Glaucoma: Ones other than Primary

Pinakin Davey OD, PhD, FAAO, FOWNS, FARVO
WesternU Director of Clinical Research
Professor College of Optometry

Western University of Health Sciences
College of Optometry

1

Terminology

- "true" exfoliation of lens- exfoliation syndrome
  - Common in glass blowers- no protection against infrared radiation
  - Not commonly associated with glaucoma
  - Also seen in cases of inflammation, trauma and older age group
  - Capsular delamination of lens

2

Terminology cont…2

- "pseudo-exfoliation" syndrome
- The exfoliation syndrome
- Historically it was considered to be deposits of unknown material on lens and anterior segment.
- Subsequently it was identified to be in part at least from the lens
- The exfoliation syndrome (XFS) or pseudo-exfoliation syndrome mean the same

3

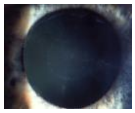
Epidemiology –exfoliation syndrome

- Not just in Scandinavia, Greece, and Italy – common worldwide
- Exfoliation syndrome (XFS) is a significant risk factor for exfoliation glaucoma (XFG)
- About 30% of XFS develop XFG in lifetime

4

Characters

- Deposit of distinctive fibrillar material
- Precise origin unknown (partly lens and iris)
- Hitologically found on lens epithelium and capsule, pupillary margin, ciliary epithelium, iris pigment epithelium, iris stroma, iris blood vessels and subconjunctival tissue



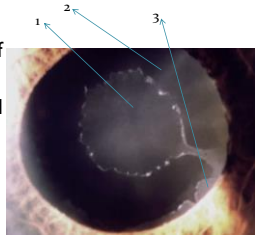
5

- Best seen post dilation
- Zones of deposit are separated by intermediate clear area
- Material visible on iris at pupillary edge

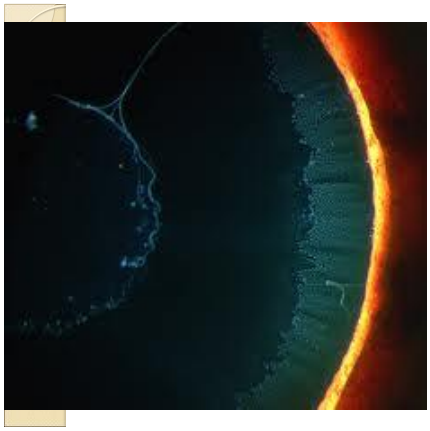
6

Features of XFS

- 1 – central disc corresponds to size of pupil, not always seen
- 2- clear zone- removal of material by iris movement
- 3- peripheral granular zone due to undisturbed accumulation



7



8

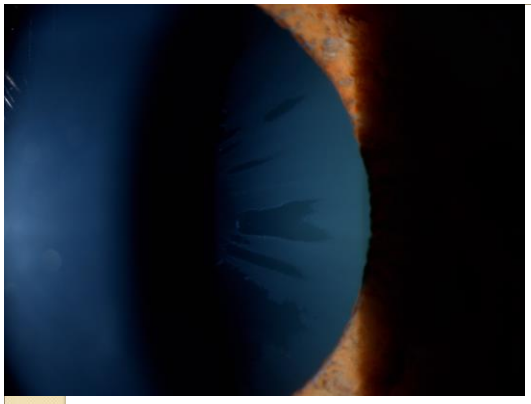


Image courtesy Gabor Hollo

9

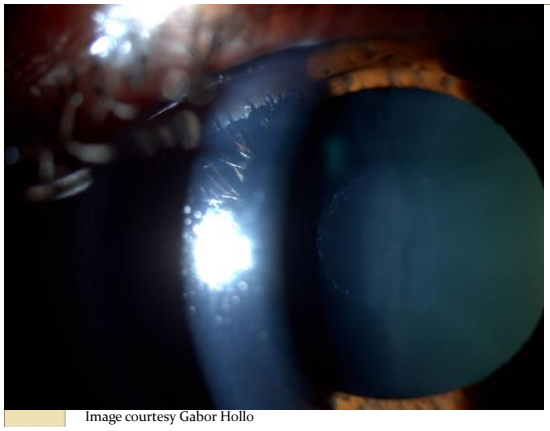


Image courtesy Gabor Hollo

10

Other lens findings

- Phacodonesis — Due to degenerative changes
- subluxation of lens — in zonular fibers

- Why?
- The XFS material is also found on zonules and it contains proteolytic enzymes

11

XFS and angle closure

- In prone position anterior lens movement can occur –pupillary block
- thus increased chances of angle closure

12

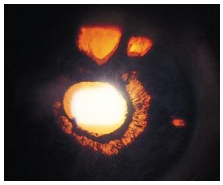
Post-op complications

- Production of XFS material continues after cataract extraction
- May cause late decentration or even subluxation of lens implant

13

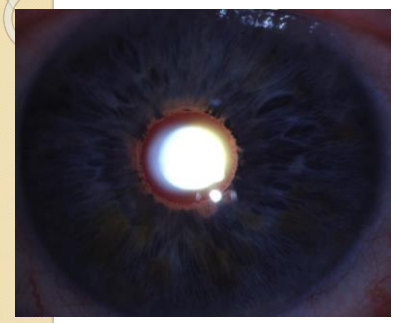
Iris changes

- Don't dilate well- deposits on iris stroma muscle and degeneration of sphincter and dilator
- White flecks in pupillary margin
- Loss of pigment in pupillary margin
- Iris transillumination defects – moth-eaten pattern



14

Retroillumination in exfoliation syndrome



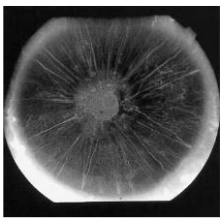
Loss of pupillary ruff

15

Iris changes Fluorescein angiography

- Hypoperfusion
- And neovascularization
- Increases with age and duration of disease

- Why?
- Vessels blocked with material- causing hypoxia



Parodi et al. Acta Oph Scan. 78(4): 437-442. 2000

16

Iris pigment and acute rise in IOP

- Dispersion of melanin post pharmacological dilation
- May result in acute IOP rise

- Check IOP post dilation

17

Gonioscopy in exfoliation syndrome

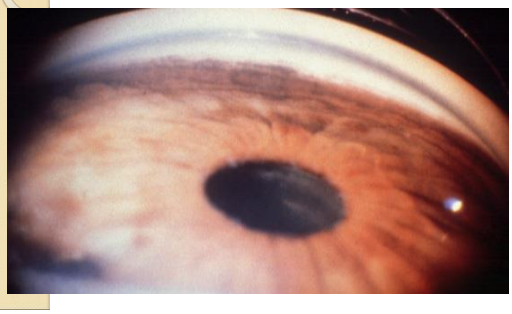
- TM heavily pigments
- Pigment deposition on Schwalbe's line referred as Sampaolesi's line

- Uneven pigmentation

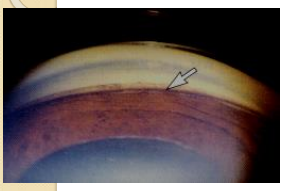
- Chamber narrow presumably due to forward movement of lens–iris diaphragm

18

Sampaolesi line



19



20

Trabecular meshwork

- Chronic pressure elevation due to increased outflow resistance.
- Particularly with deposits juxtacanlicular tissue beneath the inner wall of schlems canal.
- Pigment deposits may also play a role

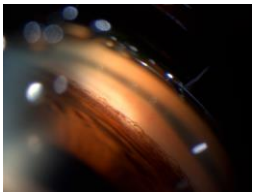


Image courtesy Gabor Hollo

21

Cornea

- Corneal endothelium may show some adhering XFS material
- Specular microscopy of corneal endothelium- low cell density
- Morphological changes also seen

22

UNILATERAL OR BILATERAL DISEASE?

23

Clinically

- Often appears unilateral
- May remain so for a long periods
- Tarkkanen 48% of Caucasians unilateral
- Shimizu et al 85% of Japanese population unilateral

- Signs may be subtle and even experienced observers miss 15% of cases
- First signs to typical presentation 5-10 years.

24

IS EXFOLIATION SYNDROME SYSTEMIC DISEASE?

25

Exfoliation material

- Presence of exfoliation material is not restricted to intraocular tissues
- Conjunctiva, orbital tissue, extraocular muscles, optic nerve, ciliary arteries
- Systemically- skin, lungs, heart muscle, vessel walls, liver, kidney, gall bladder and cerebral meningies

26

XFS and XFG- systemic diseases

- Not clearly understood
- Increased rate of morbidity of cardiovascular, cerebrovascular disease and alzheimers disease and XFS
- But not increase in mortality
- Elevated plasma homocystein levels- related to increased risk of venous occlusion
- Mild sensory hearing loss is also reported

27

Summary

- XFS is a systemic disease
- But the role of exfoliation material in causing or exaggerating the systemic diseases remains to be clarified.

28

DEVELOPMENT OF EXFOLIATION GLAUCOMA

29

Risk of glaucoma in XFS

- Exfoliation increases the relative risk of glaucoma
  - Ekstorm et al., - 9.8 fold
  - Mitchell et al., - 5 fold
  - Even after adjusting for IOP the relationship between XFS and glaucoma was unchanged
  - XFS without high IOP is an independent risk factor in glaucoma development

30

So if IOP is not "the" mechanism on normotensive XFG what is?

- Exfoliation material found in posterior ciliary artery and vortex veins
  - Disturbance in perfusion in posterior ocular tissues

31

Onset of glaucoma related to exfoliation material

- No set pattern
  - Simultaneous
  - After
  - Long after
  - May precede

32

Intraocular pressure and XFG

- Higher mean IOP compared to POAG
  - Often exceed 35 mmHg
- Greater 24 hour IOP fluctuations both in in XFS and XFG
  - Normals <5 mmHg vs normotensive XFS 50% 5 mmHg
  - 10% normotensive XFS showed 10 mmHg fluctuations

33

Intraocular pressure and XFG-2

- Significant diurnal IOP fluctuations may differentiate XFG from POAG
- 50% of XFG show peak IOP outside office hours
- Greater IOP fluctuations may account for faster progression in XFG

34

Summary

- Presence of XFS represents risk of development of XFG
- In eyes with XFS but normal IOP risk of conversion to XFG is 30% in 10 years
- Most convert in 5 years
- XFS and ocular hypertension combined has twice the chances of developing glaucoma when compared to only ocular hypertension
- 24-hour diurnal variations may be greater in XFS and XFG patients compared to controls.

35

Clinical features of XFG

- High IOP, open angle
- Exfoliative trabeculopathy
- Iridopathy, phacopathy, zonulopathy
- Significant diurnal fluctuations
- IOP spikes
- Pigment dispersion
- Acute IOP rise after pupillary dilation
- Aggressive course, rapid progression
- Poor response to medications
- Need for surgery common

36

CATARACT SURGERY AND XFS

37

- Careful pre-operative evaluation to identify XFS and weak zonules
- Max pupil dilation should be noted as pupils tend to not dilate well
- Risk of surgical complications should be discussed
  - Capsular tear, vitreous loss
  - Dislocation of IOL

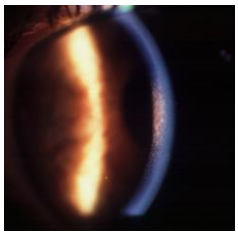
38

Pigmentary glaucoma

39

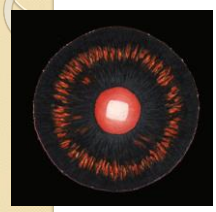
Pigment dispersion syndrome

- Pigment deposits on corneal endothelium
- Pigments on trabecular meshwork
- Lens periphery
- Midperipheral transillumination defects



Krukenberg's spindle

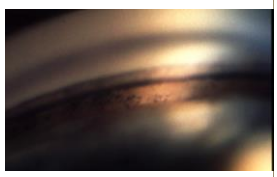
40



41

Gonioscopy

- Homogenous TM pigmentation



42

Clinical appearance

- Midperipheral iris is concave bowing towards the zonular fibers
- Pigment deposits can be seen on zonules
- Does not universally develop glaucoma
- Common in white males with myopia between 20-50

43

- Wide IOP fluctuations
- Pigment may be released in aqueous humor after exercise

44

MEDICAL THERAPY IN EXFOLIATION SYNDROME AND PIGMENTARY GLAUCOMA

45

- Generally medical therapy is not very effective
- May be due to worst IOP characteristics rather than lack of response to medications
  - High mean IOP
  - IOP fluctuations greater
  - High IOP spikes

46

Target IOP

- Like in all glaucoma IOP lowering decreases the chances of progression but does not guarantee it
- XFG patients with mean IOP less than 17 mmHg only 28% progressed compared to 70 %mean IOP $\geq$20mmHg
- Lower IOP also ideal in pigmentary glaucoma and pigment dispersion syndrome

47

Protocols of treatment

- Similar to POAG
- But monotherapy not always successful
- Maximal therapy required
- Miotics may have a role to play-
  - pupil is fixed so less pigment dispersion
  - May help outflow and removal of materials
- Systemic aqueous suppressants not suitable- decreases trabecular function over time
- Often early surgery

48

Surgical treatment Main points

- Frequently needed in XFG, pigmentary glaucoma
- Laser works great- but late failures are common
- In cases of very low target IOP- trabeculectomy surgery of choice
- Non-penetrating surgeries if cataract progression is a concern
- Trabecular aspiration may be considered in XFG if cataract surgery is performed

49

Drugs and glaucoma

50

Corticosteroid induced glaucoma

- Open angle glaucoma
- Prolonged use of corticosteroid in any form
- Mimics POAG
- A high percentage of POAG individuals show response to topical corticosteroid
- Systemic administration of steroid increases IOP in some individuals however to a lesser degree

51

Corticosteroid induced glaucoma -2

- The response is due to an increase resistance to aqueous outflow in trabecular meshwork.
- Some corticosteroid are less likely to raise IOP; flurometholone, rimexolone, or loteprednol when compared to prednisolone or dexamethasone, or Difluprednate (Durezol)
- Susceptible individuals may have raised IOP even to weaker steroids

52

Corticosteroid induced glaucoma-3

- IOP decreases if the steroid use is stopped or discontinued
- Usually takes two weeks for spike to occur
- Difluprednate (Durezol) may show spikes early (1- week)
- Other causes
  - Cycloplegic drugs may cause raise in IOP
  - Routine dilation may cause raise in IOP in individuals with open angle

53

Glauomatocyclitic crisis

- Also known as Posner Schlossman syndrome
- Unilateral, young to middle aged individuals, recurrent
- Symptoms
  - Mild pain, vn decreased, rainbow around lights.
- Signs
  - IOP 40-60 mmHg, open angle no synechiae
  - Corneal edema
  - Mild anterior chamber reaction

54

- Pupils constricted
- Fine keratic precipitates
- Iris hypochromia

- Treatment
  - IOP lowering agents, beta blocker, alpha-2-agonist or carbonic anhydrase inhibitor
  - NO prostagndins-because inflammation
  - Short course steroid or NSAIDs

55

Aqueous misdirection syndrome

- Also known as malignant glaucoma
- Classically follows surgery with small anterior chamber
- Symptoms
  - Mild to moderate pain
  - Myopic shift (Anterior displacement of Iris and lens diaphragm
- Signs
  - Shallow flat AC
  - Increased IOP usually
  - Patent PI
  - Absence of choroidal detachment or iris Bombe

56

Pathophysiology- theories

- Shaffer and Hoskins- Posterior misdirection of aqueous- trapping of fluid in posterior chamber in PVD pocket
- Chandler – Laxity lens zonules and increased aqueous pushes lens and iris firmly forward and increases with time.
- Quigley- choroidal expansion occurs first, this is followed by anterior chamber shallowing

57

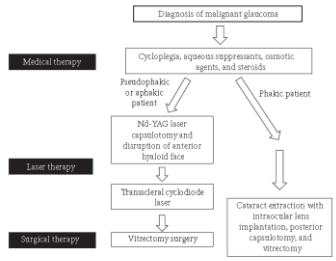


Figure 1: Management pathway for malignant glaucoma.

Journal of Ophthalmology
Volume 2012, Article ID 852659, 6 pages
doi:10.1155/2012/852659

58

Neovascular glaucoma

59

Mechanisms

- Contraction of an inflammatory, hemorrhagic or vascular membrane band or exudates in the angle leading to peripheral anterior synechiae
- Forward displacement of the iris lens diaphragm often accompanied by swelling and anterior rotation of ciliary body

60

- Common, severe angle closure glaucoma caused by a variety of disorders
- Most common causes are diabetes mellitus, central retinal vein occlusion

61

Corneal endothelial disorders

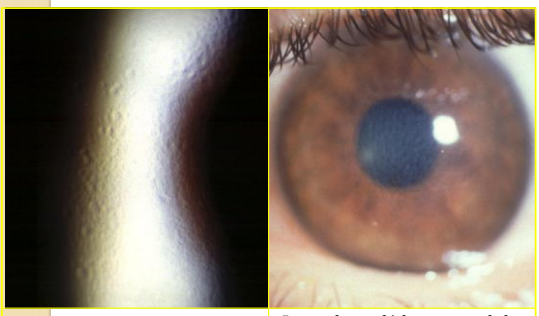
62

ICE syndromes

- Group of disorders characterized by abnormal corneal endothelium
- Causes variable degree of iris atrophy, secondary angle closure and corneal edema
  - Chandler syndrome
  - Essential/progressive iris atrophy
  - Iris nevus/ Cogan-Reese syndrome

63

Chandler syndrome



Initially 'hammer-silver' endothelial changes

Later edema which may cause halos

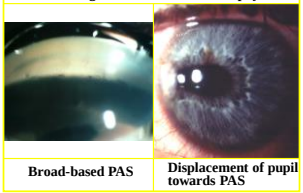
64

- High peripheral anterior synechiae(PAS) characteristic of ICE syndrome
- PAS caused by contraction of endothelial layer
- PAS results in angle closure
- Minimal iris atrophy
- 50% of ICE cases

65

Progressive iris atrophy

Progressive stromal iris atrophy



Broad-based PAS

Displacement of pupil towards PAS

66

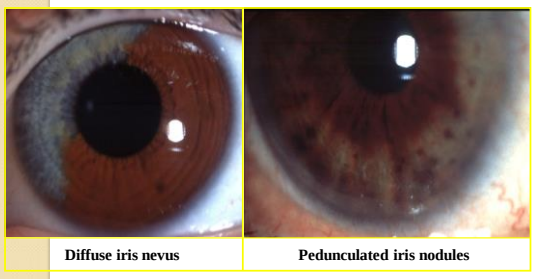
Progressive iris atrophy

Severe iris atrophy
Hetrochromia
Correctopia- displacement of pupil

Ectropion uveae- Clinically : glassy, smooth, cryptless iris surface, iris stromal atrophy, proliferation of iris pigment epithelium onto the anterior surface of the iris (Ectropion uveae)

67

Iris nevus (Cogan-Reese) syndrome



Diffuse iris nevus | Pedunculated iris nodules

68

Iris nevus (Cogan-Reese) syndrome

Minimal iris atrophy
Distinguished by pedunculate nodules or diffuse pigment lesions

69

•50% of ICE cases develop glaucoma
•Vision decrease is due to corneal edema and corneal problems
•Pain due to edema
•May affect one eye and subclinical signs may be present fellow eye

70

Lens induced glaucoma

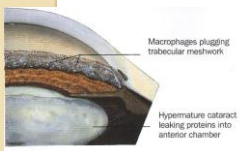
71

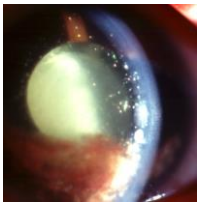
- Can cause open angle and angle closure glaucoma
- Open angle lens induced 3 types
  - Phacolytic - leakage of lens protein through capsule of a hypermature lens
  - Lens particle
  - Phacoanaphylaxis

72

Phacolytic

- Leakage of lens protein through capsule of a hypermature lens
- Flare without keratic precipitates





73

Lens particle glaucoma

- Lens particle in anterior chamber post cataract extraction
- Occurs within weeks of cataract extraction may occur months or year later
- Moderate anterior chamber reaction
- Microcystic corneal edema
- With time posterior synechiae develop

74

Phacoanaphylaxis

- Rare
- Patient becomes sensitized to their own lens protein following cataract extraction or penetrating trauma.
- Results in a granulomatous inflammation
- keratic precipitates present
- Moderate anterior chamber reaction
- Low grade vitritis, synechial formation, residual lens material in anterior chamber may be found

75

Ocular tumors

76

- Variety of tumors can cause unilateral chronic glaucoma
- Different mechanisms
  - Direct tumor invasion of anterior chamber angle
  - Angle closure by ciliary body rotation
  - Or anterior displacement of lens-iris diaphragm
  - Intraocular hemorrhage
  - Neovascularization of angle
  - Deposition of tumor cells, inflammatory cells and cellular debris within trabecular meshwork

77

- Choroidal melanomas and other retinal and choroidal tumors cause secondary angle closure glaucoma

78

Ocular inflammation and secondary OAG

79

- Often combine components of open angle and angle closure glaucoma
- Variety of mechanisms
  - Edema of trabecular meshwork
  - Trabecular meshwork endothelial cell dysfunction
  - Blockage of trabecular meshwork by fibrin and inflammatory cells
  - Break down of blood-aqueous barrier
  - Steroid induced reduction in aqueous outflow through TM

80

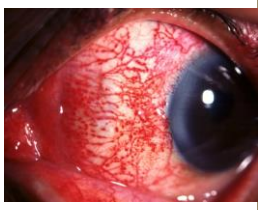
Elevated episcleral venous pressure

81

- Important factor in regulation of IOP
- Normally 8-10 mmHg
- But can be raised in variety of clinical entities that obstruct venous outflow or involve arteriovenous malformations

82

- Chronic red eye
- History of head trauma: carotid cavernous fistula or dural fistula
- Dilated episcleral veins
- Unilateral or bilateral
- Blood in schlemm's canal



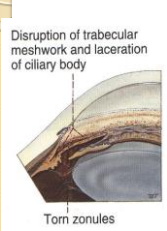
83

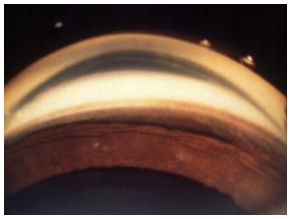
Trauma

84

- Non penetrating trauma cause a variety of anterior segment injuries
  - Hyphema
  - Angle recession
  - Iridodialysis
  - Iris sphincter tear
  - Cyclodialysis
  - Lens subluxation

85





Blunt traumatic damage to trabecular meshwork

86

Angle recession Glaucoma

- Usually asymptomatic
- 10-20 years to develop (if not immediately due to trauma)
- Gonioscopy findings uneven iris insertion, are of torn iris, wide ciliary body band
  - Must examine fellow eye to confirm findings
- Miotics will not work (pilocarpine)

87

Thank You!

Pinakin G. Davey OD, PhD, FAAO, FOWNS, FARVO
pdavey@westernu.edu
909-469-8473

88