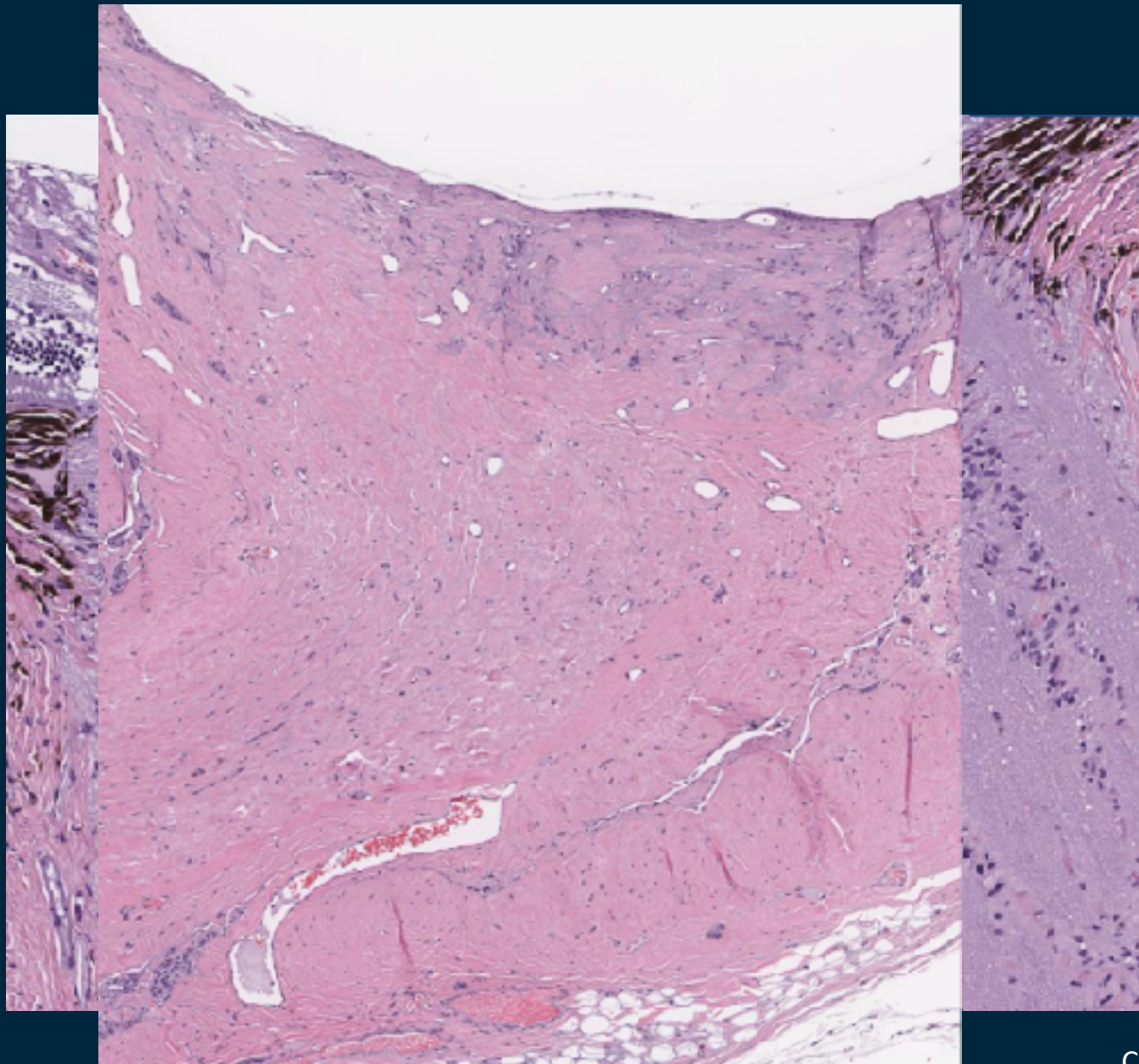
could not be identified

chiasm injury

facilitate ON ligation is

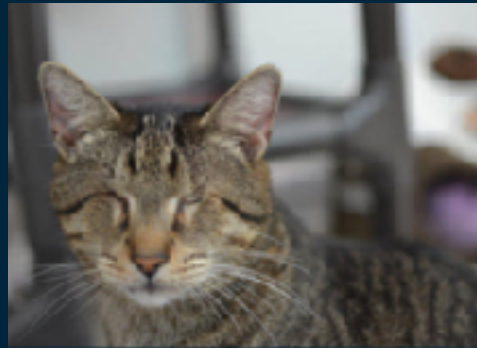
al eye!

# Optic nerve atrophy



Coplow

# Caring for a blind cat



- ▮ Sudden blindness -> Stressed and confused
- ▮ Gentle handling and reassurance
- ▮ At the vet: Quiet area, examination wrapped in a towel? Spoken to on approach
- ▮ At home:
  - ▮ Confine in one room initially, spread out the placement of food, water, bed and litter tray
  - ▮ Gradually increase living area and permanent placement of litter tray ect
  - ▮ Safe garden, outdoor enclosure
  - ▮ Safety - block windows, fireplace ect
  - ▮ Low chair/ramp to access to favourite high resting places
  - ▮ Scratching post and attention to claws
  - ▮ Companionship
  - ▮ Toys with bells or rattles, squeaking mice



# Take home message

1. PLR does not test vision
2. Measure SBP in cats with CKD, hyperthyroidism and in older cats > 10 years
3. Avoid using mouth gags during dental procedures



# Questions?

Time for coffee...

