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A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss
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Why isn’t elevated IOP mentioned above?
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In addition to being the strongest risk factor for glaucoma, IOP has another quality that renders it unique—what is it?
It is the only risk factor that is **modifiable** in a manner proven to influence the risk of glaucoma progression

That’s why glaucoma management concerns nothing but IOP-lowering maneuvers!
The first thought you should have when encountering a pt you suspect has glaucoma is…
The first thought you should have when encountering a pt you suspect has glaucoma is… *What is the status of the angle?*
Glaucoma

Open-angle

Closed- or narrow-angle

The first thought you should have when encountering a pt you suspect has glaucoma is…

What is the status of the angle?

How does one determine the status of the angle?
The first thought you should have when encountering a pt you suspect has glaucoma is…

What is the status of the angle?

How does one determine the status of the angle?
Gonioscopy. Don’t assume your glaucoma pt has open angles—prove it by gonioing them!
How does one determine the status of the angle?

Gonioscopy. Don’t assume your glaucoma pt has open angles—prove it by gonioscopy!

Glaucoma

Open-angle

Closed- or narrow-angle

The first thought you should have when encountering a pt you suspect has glaucoma is…

What is the status of the angle?

Angle-closure glaucoma is covered in multiple slide-sets; see the Table of Contents
Once you have determined a pt has open-angle glaucoma, the next ‘first thought’ is to ask…
Once you have determined a pt has open-angle glaucoma, the next ‘first thought’ is to ask…

Is it high-pressure OAG, or low (aka normal) tension OAG?

Normal-tension glaucoma (NTG)

OAG

↑IOP

Open-angle Glaucoma: Secondary
Untreated IOP consistently above \# mmHg

Normal-tension glaucoma (NTG)

Untreated IOP consistently below \# mmHg
Untreated IOP consistently above 22 mmHg

Untreated IOP consistently below 22 mmHg

(Note that this distinction is somewhat controversial, as some glaucomalogists contend NTG is not a separate condition.)
Untreated IOP consistently above 22 mmHg

↑IOP

Normal-tension glaucoma (NTG)

Untreated IOP consistently below 22 mmHg

Open-angle Glaucoma: Secondary

OAG

Normal-tension glaucoma is covered in its own slide-set (G21)

(Note that this distinction is somewhat controversial, as some glaucomalogists contend NTG is not a separate condition.)

Open-angle Glaucoma: Secondary

OAG
Once you have determined a pt has high-pressure open-angle glaucoma, the next ‘first thought’ is to ask…
Once you have determined a pt has high-pressure open-angle glaucoma, the next ‘first thought’ is to ask…

*Is it primary open-angle glaucoma (POAG), or secondary OAG?*
Open-angle Glaucoma: Secondary

Primary ➔ Secondary

↑ IOP OAG

There are many forms of secondary open-angle glaucoma!
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

↑ EVS

Drug-Induced

General category

Schwartz syndrome

Specific condition

Trauma-Related

General category

Inflammation-Induced

General categories

Tumor-Induced

General categories

Lens-Induced

Specific conditions

Pigmentary

PXS

There are many forms of secondary open-angle glaucoma!
Note that primary open-angle glaucoma (POAG) is a diagnosis of exclusion—it can only be made by first determining that the angle is open, and then ruling out the myriad causes of secondary OAG.
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Drug-Induced

↑ EVP

Trauma-Related

Schwartz syndrome

PXS Pigmentary

Tumor-induced

Lens-induced

Inflammation-Induced

PXS and pigmentary glaucoma are addressed in slide-set G4
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Let's take a look at secondary OAG owing to the lens
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- The only one described in the *Glaucoma* book as ‘rare’:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC:
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

1. The only one described in the *Glaucoma* book as ‘rare’:
   - Phacoantigenic

2. Mediated by inflammatory response to lens proteins in AC:
   - Phacoantigenic; phacolytic
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies:
The only one described in the *Glaucoma* book as ‘rare’: **Phacoantigenic**

Mediated by inflammatory response to lens proteins in AC: **Phacoantigenic; phacolytic**

Mediated by IgG antibodies: **Phacoantigenic**
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic
- Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic
- Mediated by IgG antibodies: Phacoantigenic
- **TM is clogged with macrophages**: Phacolytic

‘**TM clogged with macrophages**’ applies also to another form of secondary OAG—which one?
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

**TM is clogged with macrophages**: Phacolytic

‘**TM clogged with macrophages**’ applies also to another form of secondary OAG—which one?

Hemolytic glaucoma
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

**TM is clogged with macrophages**: Phacolytic

 `'TM clogged with macrophages’ applies also to another form of secondary OAG—which one?` Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of two words.*
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to **lens proteins** in AC: Phacoantigenic; **phacolytic**

Mediated by IgG antibodies: Phacoantigenic

**TM is clogged with macrophages:** Phacolytic

‘**TM clogged with macrophages**’ applies also to another form of secondary OAG—**which one?**

Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of lens proteins.*
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

• The only one described in the Glaucoma book as ‘rare’: Phacoantigenic
• Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic
• Mediated by IgG antibodies: Phacoantigenic
• **TM is clogged with macrophages**: Phacolytic

‘TM clogged with macrophages’ applies also to another form of secondary OAG—which one?
Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of lens proteins.*
*What are they full of in hemolytic glaucoma?*
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to *lens proteins* in AC: Phacoantigenic; **phacolytic**

Mediated by IgG antibodies: Phacoantigenic

**TM is clogged with macrophages**: Phacolytic

‘TM clogged with macrophages’ applies also to another form of secondary OAG—*which one?*

Hemolytic glaucoma

*In phacolytic glaucoma, the macrophages are full of *lens proteins*. What are they full of in hemolytic glaucoma?*

Hemoglobin
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle
Lens-particle glaucoma
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] uveitis:
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- The only one described in the *Glaucoma* book as ‘rare’: **Phacoantigenic**
- Mediated by inflammatory response to lens proteins in AC: **Phacoantigenic; phacolytic**
- Mediated by IgG antibodies: **Phacoantigenic**
- TM is clogged with macrophages: **Phacolytic**
- Chunks of cortex may be visible in AC: **Lens particle**
- Is also known as [condition name] *uveitis*: **Phacoantigenic**
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- **Phacolytic glaucoma**
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- TM is clogged with macrophages: **Phacolytic**
- Chunks of cortex may be visible in AC: **Lens particle**
- Is also known as [condition name] *uveitis*: **Phacoantigenic**
- Capsule is intact:
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- **Phacolytic glaucoma**
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- The only one described in the *Glaucoma* book as ‘rare’: **Phacoantigenic**
- Mediated by inflammatory response to lens proteins in AC: **Phacoantigenic; phacolytic**
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Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] *uveitis*: Phacoantigenic

**Capsule is intact: Phacolytic**

*What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?*
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

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TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] *uveitis*: Phacoantigenic

**Capsule is intact:** Phacolytic

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What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?

It implies (correctly) that the capsule is open in these conditions
The only one described in the Glaucoma book as ‘rare’:

- Phacoantigenic

Mediated by inflammatory response to lens proteins in AC:

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TM is clogged with macrophages:

- Phacolytic

Chunks of cortex may be visible in AC:

- Lens-particle

Is also known as [condition name] uveitis:

- Phacoantigenic

Capsule is intact:

- Phacolytic

What does this imply about the status of the capsule in phacoantigenic and lens-particle glaucoma?

It implies (correctly) that the capsule is open in these conditions.
Q

The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

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Is also known as [condition name] *uveitis*: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous:

---

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**  **Phacoantigenic glaucoma**  **Lens-particle glaucoma**
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Is also known as [condition name] uveitis: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to normal lens proteins:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] *uveitis*: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to *normal* lens proteins: Phacoantigenic
Why is it significant that phacoantigenic glaucoma involves an immune reaction to ‘normal’ lens proteins?

In phakic eyes, minute amounts of lens proteins make their way through the capsule and into the AC. Because of this, normal lens proteins enjoy a certain level of immunologic privilege and are well tolerated by the eye. However, violation of the capsule results in massive amounts of lens proteins spilling into the AC. If this influx disrupts the privilege, severe inflammation, ie, phacoantigenic uveitis—and glaucoma—may result.
The only one described in the Glaucoma book as ‘rare’: Phacoantigenic
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TM is clogged with macrophages: Phacolytic
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- **Phacoantigenic glaucoma**
- Mediated by inflammatory response to lens proteins in AC:
- **Phacoantigenic**
- Mediated by IgG antibodies: Phacoantigenic
- TM is clogged with macrophages: Phacoantigenic
- **Phacolytic**
- Chunks of cortex may be visible in AC: Lens-particle glaucoma
- Capsule is intact: Phacoantigenic
- Is also known as [condition name] **uveitis**: Phacoantigenic
- **Phacoantigenic glaucoma**
- Capsule is intact: Phacolytic
- AC reaction is granulomatous: Phacoantigenic
- **Phacoantigenic glaucoma**
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- **Phacoantigenic glaucoma**

*Why is it significant that phacoantigenic glaucoma involves an immune reaction to ‘normal’ lens proteins?*

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Q: For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer).

- The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic
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- Mediated by IgG antibodies: Phacoantigenic
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- Is a reaction to *normal* lens proteins: Phacoantigenic
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- Is also known as [condition name] *uveitis*: Phacoantigenic
- Capsule is intact: Phacolytic
- AC reaction is granulomatous: Phacoantigenic
- Is a reaction to denatured lens proteins:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Is a reaction to *normal* lens proteins: Phacoantigenic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] uveitis: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to *denatured* lens proteins: Phacolytic
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Is a reaction to *denatured* lens proteins: Phacolytic

What does it mean to say a protein has been ‘denatured’?

It means the protein has been forced out of its native conformation. Because a protein’s function is inextricably tied to its shape, denatured proteins do not behave as they do in their native form.

Can you give an example of protein denaturation?

Consider egg albumin. In its native state, it’s a clear liquid. But if sufficient heat is applied, it becomes a white solid. (And if sufficient salsa is applied to the white solid, it becomes delish.)

What role does denaturation play in the inflammatory process?

Recall that normal lens proteins enjoy a degree of immunologic privilege. In contrast, denatured proteins enjoy no immunologic privilege, and thus tend to attract macrophages in large numbers.
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

*What does it mean to say a protein has been ‘denatured’?*
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Is a reaction to *denatured* lens proteins: Phacolytic
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

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*Can you give an example of protein denaturation?*

*Is a reaction to denatured lens proteins: Phacolytic*
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

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Consider egg albumin. In its native state, it’s a clear liquid. But if sufficient heat is applied, it becomes a white solid. (And if sufficient salsa is applied to the white solid, it becomes delish.)

*Is a reaction to denatured lens proteins: Phacolytic*
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What role does denaturation play in the inflammatory process?

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Is a reaction to *denatured* lens proteins: Phacolytic
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

What does it mean to say a protein has been ‘denatured’?

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Is a reaction to denatured lens proteins: Phacolytic
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] uveitis: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to *normal* lens proteins: Phacoantigenic

Is a reaction to *denatured* lens proteins: Phacolytic

The presence of KP is a key clinical finding:
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] uveitis: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to *normal* lens proteins: Phacoantigenic

Is a reaction to *denatured* lens proteins: Phacolytic

The presence of KP is a key clinical finding: Phacoantigenic
### For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

<table>
<thead>
<tr>
<th>Phacolytic glaucoma</th>
<th>Phacoantigenic glaucoma</th>
<th>Lens-particle glaucoma</th>
</tr>
</thead>
</table>

- The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic
- Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic
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- TM is clogged with macrophages: Phacolytic
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- Is also known as [condition name] *uveitis*: Phacoantigenic
- Capsule is intact: Phacolytic
- AC reaction is granulomatous: Phacoantigenic
- Is a reaction to *normal* lens proteins: Phacoantigenic
- Is a reaction to *denatured* lens proteins: Phacolytic
- **The presence of KP is a key clinical finding**: Phacoantigenic

---

*Are the KP granulomatous, or nongranulomatous?*
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] *uveitis*: Phacoantigenic

Capsule is intact: Phacolytic

**AC reaction is granulomatous**: Phacoantigenic

Is a reaction to *normal* lens proteins: Phacoantigenic

Is a reaction to *denatured* lens proteins: Phacolytic

The presence of KP is a key clinical finding: Phacoantigenic

Are the KP granulomatous, or nongranulomatous? Granulomatous
Phacoantigenic glaucoma: Granulomatous KP
The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic

Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic

Mediated by IgG antibodies: Phacoantigenic

TM is clogged with macrophages: Phacolytic

Chunks of cortex may be visible in AC: Lens particle

Is also known as [condition name] uveitis: Phacoantigenic

Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to normal lens proteins: Phacoantigenic

Is a reaction to denatured lens proteins: Phacolytic

The presence of KP is a key clinical finding: Phacoantigenic

The one most likely to have a very high IOP:
A - For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- The only one described in the *Glaucoma* book as ‘rare’: Phacoantigenic
- Mediated by inflammatory response to lens proteins in AC: Phacoantigenic; phacolytic
- Mediated by IgG antibodies: Phacoantigenic
- TM is clogged with macrophages: Phacolytic
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- Is also known as [condition name] uveitis: Phacoantigenic
- Capsule is intact: Phacolytic
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- Is a reaction to *normal* lens proteins: Phacoantigenic
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- The presence of KP is a key clinical finding: Phacoantigenic
- The one most likely to have a very high IOP: Phacolytic

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma:*
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka** phacoanaphylactic glaucoma: Phacoantigenic
Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka **phacoanaphylactic glaucoma**: Phacoantigenic

*Why is phacoanaphylactic glaucoma actually a misnomer?*
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

### aka *phacoanaphylactic glaucoma*: Phacoantigenic

*Why is phacoanaphylactic glaucoma *actually a misnomer*?*

Because the condition is not a Type 1 (anaphylactic) reaction
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer): Phacolytic glaucoma, Phacoantigenic glaucoma, Lens-particle glaucoma.

- **Phacoanaphylactic glaucoma**

**Why is phacoanaphylactic glaucoma actually a misnomer?**
Because the condition is not a Type 1 (anaphylactic) reaction.

**What characteristics inherent to true anaphylaxis are missing in phacoantigenic glaucoma?**
Phacoanaphylactic glaucoma is actually a misnomer because the condition is not a Type 1 (anaphylactic) reaction. The involvement of IgE, mast cells, and basophils are missing in phacoantigenic glaucoma.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka** *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral:
A

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

*Phacolytic glaucoma*  *Phacoantigenic glaucoma*  *Lens-particle glaucoma*

- aka *phacoanaphylactic glaucoma*: **Phacoantigenic**
- Usually unilateral: **All of them**
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka phacoanaphylactic glaucoma:** Phacoantigenic
- Usually unilateral: **All of them**
- Is mediated by an *adaptive* immune response: 
A

For each statement, identify the **lens-related secondary OAG with which it is associated** (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: **Phacoantigenic**
- Usually unilateral: **All of them**
- Is mediated by an *adaptive* immune response: **Phacoantigenic**
Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- **Phacolytic glaucoma**
- **Phacoantigenic glaucoma**
- **Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: **Phacoantigenic**
- Usually unilateral: **All of them**
- Is mediated by an *adaptive* immune response: **Phacoantigenic**
- Associated with mature/hypermature cataract:
• aka *phacoanaphylactic glaucoma*: Phacoantigenic
• Usually unilateral: All of them
• Is mediated by an *adaptive* immune response: Phacoantigenic
• Associated with mature/hypermature cataract: Phacolytic
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature **cataract**: Phacolytic

What is a mature cataract?
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

**What is a mature cataract?**

A cataract that has progressed to involve the entire lens
A aka phacoanaphylactic glaucoma: Phacoantigenic
• Usually unilateral: All of them
• Is mediated by an adaptive immune response: Phacoantigenic
• Associated with mature/hypermature cataract: Phacolytic

What is a mature cataract?
A cortical cataract that has progressed to involve the entire lens cortex
Mature cataract
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

| Phacolytic glaucoma | Phacoantigenic glaucoma | Lens-particle glaucoma |

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

**What is a mature cataract?**

A cortical cataract that has progressed to involve the entire lens cortex.

**What is a hypermature cataract?**
Phacoanaphylactic glaucoma: Phacoantigenic
Usually unilateral: All of them
Is mediated by an adaptive immune response: Phacoantigenic
Associated with mature/hypermature cataract: Phacolytic

What is a mature cataract?
A cortical cataract that has progressed to involve the entire lens cortex

What is a hypermature cataract?
Mature cataracts may absorb water, transforming them into an cortical cataract.
aka *phacoanaphylactic glaucoma*: Phacoantigenic

- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex

**What is a hypermature cataract?**
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract.*
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

- aka **phacoanaphylactic glaucoma**: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an **adaptive immune response**: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

What is a **mature cataract**?
A cortical cataract that has progressed to involve the entire lens cortex

What is a **hypermature cataract**?
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
Phacolytic glaucoma

Phacoantigenic glaucoma

Lens-particle glaucoma

aka phacoanaphylactic glaucoma: Phacoantigenic

Usually unilateral: All of them

Is mediated by an adaptive immune response: Phacoantigenic

Associated with mature/hypermature cataract: Phacolytic

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex

**What is a hypermature cataract?**
Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

**Take note of the stages:**

Mature cataract ?
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

What is a mature cataract?
A cortical cataract that has progressed to involve the entire lens cortex.

What is a hypermature cataract?
Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

Take note of the stages:
For each statement, identify the **lens-related secondary OAG with which it is associated** (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka** *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

*What is a mature cataract?*
A cortical cataract that has progressed to involve the entire lens cortex

*What is a hypermature cataract?*
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A *hypermature cataract* results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

*Take note of the stages:*

Mature cataract ➔ intumescent cataract ➔ hypermature cataract
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka phacoanaphylactic glaucoma**: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/*hypermature cataract**: Phacolytic

---

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex.

**What is a hypermature cataract?**
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

*Take note of the stages:*

Cataract → **intumescent cataract** → **hypermature cataract**

Cataract absorbs water → Cataract leaks water
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

| Phacolytic glaucoma | Phacoantigenic glaucoma | Lens-particle glaucoma |

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/*hypermature cataract*: Phacolytic

---

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex

**What is a hypermature cataract?**
Mature cataracts may **absorb water**, transforming them into an *intumescent cortical cataract*. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

---

**Take note of the stages:**

| Mature cataract | intumescent cataract | hypermature cataract |

Cataract **absorbs** water  ➔  What happens
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**  **Phacoantigenic glaucoma**  **Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

What is a **mature cataract**?
A cortical cataract that has progressed to involve the entire lens cortex

What is a **hypermature cataract**?
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

*Take note of the stages:*

Mature cataract  **intumescent cataract**  **hypermature cataract**

Cataract *absorbs* water  ← What happens  →  Cataract *leaks* water
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- **Phacolytic glaucoma**
- **Phacoantigenic glaucoma**
- **Lens-particle glaucoma**

- aka **phacoanaphylactic glaucoma**: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex

**What is a hypermature cataract?**
Mature cataracts may *absorb water*, transforming them into an *intumescent cortical cataract*. A *hypermature cataract* results when an intumescent cataract begins *leaking water* and denatured proteins through its intact anterior capsule.

*Take note of the stages:*

**Mature cataract** → **intumescent cataract** → **hypermature cataract**

Cataract *absorbs* water ← What happens → Cataract *leaks* water*

*and proteins*
Phacoanaphylactic glaucoma:
- Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

What is a mature cataract?
A cortical cataract that has progressed to involve the entire lens cortex

What is a hypermature cataract?
Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?

Take note of the stages:
- Mature cataract
- Intumescent cataract
- Hypermature cataract
A

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?
For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka **phacoanaphylactic glaucoma**: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

**Q**

All three of these pose a particular challenge during an early, crucial step in cataract surgery. **What step, and what challenge?**

For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

**What step do most surgeons take to facilitate capsulorrhexis in these cases?**

**Take note of the stages:**

Mature cataract → intumescent cataract → hypermature cataract
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

What is a mature cataract?
A cortical cataract that has progressed to involve the entire lens cortex

What is a hypermature cataract?
Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

Take note of the stages:

Mature cataract  intumescent cataract  hypermature cataract

All three of these pose a particular challenge during an early, crucial step in cataract surgery. What step, and what challenge?
For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

What step do most surgeons take to facilitate capsulorrhexis in these cases?
They stain the anterior capsule with trypan blue.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- **Phacolytic glaucoma**
- **Phacoantigenic glaucoma**
- **Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an **adaptive immune response**: Phacoantigenic
- Associated with mature/[hypermature cataract]: Phacolytic

What is a **mature cataract**?
A  cortical cataract that has progressed to involve the entire lens cortex

What is a **hypermature cataract**?
Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

**Take note of the stages:**

- **Mature cataract**  →  **intumescent cataract**  →  **hypermature cataract**

All three of these pose a particular challenge during an early, crucial step in cataract surgery.

**What step, and what challenge?**
For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

**What step do most surgeons take to facilitate capsulorrhexis in these cases?**
They stain the anterior capsule with **trypan blue**

*Take note of the stages:*
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

- Phacoanaphylactic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- **aka** phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

Let’s *drill down* on intumescent cataracts *for a moment*. *In this context, what does* intumescent *mean?*

*All the information you need to answer*.

*What step do most surgeons take to facilitate capsulorrhexis in these cases?*

They stain the anterior capsule with *trypan blue*

*Take note of the stages:*

Mature cataract  ➔ **intumescent cataract**  ➔ Hypermature cataract
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

Let’s drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?

It means ‘swollen.’ As mentioned a few slides ago, the event that transforms a mature cataract into an intumescent cataract is absorption of water, and this absorption results in swelling of the lens.

What step do most surgeons take to facilitate capsulorrhexis in these cases?

They stain the anterior capsule with *trypan blue*

Take note of the stages:

Mature cataract  intumescent cataract  hypermature cataract
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

*Phacolytic glaucoma*  *Phacoantigenic glaucoma*  *Lens-particle glaucoma*

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive immune response*: Phacoantigenic
- Associated with *mature/hypermature cataract*: Phacolytic

**Q**

What is a **mature cataract**?
A cortical cataract that has progressed to involve the entire lens cortex

What is a **hypermature cataract**?
Mature cataracts may absorb water, transforming them into an *intumescent* cortical cataract. A **hypermature cataract** results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

**Take note of the stages:**

Mature cataract → **intumescent cataract** → hypermature cataract

*Let’s drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?*

It means ‘swollen.’ As mentioned a few slides ago, the event that transforms a **mature** cataract into an **intumescent** cataract is absorption of water, and this absorption results in swelling of the lens.

**What effect does swelling have on the internal dynamics of the lens?**

It increases the pressure within the lens.

**What step do most surgeons take to facilitate capsulorrhexis in these cases?**

They stain the anterior capsule with **trypan blue**.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**  **Phacoantigenic glaucoma**  **Lens-particle glaucoma**

- aka **phacoanaphylactic glaucoma**: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an **adaptive** immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

Let’s drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?

It means ‘swollen.’ As mentioned a few slides ago, the event that transforms a **mature** cataract into an **intumescent** cataract is absorption of water, and this absorption results in swelling of the lens.

What effect does swelling have on the internal dynamics of the lens?

It increases the pressure within the lens.

What step do most surgeons take to facilitate capsulorrhexis in these cases?

They stain the anterior capsule with **trypan blue**

---

Take note of the stages:

Mature cataract **intumescent cataract** hypermature cataract
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

---

**Q**

1. What is a mature cataract?
   - A cortical cataract that has progressed to involve the entire lens cortex

2. What is a hypermature cataract?
   - Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

---

Take note of the stages:

- Mature cataract
- Intumescent cataract
- Hypermature cataract

---

As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

---

What step do most surgeons take to facilitate capsulorrhexis in these cases?

- They stain the anterior capsule with trypan blue

---

*Let’s drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?*

As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

---

**What effect does swelling have on the internal dynamics of the lens?**

- It increases the pressure within the lens

---

What step do most surgeons take to facilitate capsulorrhexis in these cases?

- They stain the anterior capsule with trypan blue

---

Take note of the stages:

- Mature cataract
  - Intumescent cataract
  - Hypermature cataract
aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/ hypermature cataract: Phacolytic

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

Phacolytic glaucoma    Phacoantigenic glaucoma    Lens-particle glaucoma

What is a mature cataract?
- A cortical cataract that has progressed to involve the entire lens cortex

What is a hypermature cataract?
- Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

Take note of the stages:
Mature cataract intumescent cataract hypermature cataract

Let’s drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?
As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?
When the surgeon makes the initial rent in the capsule, the increased pressure within an intumescent cataract may cause the rent to suddenly and uncontrollably extend to the periphery of the capsule.

What effect does swelling have on the internal dynamics of the lens?
- Increases the pressure within the lens

What step do most surgeons take to facilitate capsulorrhexis in these cases?
They stain the anterior capsule with trypan blue

Take note of the stages:
Mature cataract intumescent cataract hypermature cataract
Q

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer):

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

- aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

Let's drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?

As if obscuration of the red reflex wasn't enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhesis—what is it?

When the surgeon makes the initial rent in the capsule, the increased pressure within an intumescent cataract may cause the rent to suddenly and uncontrollably extend to the periphery.

If/when the rent runs peripherally, what is the resulting appearance of the lens?

They stain the anterior capsule with trypan blue.

Take note of the stages:

Mature cataract → intumescent cataract → hypermature cataract
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

- aka phacoanaphylactic glaucoma: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

Phacolytic glaucoma       Phacoantigenic glaucoma    Lens-particle glaucoma

Let's drill down on intumescent cataracts for a moment. In this context, what does intumescent mean?

As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

When the surgeon makes the initial rent in the capsule, the increased pressure within an intumescent cataract may cause the rent to suddenly and uncontrollably extend to the periphery.

If/when the rent runs peripherally, what is the resulting appearance of the lens?

Recall that, because of red-reflex obscuration, trypan blue is used in all these cases.

They stain the anterior capsule with trypan blue.

Take note of the stages:

Mature cataract  intumescent cataract  hypermature cataract
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

Phacoantigenic glaucoma: Phacoantigenic

Phacolytic glaucoma: Phacoantigenic

Hypermature cataract: Phacoantigenic

What is a mature cataract?

A cortical cataract that has progressed to involve the entire lens cortex

What is a hypermature cataract?

Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

If/when the rent runs peripherally, what is the resulting appearance of the lens?

Recall that, because of red-reflex obscuration, *trypan blue* is used in all these cases. Thus, after the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule).

What step, and what challenge?

For all three stages, the red reflex is completely obscured. As most cataract surgeons rely on the red reflex to visualize the anterior capsule during capsulorrhexis, this step cannot be performed in a conventional manner.

What step do most surgeons take to facilitate capsulorrhexis in these cases?

They stain the anterior capsule with *trypan blue*.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer).

- Phacoanaphylactic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

1. Usually unilateral: All of them
2. Is mediated by an adaptive immune response: **Phacoantigenic glaucoma**
3. Associated with mature/hypermature cataract: **Phacolytic glaucoma**

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer).

- Phacolytic glaucoma
- Phacoantigenic glaucoma
- Lens-particle glaucoma

**What is a mature cataract?**

*A cortical cataract that has progressed to involve the entire lens cortex*

**What is a hypermature cataract?**

Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

**Take note of the stages:**

Mature cataract → intumescent cataract → hypermature cataract

**As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional concern for the surgeon. When the intumescent cataract may shed from the intact incontinuity and uncontrollably extend to the periphery.**

*This appearance has led to a memorable name for this finding. What is it?*

Trypan blue

Recall that, because of red-reflex obscuration, trypan blue is used in all these cases. When the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule). They stain the anterior capsule with trypan blue.

**When the rent runs peripherally, what is the resulting appearance of the lens?**

Recall that, because of red-reflex obscuration, trypan blue is used in all these cases. When the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule). They stain the anterior capsule with trypan blue.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

*Phacoanaphylactic glaucoma* Phacoantigenic glaucoma Lens-particle glaucoma

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**Phacoantigenic glaucoma**

*Usually unilateral: All of them*

*Is mediated by an adaptive immune response: Phacoantigenic*

*Associated with mature/hypermature cataract: Phacolytic*

---

**What is a mature cataract?**

A cortical cataract that has progressed to involve the entire lens cortex

**What is a hypermature cataract?**

Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

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Take note of the stages:

Mature cataract \hspace{2cm} \texttt{intumescent cataract} \hspace{2cm} hypermature cataract

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This appearance has led to a memorable name for this finding. What is it? It is known as ‘**Argentinian flag sign**’

---

If/when the rent runs peripherally: what is the resulting appearance of the lens?

Recall that, because of red-reflex obscuration, trypan blue is used in all these cases.

Thus, when the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule).

They stain the anterior capsule with **trypan blue**

Take note of the stages:

**intumescent cataract**

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As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract may lead to a particular challenge during capsulorrhexis—what is it?

When the intumescent cataract may lead to an increased intralenticular pressure, the red reflex can be obscured.

---

It means ‘swollen.’ As mentioned a few slides ago, the event that transforms a mature cataract into an intumescent cataract is absorption of water, and this absorption results in swelling of the lens.

What effect does swelling have on the internal dynamics of the lens?

It increases the pressure within the lens.

As if obscuration of the red reflex wasn’t enough, the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?

When the surgeon makes the initial rent in the capsule, the increased pressure within an intumescent cataract may cause the rent to suddenly and uncontrollably extend to the periphery.

When the rent runs peripherally, what is the resulting appearance of the lens?

Recall that, because of red-reflex obscuration, trypan blue is used in all these cases.

Thus, when the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule).

They stain the anterior capsule with **trypan blue**

Take note of the stages:
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

**Phacolytic glaucoma**  
**Phacoantigenic glaucoma**  
**Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an **adaptive immune response**: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

**Q**

**When faced with an intumescent cataract, what can the surgeon do to minimize the likelihood of seeing an Argentinian flag?**

---

- Counteract the positive pressure within the lens by filling the AC with a high-viscosity OVD
- Reduce intralenticular pressure by aspirating cortical material immediately upon creating the initial rent

---

When the surgeon makes the initial rent in the capsule, the increased pressure within an intumescent cataract may cause the rent to suddenly and uncontrollably extend to the periphery.

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Recall that, because of red-reflex obscuration, *trypan blue* is used in all these cases.

Thus, after the rent runs out, the surgeon sees a white stripe (the cataract) between two areas of blue (the undisturbed, trypan blue-stained capsule).

They stain the anterior capsule with *trypan blue*.

Take note of the stages:

**intumescent cataract**

Mature cataract → intumescent cataract → hypermature cataract
Phacoanaphylactic glaucoma: Phacoantigenic
Usually unilateral: All of them
Is mediated by an adaptive immune response: Phacoantigenic
Associated with mature/hypermature cataract: Phacolytic

When faced with an intumescent cataract, what can the surgeon do to minimize the likelihood of seeing an Argentinian flag?
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---

**What is a mature cataract?**
A cortical cataract that has progressed to involve the entire lens cortex.

**What is a hypermature cataract?**
Mature cataracts may absorb water, transforming them into an *intumescent cortical cataract*. A *hypermature cataract* results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.

*Take note of the stages:*

Mature cataract → intumescent cataract → hypermature cataract

*Finally: What stage occurs after the hypermature stage?*
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

**Phacolytic glaucoma**  **Phacoantigenic glaucoma**  **Lens-particle glaucoma**

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*Finally: What stage occurs after the hypermature stage?*

**Morganian cataract**

---

**Take note of the stages:**

Mature cataract → **intumescent cataract** → **hypermature cataract**
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer).

| Phacolytic glaucoma | Phacoantigenic glaucoma | Lens-particle glaucoma |

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
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**What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?**
Further and extensive liquefaction of the cortical material.

**What is the slit-lamp appearance of a morgagnian cataract?**
The dense brown nuclear cataract is observed to be freely mobile within the liquified remnants of the cortical cataract.
A

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
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- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

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**What is a hypermature cataract?**
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**What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?**
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For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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**Take note of the stages:**
Mature cataract → Intumescent cortical cataract → Hypermature cataract

---

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Morgagnian cataract
Q For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer).

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2. Phacoantigenic glaucoma
3. Lens-particle glaucoma

- aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an **adaptive** immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic

What effect does the leaking of water and proteins have on the volume of the cataract?

- It reduces it significantly
- This reduction in cataract volume is responsible for a classic finding in hypermature cataracts.
- What is it? The anterior capsule is shrunken and wrinkled.

Hypermature cataract

What is a mature cataract?
- A cortical cataract that has progressed to involve the entire lens cortex

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- Mature cataracts may absorb water, transforming them into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
**Phacoantigenic glaucoma:**
- Usually unilateral: All of them
- Is mediated by an adaptive immune response: Phacoantigenic
- Associated with mature/hypermature cataract

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A mature cataract may leak water, transforming it into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
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For each statement, identify the **lens-related secondary OAG with which it is associated** (some have more than one answer)

| Phacolytic glaucoma | Phacoantigenic glaucoma | Lens-particle glaucoma |
---|---|---|

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This reduction in cataract volume is responsible for a classic finding in hypermature cataracts. What is it?

- The anterior capsule is shrunken and wrinkled
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)
Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

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**hypermature cataract**

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It reduces it significantly

*This reduction in cataract volume is responsible for a classic finding in hypermature cataracts. What is it?*

The anterior capsule is shrunken and wrinkled

A mature cataract may absorb water, turning into an intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
Hypermature cataract. Note the capsular wrinkling
Phacoanaphylactic glaucoma: Phacoantigenic
Usually unilateral: All of them
Is mediated by an adaptive immune response: Phacoantigenic
Associated with mature/hypermature cataract: Phacolytic
Vitritis may be present:
aka *phacoanaphylactic glaucoma*: Phacoantigenic

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- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic
- Vitritis may be present: Phacoantigenic
- Gonioscopy reveals cortical material in the angle:
A

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

- **aka** *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: **All of them**
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic
- Vitritis may be present: Phacoantigenic
- Gonioscopy reveals cortical material in the angle: **Lens particle**
Q

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*How should lens-particle glaucoma be managed?*
aka *phacoanaphylactic glaucoma*: Phacoantigenic
- Usually unilateral: All of them
- Is mediated by an *adaptive* immune response: Phacoantigenic
- Associated with mature/hypermature cataract: Phacolytic
- Vitritis may be present: Phacoantigenic
- Gonioscopy reveals cortical material in the angle: *Lens particle*

*How should lens-particle glaucoma be managed?*
If possible, medical management should be employed to control the inflammation and IOP until the eye can absorb the inciting lens material.
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

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How should lens-particle glaucoma be managed?
If possible, medical management should be employed to control the inflammation and IOP until the eye can absorb the inciting lens material

If medical management proves inadequate, what is the next step?
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

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*How should lens-particle glaucoma be managed?*

If possible, medical management should be employed to control the inflammation and IOP until the eye can absorb the inciting lens material

*If medical management proves inadequate, what is the next step?*

Surgical removal of the offending material
Phacoanaphylactic glaucoma: Phacoantigenic

Usually unilateral: All of them

Is mediated by an adaptive immune response: Phacoantigenic

Associated with mature/hypermature cataract: Phacolytic

Vitritis may be present: Phacoantigenic

Gonioscopy reveals cortical material in the angle: Lens particle

Least likely to develop elevated IOP:
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• Associated with mature/hypermature cataract: Phacolytic
• Vitritis may be present: Phacoantigenic
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- Gonioscopy reveals cortical material in the angle: Lens particle
- Least likely to develop elevated IOP: Phacoantigenic
- Is mediated by an *innate* immune response:
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*There are two broad categories of immune response—what are they?*

Innate and adaptive

*In general, what is the nature of each, and how do they differ?*  
The adaptive immune response involves ‘education,’ with surveillance cells learning to recognize and remember foreign material. OTOH, the innate (or natural) immune response does not require education—it relies on ‘preprogrammed’ immune cells to recognize foreign material encountered in tissue or blood.
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There are two broad categories of immune response—what are they?
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What are the two main effector cell types of innate immunity?
Neutrophils and macrophages
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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**What are the two main effector cell types of innate immunity?**

Neutrophils and macrophages
And now, an overly long sidebar regarding immunology and the lens-related secondary OAGs: Some clinicians reserve the term immune response for clinical situations in which an adaptive immune response is involved. That is, if the clinical situation involves only an innate response, such clinicians opt to use the more general term inflammation in describing the clinical picture.
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer).

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Usually unilateral: All of them

Is mediated by an adaptive immune response: Phacoantigenic

Associated with mature/hypermature cataract: Phacolytic

Vitritis may be present: Phacoantigenic

Gonioscopy reveals cortical material in the angle: Lens particle

Least likely to develop elevated IOP: Phacoantigenic

Is mediated by an innate immune response: Phacolytic

For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

Phacolytic glaucoma       Phacoantigenic glaucoma    Lens-particle glaucoma

There are two broad categories of immune response—what are they?

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I’m going on about this because it explains what may seem to be inconsistencies among the BCSC books with regard to phacolytic, phacoantigenic and lens-particle glaucoma.

TLDR When studying the lens-related secondary OAGs, make sure to read about them in all four books that address them: Glaucoma, Uveitis, Lens and Path, and be prepared to encounter inconsistencies when doing so.
And now, an overly long sidebar regarding immunology and the lens-related secondary OAGs:
Some clinicians reserve the term immune response for clinical situations in which an adaptive immune response is involved. That is, if the clinical situation involves only an innate response, such clinicians opt to use the more general term inflammation in describing the clinical picture. That said, the signs and symptoms produced by both adaptive and innate immune responses are recognized clinically as ‘inflammation,’ and despite their underlying differences in mechanism, are often indistinguishable at the slit lamp.

I’m going on about this because it explains what may seem to be inconsistencies among the BCSC books with regard to phacolytic, phacoantigenic and lens-particle glaucoma. Take the Lens book. It states that “phacoantigenic uveitis” (it does not use the term phacoantigenic glaucoma) is “immune-mediated.” However, it pointedly states that phacolytic glaucoma does not elicit an immune response. This is an example of the immune response = adaptive response mindset mentioned above. Likewise, the Path book addresses phacoantigenic uveitis in a section entitled Inflammations, but not phacolytic glaucoma—it is discussed under Secondary Glaucoma with Material in the Trabecular Meshwork. (The term lens-particle glaucoma does not appear in the Path book’s index.)
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

And now, an overly long sidebar regarding immunology and the lens-related secondary OAGs:

Some clinicians reserve the term *immune response* for clinical situations in which an **adaptive** immune response is involved. That is, if the clinical situation involves only an innate response, such clinicians opt to use the more general term *inflammation* in describing the clinical picture. *That said, the signs and symptoms produced by both adaptive and innate immune responses are recognized clinically as ‘inflammation,’ and despite their underlying differences in mechanism, are often indistinguishable at the slit lamp.*

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For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer).

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TLDR When studying the lens-related secondary OAGs, make sure to read about them in all four of the BCSC books that address them—Glaucoma, Uveitis, Lens and Path—and be prepared to grapple with inconsistencies when doing so.
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

- **Phacolytic glaucoma**
- **Phacoantigenic glaucoma**
- **Lens-particle glaucoma**

- aka *phacoanaphylactic glaucoma*: **Phacoantigenic**
- Usually unilateral: **All of them**
- Is mediated by an *adaptive* immune response: **Phacoantigenic**
- Associated with mature/hypermature cataract: **Phacolytic**
- Vitritis may be present: **Phacoantigenic**
- Gonioscopy reveals cortical material in the angle: **Lens particle**
- Least likely to develop elevated IOP: **Phacoantigenic**
- Is mediated by an *innate* immune response: **Phacolytic**
- PAS development is not a concern:
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For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer):

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Given that their cataracts can’t get much worse, what accounts for the fact that phacolytic glaucoma pts c/o an acute worsening of VA coinciding with the onset of their pain and ocular injection?
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Given that their cataracts can’t get much worse, what accounts for the fact that phacolytic glaucoma pts c/o an acute worsening of VA coinciding with the onset of their pain and ocular injection? The IOP spike smashes their corneal endothelium, resulting in corneal edema which renders bad VA even worse
Phacolytic glaucoma: Corneal edema
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer).

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*How is it the fellow eye can become involved in phacoantigenic glaucoma?*
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*How is it the fellow eye can become involved in phacoantigenic glaucoma?*
Recall that it is normal for minute amounts of lens protein to be found in the AC of a phakic eye.
For each statement, identify the lens-related secondary OAG with which it is associated (some have more than one answer)

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*How is it the fellow eye can become involved in phacoantigenic glaucoma?*

Recall that it is normal for minute amounts of lens protein to be found in the AC of a phakic eye. Recall further that phacoantigenic glaucoma involves an adaptive response in which the immune system becomes sensitized to normal lens proteins.
aka *phacoanaphylactic glaucoma*: Phacoantigenic

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*How is it the fellow eye can become involved in phacoantigenic glaucoma?*

Recall that it is normal for minute amounts of lens protein to be found in the AC of a phakic eye. Recall further that phacoantigenic glaucoma involves an adaptive response in which the immune system becomes sensitized to normal lens proteins. If an immune system that has become sensitized to normal lens proteins encounters them in the AC of the fellow eye, it may kick off a uveitic process in that eye.
Q

For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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Next let's take a look at some inflammatory causes of secondary OAG.
Open-angle Glaucoma: Secondary

Is elevated IOP a common manifestation of uveitis?
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No—in fact, a lower-than-normal IOP is expected
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Why does the IOP tend to be lower in an inflamed eye?
Is elevated IOP a common manifestation of uveitis?
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Why does the IOP tend to be lower in an inflamed eye?
Inflammation causes the ciliary body to ‘shut down’ to some extent, resulting in aqueous hyposecretion
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Why does the IOP tend to be lower in an inflamed eye?
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When elevated IOP does occur in the setting of uveitis, a number of different mechanisms may be responsible. What are they?

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When elevated IOP does occur in the setting of uveitis, a number of different mechanisms may be responsible. What are they?
--Inflammation of the TM causing it to swell
--Blocking of the angle by inflammatory material
--Clogging of Schlemm’s canal with inflammatory debris
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--And lest we forget, the classic iatrogenic cause of elevated IOP in uveitis:
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Steroid-induced reduced TM outflow
Is elevated IOP a common manifestation of uveitis?
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--And lest we forget, the classic iatrogenic cause of elevated IOP in uveitis: Steroid-induced reduced TM outflow

In general terms, what is the mechanism of steroid-induced IOP elevation?
Is elevated IOP a common manifestation of uveitis?
No—in fact, a lower-than-normal IOP is expected

Why does the IOP tend to be lower in an inflamed eye?
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In general terms, what is the mechanism of steroid-induced IOP elevation?
While still uncertain, it likely stems from impeded outflow at the TM owing to remodeling of the TM induced by the steroid
Is elevated IOP a common manifestation of uveitis?
No—in fact, a lower-than-normal IOP is expected

Why does the IOP tend to be lower in an inflamed eye?
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--And lest we forget, the classic iatrogenic cause of elevated IOP in uveitis: Steroid-induced reduced TM outflow

In general terms, what is the mechanism of steroid-induced IOP elevation?
Steroid-induced IOP elevation will be addressed in greater detail later in the slide-set
While there are many causes of OAG secondary to intraocular inflammation, the Glaucoma book sees fit to mention seven by name. What are they?
Seven forms of uveitic 2ndry OAG mentioned in the Glaucoma book

- Posner-Schlossman syndrome
- Fuchs heterochromic iridocyclitis
- VZV uveitis
- HSV uveitis
- Toxoplasmosis
- Pars planitis
- Juvenile idiopathic arthritis

While there are many causes of OAG secondary to intraocular inflammation, the Glaucoma book sees fit to mention seven by name. What are they?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

- Posner-Schlossman syndrome?
- Fuchs heterochromic iridocyclitis?
- VZV uveitis?
- HSV uveitis?
- Toxo/plasmosis?
- Pars planitis?
- Juvenile idiopathic arthritis?

Of the seven, the Glaucoma book addresses two in detail—so in this slide-set, we will follow suit. Which ones?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome
- VZV uveitis
- Toxoplasmosis
- Juvenile idiopathic arthritis

Fuchs heterochromic iridocyclitis
- HSV uveitis
- Pars planitis

Of the seven, the Glaucoma book addresses two in detail—so in this slide-set, we will follow suit. Which ones?

(Note: All of the others are covered extensively in other slide-sets; see the Table of Contents)
By what noneponymous name is P-S syndrome also known?
Posner-Schlossman syndrome
(aka glaucomatocyclitic crisis)

Fuchs heterochromic iridocyclitis

Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

By what noneponymous name is P-S syndrome also known?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome (aka glaucomatocyclitic crisis) --?

Fuchs heterochromic iridocyclitis --?

Does each tend to present unilaterally, or bilaterally?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

- Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)
  --Unilateral

- Fuchs heterochromic iridocyclitis
  --Unilateral

Does each tend to present unilaterally, or bilaterally?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)
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  --?

Fuchs heterochromic iridocyclitis
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  --?

What demographic is typically affected?
Two forms of uveitic secondary OAG addressed in the Glaucoma book

Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)
- Unilateral
- Young to middle-aged adults

Fuchs heterochromic iridocyclitis
- Unilateral
- Young to middle-aged adults

What demographic is typically affected?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

- Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)
  - Unilateral
  - Young to middle-aged adults
  - Inflammation is...

- Fuchs heterochromic iridocyclitis
  - Unilateral
  - Young to middle-aged adults
  - Inflammation is...

Is inflammation typically mild, or severe?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome
(aka glaucomatocyclitic crisis)
--Unilateral
--Young to middle-aged adults
--Inflammation is...mild

Fuchs heterochromic iridocyclitis
--Unilateral
--Young to middle-aged adults
--Inflammation is...mild

Is inflammation typically mild, or severe?
Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)

- Unilateral
- Young to middle-aged adults
- Inflammation is...mild
- IOP elevation usually...

Fuchs heterochromic iridocyclitis

- Unilateral
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Is IOP elevation typically mild, or severe?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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Fuchs heterochromic iridocyclitis  
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--Young to middle-aged adults  
--Inflammation is…mild  
--IOP elevation usually…mild (or absent)

Is IOP elevation typically mild, or severe?
**Two forms of uveitic 2ndry OAG addressed in the Glaucoma book**

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<td>--Is a chronic condition</td>
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*Is it an acute, chronic, or recurrent condition?*
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)
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Is it an acute, chronic, or recurrent condition?
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*What does it mean to say a uveitic condition is acute, recurrent or chronic?*
-- An acute *uveitis*...
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What does it mean to say a uveitic condition is acute, recurrent or chronic?
--An acute uveitis…comes on suddenly, and resolves fairly quickly
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Q/A

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--A chronic uveitis...also relapses, but **its quiescent periods off-treatment last less than 3 months**

Take special note of the difference between recurrent and chronic uveitis, a commonly misunderstood distinction
Does inflammation in each respond well, or poorly to steroids?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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*What is the classic descriptor of the shape of KP for each?*
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Are the KP distributed diffusely, or limited to Arlt’s triangle?
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Are the KP distributed diffusely, or limited to Arlt’s triangle? They are diffusely distributed in both conditions.
Open-angle Glaucoma: Secondary

FHI: Stellate KP. Note the diffuse distribution
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Are the KP distributed diffusely, or limited to Arlt’s triangle?
They are diffusely distributed in both conditions.

Where is Arlt’s triangle located?

Arlt’s triangle
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**Are the KP distributed diffusely, or limited to Arlt’s triangle?**

They are diffusely distributed in both conditions.

**Where is Arlt’s triangle located?**

Its apex is at the corneal center, and base in the inferior cornea.

*Cornea*  
Arlt’s triangle
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Which is associated with heterochromia iridis?
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Open-angle Glaucoma: Secondary

FHI: Heterochromia
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**Is the affected eye the darker eye or the lighter eye?**

Which is associated with heterochromia iridis?
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Is the affected eye the darker eye or the lighter eye? The lighter (with one exception)
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What is the exception; ie, under what circumstances is the **darker eye** the one with FHI?

The lighter **(with one exception)** which is associated with heterochromia iridis?
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What is the exception; ie, under what circumstances is the **darker** eye the one with FHI?
In individuals with light-blue eyes...

The lighter (with one exception)
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What is the exception; ie, under what circumstances is the darker eye the one with FHI?
In individuals with light-blue eyes…the iris atrophy stemming from the FHI process will make visible the darkly-pigmented epithelium of the posterior iris, thus making the eye appear darker

The lighter eye is the one with FHI, with one exception: in individuals with light-blue eyes, the darker eye is the one with FHI, which is associated with heterochromia iridis.
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*Which is associated with NVI and NVA?*
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Which is associated with NVI and NVA?
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Which is associated with PAS and NVG?

Do NVI and NVA in FHI lead to PAS and NVG?
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- Associated with heterochromia iridis
- Associated with NVI and NVA, but PAS and/or NVG rarely develop

Which is associated with:

Do NVI and NVA in FHI lead to PAS and NVG?
Only rarely
Q

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The NVA vessels in FHI rupture easily, and it not uncommon for FHI pts to develop a small hyphema when the paracentesis wound is made at the start of cataract surgery. What is the eponymous name for this classic finding?
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The NVA vessels in FHI rupture easily, and it not uncommon for FHI pts to develop a small hyphema when the paracentesis wound is made at the start of cataract surgery. What is the eponymous name for this classic finding? Amsler’s (or Amsler-Verrey) sign
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Which has a strong association with cataract, and with what type of cataract is it associated?
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-- KP are ‘white and stellate’
-- Associated with heterochromia iridis
-- Associated with NVI and NVA, but PAS and/or NVG rarely develop
-- Associated with PSC

Which has a strong association with cataract, and with what type of cataract is it associated?
Open-angle Glaucoma: Secondary

FHI: Note the cataract
Next let's take a look at OAG secondary to increased EVP
What does EVP stand for in this context?

OAG 2ndry to ↑ EVP
What does EVP stand for in this context?
Episceral venous pressure, ie, the BP in the episcleral venous plexus

OAG 2ndry to ↑ EVP

Open-angle Glaucoma: Secondary
What does EVP stand for in this context?
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus?
What does EVP stand for in this context?
Episcleral venous pressure, i.e., the BP in the episcleral venous plexus

What is the episcleral venous plexus?

The episcleral venous plexus is the network of venous channels located in the episclera in the peri-limbal region.
What does EVP stand for in this context?
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus?
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What is the episclera?
What does EVP stand for in this context?
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus?
The episcleral venous plexus is the network of venous channels located in the episclera in the peri-limbal region

What is the episclera?
The outermost of the three layers of the sclera
What does EVP stand for in this context?
Episceral venous pressure, i.e., the BP in the episcleral venous plexus.

What is the episcleral venous plexus?
The episcleral venous plexus is the network of venous channels located in the peri-limbal region.

What is the episclera?
The outermost of the three layers of the sclera.

Out to in, what are the other two layers?
--Episclera
--
**Open-angle Glaucoma: Secondary**

**OAG 2ndry to ↑ EVP**

*What does EVP stand for in this context?*
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

*What is the episcleral venous plexus?*

The episcleral venous plexus is the network of venous channels located in the peri-limbal region.

*What is the episclera?*
The outermost of the three layers of the sclera

*Out to in, what are the other two layers?*
--Episclera
--Stroma
--Lamina fusca
Open-angle Glaucoma: Secondary

The * indicates the lamina fusca

Sclera: Anatomy
What does EVP stand for in this context?
Episceral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus? From where does it receive its intake?

The episcleral venous plexus is the network of venous channels located in the episclera in the peri-limbal region.

Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP
What does EVP stand for in this context?
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus? From where does it receive its intake?

The episcleral venous plexus is the network of venous channels located in the episclera in the peri-limbal region. So-called carry aqueous to it that drained from Schlemm’s canal via collector channels.
What does EVP stand for in this context?
Episcleral venous pressure, i.e., the BP in the episcleral venous plexus.

What is the episcleral venous plexus? From where does it receive its intake?

The episcleral venous plexus is the network of venous channels located in the episclera in the peri-limbal region. So-called aqueous veins carry aqueous to it that drained from Schlemm’s canal via collector channels.
Open-angle Glaucoma: Secondary

Conventional aqueous outflow pathway
**Open-angle Glaucoma: Secondary**

Aqueous vein. Note that the first portion (*black arrowhead*) contains only aqueous, whereas upon emptying into a venule, laminar flow consisting of separate aqueous and blood columns can be seen (*blue arrowhead*)
What does EVP stand for in this context?
Episcleral venous pressure, ie, the BP in the episcleral venous plexus

What is the episcleral venous plexus? From where does it receive its intake? To where does it subsequently discharge that intake?
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There are two main pathways for blood leaving the globe. What are they?
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The central retinal vein (CRV), and the vortex veins
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How many vortex veins are there?
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How many vortex veins are there?
4-7 (can be more)
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How many vortex veins are there? 4-7 (can be more)

Where are they located?
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There are two main pathways for blood leaving the globe. What are they?
The central retinal vein (CRV), and the vortex veins.

How many vortex veins are there?
4-7 (can be more)

Where are they located?
The pierce the sclera roughly at the equator of the globe. There is at least one (often more) in each quadrant of the eye.
Open-angle Glaucoma: Secondary

Vortex veins
Open-angle Glaucoma: Secondary

Vortex veins. Their ampullae are visible during DFE (the large circle is approximating the equator of the globe)
OAG 2ndry to ↑ EVP

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What ocular structures does each pathway drain?
--The CRV:
--The vortex veins:
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--The CRV: The retina
--The vortex veins: Pretty much everything else
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What ocular structure comprises the lion’s share of ‘everything else’?
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What ocular structure comprises the lion’s share of ‘everything else’?
The uvea, ie, the three parts of the uvea
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What ocular structure comprises the lion’s share of ‘everything else’?
The uvea, ie, the choroid, ciliary body and iris
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What venous structure receives the majority of CRV and vortex veins outflow?
The superior ophthalmic vein (SOV)
Open-angle Glaucoma: Secondary

Superior ophthalmic vein
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Into what structure does the SOV empty?
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The superior ophthalmic vein (SOV)

Into what structure does the SOV empty?
The cavernous sinus
Open-angle Glaucoma: Secondary

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What is the normal range for EVP?
5-9 mmHg—same as CVP
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OAG 2ndry to ↑ EVP

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Central venous pressure, ie, the blood pressure in the...
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What does CVP stand for in this context?
Central venous pressure, ie, the blood pressure in the right atrium
**What does EVP stand for in this context?**
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**What is the normal range for EVP?**
5-9 mmHg—same as CVP

**What happens if EVP increases significantly?**
Open-angle Glaucoma: Secondary

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OAG 2ndry to ↑ EVP
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What is the normal range for EVP?
5-9 mmHg—same as CVP

What happens if EVP increases significantly?
If EVP is high, back-pressure will be transmitted to the AC via the aqueous veins, collector channels, Schlemm’s canal and TM, causing a proportional increase in IOP.
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

In addition to elevated IOP, what other sign/symptoms might result from elevated EVP?

If EVP is high, the episcleral veins will be ‘prominent’—dilated and/or tortuous.

The pt may c/o and present with a chronic ‘red eye’
Two aspects of such a red-eye presentation—one symptom-related, one sign-related—will suggest it’s not a run-of-the-mill red eye. What are they?

--Symptom-wise…
The presentation will lack c/o related to ocular surface dz—no FBS, itching, tearing, etc

--Sign-wise…
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Open-angle Glaucoma: Secondary

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Open-angle Glaucoma: Secondary

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Open-angle Glaucoma: Secondary

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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---Sign-wise…The episcleral veins will be ‘prominent’—dilated and/or tortuous
Open-angle Glaucoma: Secondary

Prominent episcleral veins 2ndry to increased EVP
In cases for which a cause can be identified, what are the two basic mechanisms of increased EVP?
In cases for which a cause can be identified, what are the two basic mechanisms of increased EVP?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

Note for those of you thought ‘AV malformation’ was the correct answer here…
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

Note for those of you thought ‘AV malformation’ was the correct answer here… This is one of very few times where I’m substituting my judgment for that of a BCSC book. The Glaucoma book does indeed label this category “AV malformations,” but that term clearly does not apply to all of the conditions the Glaucoma book hangs under it (TBH, I don’t think it applies to any of them). This is why I decided to go with my own term—the anodyne-but-accurate Arterial and/or venous abnormalities.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

? Umbrella term for several conditions

? Fairly specific condition, but can present several ways

? Very specific condition

The Glaucoma book mentions three arterial/venous abnormalities as causes—what are they?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula  
  Umbrella term for several conditions
- Orbital varix  
  Fairly specific condition, but can present several ways
- Sturge-Weber syndrome  
  Very specific condition

Venous obstruction

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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- A-V fistula
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Venous obstruction
- ? Category of condition
- ? Very specific condition

*It mentions two causes of venous obstruction—what are they?*
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

*It mentions two causes of venous obstruction—what are they?*
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic?

Arterial and/or venous abnormalities
- A-V fistula?
- Orbital varix?
- Sturge-Weber syndrome?

Venous obstruction
- Retrobulbar tumor?
- Thyroid eye dz?

Finally: Of the conditions known to cause 2ndry OAG owing to increased EVP, which is most common?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Arterial and/or venous abnormalities
- A-V fistula
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Idiopathic
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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- A-V fistula
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Venous obstruction
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The A-V fistulas implicated in OAG 2ndry to increased EVP: Where are they located?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Orbital varix

Venous obstruction

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The cavernous sinus (CS)
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

A-V fistula

Orbital varix

The A-V fistulas implicated in OAG 2ndry to increased EVP: Where are they located?
The cavernous sinus (CS)

An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is it?
Open-angle Glaucoma: Secondary

**OAG 2ndry to ↑ EVP**

Idiopathic

**Arterial and/or venous abnormalities**

- A-V fistula
- Orbital varix

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

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The A-V fistulas implicated in OAG 2ndry to increased EVP: Where are they located?
The cavernous sinus (CS)

An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is it? It is the configuration--unique in the human body--of having an arterial structure (the artery and its branches) wholly within the confines of a venous structure (ie, the CS itself)
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

A-V fistula

Orbital varix

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An aspect of CS anatomy makes it uniquely vulnerable to the development of A-V fistulas. What is it? It is the configuration--unique in the human body--of having an arterial structure (the internal carotid artery and its dural branches) wholly within the confines of a venous structure (ie, the CS itself)
Open-angle Glaucoma: Secondary

Relationship between the internal carotid artery and the CS
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Venous obstruction

- Retrobulbar tumor
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What is the fundamental problem that results from a fistula within the CS?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

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What is the fundamental problem that results from a fistula within the CS? It’s a pressure thing. A fistula allows high-pressure blood from the arterial tree to flow into the low-pressure, venous-sided CS. The subsequent increase in blood pressure within the CS impedes venous flow into the CS, leading to congestion of the eye and orbit.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Venous obstruction

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Open-angle Glaucoma: Secondary

Carotid-CS fistula
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

The A-V fistulas implicated in OAG 2ndry to increased EVP: Where are they located?

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Earlier in the slide-set, the main venous conduit from the eye and orbit to the CS was identified. What was it again?

The superior ophthalmic vein

In a pt with a CS fistula, what is the appearance of the superior ophthalmic vein on orbital imaging studies?

It is enlarged. This is an important sign to search for when reviewing imaging studies in cases of suspected CS fistulas!
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Venous obstruction

- Retrobulbar tumor
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What was it again?

The superior ophthalmic vein (SOV)

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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Venous obstruction

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Open-angle Glaucoma: Secondary

Carotid-CS fistula: Enlarged SOV on MRA
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

A-V fistula

Venous obstruction

- Retrobulbar tumor
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

Orbital varices are known also by what other name?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
  - A-V fistula
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Venous obstruction
  - Retrobulbar tumor
  - Thyroid eye dz

Orbital varices are known also by what other name? Orbital venous malformations
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Venous obstruction
- Retrobulbar tumor
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Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
  - A-V fistula
  - Orbital varix
  - Sturge-Weber syndrome

Venous obstruction
  - Retrobulbar tumor
  - Thyroid eye dz

Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt’s head is tilted or when the pt raises action
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
  - A-V fistula
  - Sturge-Weber syndrome

Venous obstruction
  - Retrobulbar tumor
  - Thyroid eye dz

Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt’s head is dependent, or when the pt Valsalvas
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

Orbital varices are known also by what other name? Orbital venous malformations

What is the classic presenting sign? Proptosis that occurs or worsens when the pt’s head is dependent, or when the pt Valsalva-ing

Do these pts always have proptosis at rest, ie, when not Valsalva-ing?

Conservatively, if at all possible—complete excision is difficult, and significant intra-op bleeding is a concern
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction

- Retrobulbar tumor
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Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt's head is dependent, or when the pt Valsalvas

Do these pts always have proptosis at rest, ie, when not Valsalva-ing?
No; in fact, it is not uncommon for the affected eye to be enophthalmic at rest
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

- A-V fistula
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**Orbital varices are known also by what other name?**
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**What is the classic presenting sign?**
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**What is the best means of diagnosing an orbital varix?**
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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What is the best means of diagnosing an orbital varix?
Perform contrast-enhanced spiral CT while the pt

action
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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What is the best means of diagnosing an orbital varix?
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Orbital varix. A 70-year-old woman who presented due to an orbital mass incidentally discovered on an outside brain MR imaging. Axial (A and C) and coronal (B and D) CT images of the orbits without (A and B) and with (C and D) a Valsalva maneuver demonstrate inducible enlargement of a lobular structure in the right orbit (arrows), consistent with a varix. The patient subsequently reported right-eye fullness when bending over.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
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Orbital varices are known also by what other name?
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What is the classic presenting sign?
Proptosis that occurs or worsens when the pt Valsalvas

Why spiral CT?
Because it's a relatively fast imaging modality
Why is speed important?
Because the pt is holding her breath!

What is the best means of diagnosing an orbital varix?
Perform contrast-enhanced spiral CT while the pt Valsalvas
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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How should orbital varices be managed?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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How should orbital varices be managed?
Conservatively, if at all possible—complete excision is difficult, and significant intra-op bleeding is a concern
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt’s head is dependent, or when the ptValsalvas

Per the Orbit book, in what two circumstances should excision of an orbital varix be considered?

Conservatively, if at all possible—complete excision is difficult, and significant intra-op bleeding is a concern
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Arterial and/or venous abnormalities
- A-V fistula
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Venous obstruction
- Retrobulbar tumor
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Orbital varices are known also by what other name?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt’s head is dependent, or when the pt Valsalvas

Per the Orbit book, in what two circumstances should excision of an orbital varix be considered?
--If the varix is causing severe pain
--If optic-nerve compression is threatening vision

How should orbital varices be managed?
Conservatively, if at all possible—complete excision is difficult, and significant intra-op bleeding is a concern
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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Sturge-Weber syndrome

In one word, what sort of condition is Sturge-Weber?

- A phakomatosis
- Encephalotrigeminal angiomatosis
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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Open-angle Glaucoma: Secondary

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In one word, what sort of condition is Sturge-Weber?
A phakomatosis

Briefly, what is a phakomatosis?
Open-angle Glaucoma: Secondary

Q/A

OAG 2ndry to ↑ EVP

Idiopathic

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In one word, what sort of condition is Sturge-Weber?
A phakomatosis

Briefly, what is a phakomatosis?
A congenital condition involving hamartomatous lesions of multiple organ systems, usually including the [abl], [ ], [ ] and [ ]
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Sturge-Weber syndrome

In one word, what sort of condition is Sturge-Weber?
A phakomatosis

By what noneponymous name is Sturge-Weber known?
Open-angle Glaucoma: **Secondary**

- **OAG 2ndry to ↑ EVP**
  - **Idiopathic**
  - **Arterial and/or venous abnormalities**
    - A-V fistula
    - Orbital varix
  - **Venous obstruction**
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  - **Sturge-Weber syndrome**

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**In one word, what sort of condition is Sturge-Weber?**
A phakomatosis

**By what noneponymous name is Sturge-Weber known?**
Encephalotrigeminal angiomatosis
Open-angle Glaucoma: Secondary

- OAG 2ndry to ↑ EVP

  - Idiopathic

  - Arterial and/or venous abnormalities
    - A-V fistula
    - Orbital varix
    - Sturge-Weber syndrome

  - Venous obstruction
    - Retrobulbar tumor
    - Thyroid eye dz

What facial lesion is a hallmark of Sturge-Weber syndrome?

- The port wine stain, aka 'nevus flammeus'

What facial lesion is a hallmark of Sturge-Weber syndrome?

- At birth

What facial lesion is a hallmark of Sturge-Weber syndrome?

- It comports to the distribution of one or more divisions of CN5

What facial lesion is a hallmark of Sturge-Weber syndrome?

- All infants with Sturge-Weber syndrome have a port wine stain.

What facial lesion is a hallmark of Sturge-Weber syndrome?

- Do all infants with a port wine stain have Sturge-Weber syndrome?

No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
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Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
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The port wine stain, aka 'two words'
Open-angle Glaucoma: Secondary

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Open-angle Glaucoma: Secondary

Sturge-Weber: Port-wine stain
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka ‘ nevus flammeus ’

When does it present?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Venous obstruction
- Retrobulbar tumor
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What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka ‘ nevus flammeus ’

When does it present?
At birth
Open-angle Glaucoma: Secondary

Sturge-Weber: Port-wine stain
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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Sturge-Weber syndrome

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Sturge-Weber syndrome

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When does it present?
At birth

What is the typical pattern of distribution?
It comports to the distribution of one or more divisions of CN5
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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All infants with Sturge-Weber syndrome have a port wine stain.
Do all infants with a port wine stain have Sturge-Weber syndrome?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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It comports to the distribution of one or more divisions of CN5

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Do all infants with a port wine stain have Sturge-Weber syndrome?
No

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?
The diffuse choroidal hemangioma

Diffuse choroidal hemangioma is present in what percent of SWS?
About 50%

Can the choroidal hemangioma be present bilaterally?
Yes, but it’s uncommon

Does the choroidal hemangioma have malignant potential?
No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic
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- A-V fistula
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

*Arterial and/or venous abnormalities*

- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

*Venous obstruction*

- Retrobulbar tumor
- Thyroid eye dz

What facial lesion is a hallmark of Sturge-Weber syndrome?

*The port wine stain, aka 'nevus flammeus'.*

When does it present?

*At birth.*

What is the typical pattern of distribution?

*It comports to the distribution of one or more divisions of CN5.*

All infants with Sturge-Weber syndrome have a port wine stain.

Do all infants with a port wine stain have Sturge-Weber syndrome?

*No.*

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?

*The diffuse choroidal hemangioma.*

By what food-based name is the DFE appearance of a diffuse choroidal hemangioma known?

*Tomato catsup fundus.*
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
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‘Tomato catsup fundus’
Sturge-Weber: Tomato catsup fundus OD
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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When does it present?
At birth

What is the typical pattern of distribution?
It comports to the distribution of one or more divisions of CN5

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No

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Diffuse choroidal hemangioma is present in what percent of SWS?
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Can the choroidal hemangioma be present bilaterally?
Yes, but it's uncommon

Does the choroidal hemangioma have malignant potential?
No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix
- Sturge-Weber syndrome

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

What sort of condition is Sturge-Weber?
A phakomatosis

By what noneponymous name is Sturge-Weber known?
Encephalotrigeminal angiomatosis

What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka ' nevus flammeus'

When does it present?
At birth

What is the typical pattern of distribution?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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At birth

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It comports to the distribution of one or more divisions of CN5

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

- A-V fistula
- Orbital varix

Sturge-Weber syndrome

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

What facial lesion is a hallmark of Sturge-Weber syndrome? The port wine stain, aka "nevus flammeus".

When does it present? At birth.

What is the typical pattern of distribution? It comports to the distribution of one or more divisions of CN5.

All infants with Sturge-Weber syndrome have a port wine stain. No

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Diffuse choroidal hemangioma is present in what percent of SWS? About 50%.

Can the choroidal hemangioma be present bilaterally? Yes, but it’s uncommon.
Open-angle Glaucoma: Secondary

**OAG 2ndry to ↑ EVP**

- Idiopathic
- Arterial and/or venous abnormalities
  - A-V fistula
  - Orbital varix
  - **Sturge-Weber syndrome**
- Venous obstruction
  - Retrobulbar tumor
  - Thyroid eye dz

**What facial lesion is a hallmark of Sturge-Weber syndrome?**
The port wine stain, aka ‘nevus flammeus’

**When does it present?**
At birth

**What is the typical pattern of distribution?**
It comports to the distribution of one or more divisions of CN 5

**All infants with Sturge-Weber syndrome have a port wine stain.**
No

**What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?**
The **diffuse choroidal hemangioma**

**Diffuse choroidal hemangioma is present in what percent of SWS?**
About 50%

**Can the choroidal hemangioma be present bilaterally?**
Yes, but it’s uncommon

**Does the choroidal hemangioma have malignant potential?**
No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
- Orbital varix

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

Sturge-Weber syndrome

What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka 'nevus flammeus'.

When does it present?
At birth

What is the typical pattern of distribution?
It comports to the distribution of one or more divisions of CN5.

All infants with Sturge-Weber syndrome have a port wine stain.

Do all infants with a port wine stain have Sturge-Weber syndrome?
No

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**Open-angle Glaucoma: Secondary**

OAG 2ndry to ↑ EVP

- Idiopathic
- Arterial and/or venous abnormalities
- Venous obstruction abnormalities

*There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?*

- Sturge-Weber syndrome

*What facial lesion is a hallmark of Sturge-Weber syndrome?*

- The port wine stain, aka ‘nevus flammeus’

*When does it present?*

- At birth

*What is the typical pattern of distribution?*

- It comports to the distribution of one or more divisions of CN5

*All infants with Sturge-Weber syndrome have a port wine stain.*

*Do all infants with a port wine stain have Sturge-Weber syndrome?*

- No

*What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?*

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*Diffuse choroidal hemangioma is present in what percent of SWS?*

- About 50%

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- Yes, but it’s uncommon

*Does the choroidal hemangioma have malignant potential?*

- No
**Open-angle Glaucoma: Secondary**

- **OAG 2ndry to ↑ EVP**
  - Idiopathic
  - Arterial and/or venous abnormalities
  - Venous obstruction abnormalities
    - Venous obstruction abnormalities

**Sturge-Weber syndrome**

- There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?
  - Glaucomatous cupping of the ONH, aka the reason we’re talking about it!

**Questions**

- What facial lesion is a hallmark of Sturge-Weber syndrome?
  - The port wine stain, aka 'nevus flammeus'
- When does it present?
  - At birth
- What is the typical pattern of distribution?
  - It comports to the distribution of one or more divisions of CN5
- All infants with Sturge-Weber syndrome have a port wine stain.
  - No
- What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?
  - The diffuse choroidal hemangioma
- Diffuse choroidal hemangioma is present in what percent of SWS?
  - About 50%
- Can the choroidal hemangioma be present bilaterally?
  - Yes, but it’s uncommon
- Does the choroidal hemangioma have malignant potential?
  - No
Sturge-Weber: Same pic, but this time take note the glaucomatous cupping on the affected side.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

Glaucmatous cupping of the ONH, aka the reason we’re talking about it!

Sturge-Weber syndrome

What facial lesion is a hallmark of Sturge-Weber syndrome?

The port wine stain, aka ‘nevus flammeus’

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?

The diffuse choroidal hemangioma

What percent of Sturge-Weber syndrome pts develop glaucoma?

Approximately 70%

All infants with Sturge-Weber syndrome develop a port wine stain.

Do all infants with a port wine stain have Sturge-Weber syndrome?

No

Does the choroidal hemangioma have malignant potential?

No

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

Glaucomatous cupping of the ONH
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

Glaucmatous cupping of the ONH, aka the reason we’re talking about it!

Sturge-Weber syndrome

What facial lesion is a hallmark of Sturge-Weber syndrome?

The port wine stain, aka ‘nevus flammeus’

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?

The diffuse choroidal hemangioma

What percent of Sturge-Weber syndrome pts develop glaucoma?

Estimates run as high as 70%

All infants with Sturge-Weber syndrome? Do all infants with a port wine stain?

No

Does the choroidal hemangioma have malignant potential?

No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?  
Glaucmatous cupping of the ONH, aka the reason we’re talking about it!

Sturge-Weber syndrome

What facial lesion is a hallmark of Sturge-Weber syndrome?  
The port wine stain, aka ‘nevus flammeus’

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?  
The diffuse choroidal hemangioma

What percent of Sturge-Weber syndrome pts develop glaucoma?  
Estimates run as high as 70

Is there a relationship between the port-wine stain and risk of glaucoma?  
Yes—if the port-wine stain involves the eyelid, the risk is increased

All infants with Sturge-Weber syndrome do not have a port wine stain.  
No

Do all infants with a port wine stain have Sturge-Weber syndrome?  
No

Does the choroidal hemangioma have malignant potential?  
No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

Glucomatous cupping of the ONH, aka the reason we’re talking about it!

Sturge-Weber syndrome

What facial lesion is a hallmark of Sturge-Weber syndrome?
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All infants with Sturge-Weber
Do all infants with a port wine stain have Sturge-Weber syndrome?
No

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No
Open-angle Glaucoma: Secondary

**OAG 2ndry to ↑ EVP**

- Arterial and/or venous abnormalities
- Venous obstruction abnormalities
- Idiopathic

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

**Glaucotamous cupping** of the ONH, aka the reason we’re talking about it!

**Sturge-Weber syndrome**

What facial lesion is a hallmark of Sturge-Weber syndrome?

The **port wine stain**, aka ‘nevus flammeus’

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The **diffuse choroidal hemangioma**

What percent of Sturge-Weber syndrome pts develop glaucoma?

Estimates run as high as 70

Is there a relationship between the port-wine stain and risk of glaucoma?

Yes—if the port-wine stain involves the **eyelid**, the risk is increased

All infants with Sturge-Weber syndrome

Do all infants with a port wine stain have Sturge-Weber syndrome?

No

Does the choroidal hemangioma have malignant potential?

No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

There is another DFE finding that is a hallmark of Sturge-Weber syndrome. What is it?

Glaucmatous cupping of the ONH, aka the reason we’re talking about it!

Sturge-Weber syndrome

For more on Sturge-Weber syndrome, see slide-set P10

What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka ‘nevus flammeus’

What posterior-pole lesion is a hallmark of Sturge-Weber syndrome?
The diffuse choroidal hemangioma

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Estimates run as high as 70%

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Yes—if the port-wine stain involves the eyelid, the risk is increased

All infants with Sturge-Weber syndrome

Do all infants with a port wine stain have Sturge-Weber syndrome?
No

Does the choroidal hemangioma have malignant potential?
No
In a nutshell, what causes increased EVP in thyroid eye dz (TED)?
In a nutshell, what causes increased EVP in thyroid eye dz (TED)?
Recall that TED involves congestion of the orbit owing to both infiltrating inflammatory cells as well as increased secretion of ground substance (eg, glycosaminoglycans). This increase in orbital mass leads to proptosis (TED is the #1 cause of both uni- and bilateral proptosis in adults).
In a nutshell, what causes increased EVP in thyroid eye dz (TED)?
Recall that TED involves congestion of the orbit owing to both infiltrating inflammatory cells as well as increased secretion of ground substance (eg, glycosaminoglycans). This increase in orbital mass leads to proptosis (TED is the #1 cause of both uni- and bilateral proptosis in adults). Further, the orbital congestion often compresses the vortex veins, which in turn increases EVP.
In a nutshell, what causes increased EVP in thyroid eye dz (TED)?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
  - A-V fistula
  - Venous obstruction
    - Retrobulbar tumor
    - Thyroid eye dz

In a nutshell, what causes increased EVP in thyroid eye dz (TED)?

Recall that TED involves congestion of the orbit owing to both infiltrating inflammatory cells as well as increased secretion of ground substance (e.g., glycosaminoglycans). This increase in orbital mass leads to proptosis (TED is the #1 cause of both uni- and bilateral proptosis in adults). Further, the orbital congestion often compresses the vortex veins, which in turn increases EVP.

For more on TED, see slide-set O5
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Is OAG 2ndry to increased EVP amenable to medical management?
Is OAG 2ndry to increased EVP amenable to medical management? Yes, provided the clinician keep in mind that treatments which work by are unlikely to be effective
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

*Is OAG 2ndry to increased EVP amenable to medical management?*
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective
Is OAG 2ndry to increased EVP amenable to medical management? Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work?
Is OAG 2ndry to increased EVP amenable to medical management?
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Is OAG 2ndry to increased EVP amenable to medical management?
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.
OAG 2ndry to ↑ EVP

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Which two therapies are off the table?
Hints forthcoming…
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Is OAG 2ndry to increased EVP amenable to medical management?
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Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

Which two therapies are off the table?
-- (this one is NBD, because you never use it anyway)
-- (this one you use a lot)
Is OAG 2ndry to increased EVP amenable to medical management?
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work? Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

Which two therapies are off the table?
--Topical tx with…
--Surgical tx with…
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

Which two therapies are off the table?
--Topical tx with…pilo
--Surgical tx with…SLT
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Is OAG 2ndry to increased EVP amenable to medical management?
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Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

Which two therapies are off the table?
--Topical tx with pilocarpine
--Surgical tx with...MIGS?

If you answered MIGS...
Open-angle Glaucoma: Secondary

OAG 2ndry to \( \uparrow \) EVP

**Is OAG 2ndry to increased EVP amenable to medical management?**
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

**Why don’t treatments directed at increasing TM outflow work?**
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

*Which two therapies are off the table?*

---
Topical tx with...pilo
---
Surgical tx with...MIGS?

*If you answered MIGS...* The Glaucoma book in my possession does not address these procedures specifically in the context of elevated EVP. But it would certainly stand to reason that procedures intended to facilitate TM outflow (as is the case for all FDA-approved MIGS at the time of this writing) would be ineffective as well.
Is OAG 2ndry to increased EVP amenable to medical management?
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

OK, so what treatments should be employed?
Is OAG 2ndry to increased EVP amenable to medical management?
Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work?
Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

OK, so what treatments should be employed?
Drops that decrease aqueous production should be used, along with those that increase uveoscleral outflow.
Is OAG 2ndry to increased EVP amenable to medical management? Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

Why don’t treatments directed at increasing TM outflow work? Because of the pathophysiology of the condition—the mechanism by which IOP is elevated. Remember: High EVP produces back-pressure that is transmitted to the AC via a path that directly involves the TM. Because of this, the TM is not amenable to therapeutic maneuvers intended to enhance its functionality.

OK, so what treatments should be employed? Drops that decrease aqueous production should be used, along with those that increase uveoscleral outflow.
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Yes, provided the clinician keep in mind that treatments which work by increasing TM outflow are unlikely to be effective.

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While not strictly contraindicated, it is best not attempted by surgeons who are faint of heart, because the presence of elevated EVP significantly increases the risk of intra-op effusion and/or hemorrhage of the uvea.
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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If medical management fails, should filtering surgery be pursued?
While not strictly contraindicated, it is best not attempted by surgeons who are faint of heart, because the presence of elevated EVP significantly increases the risk of intra-op effusion and/or hemorrhage of the uvea. Filtering surgeries on these eyes can get real sporty real fast.
Next let’s take a look at certain trauma-related causes of secondary OAG, along with Schwartz syndrome.
One of these things is not like the others. Which two belong together, which one stands alone, and why?
Open-angle Glaucoma: Secondary

- Glaucoma 2ndry to hyphema
  - Follows AC bleed
- Hemolytic glaucoma
  - Follow vitreous bleed
- Ghost-cell glaucoma

One of these things is not like the others. Which two belong together, which one stands alone, and why?
Open-angle Glaucoma: Secondary

- Glaucoma secondary to hyphema
  - Follows AC bleed

Hyphema is covered in its own slide-set (FELT12)

- Hemolytic glaucoma
  - Follow vitreous bleed

- Ghost-cell glaucoma
Open-angle Glaucoma: Secondary

Hemolytic glaucoma
Ghost-cell glaucoma

Follow vitreous bleed

The remainder of this set will focus on hemolytic- and ghost-cell glaucoma

Glaucoma 2ndry to hyphema
Follows AC bleed
Glaucoma secondary to hyphema  
Follows **AC** bleed

**Open-angle Glaucoma: Secondary**

- **Hemolytic glaucoma**  
  Follow **vitreous** bleed

- **Ghost-cell glaucoma**

---

**THIS IS IMPORTANT!** Take a moment to file a mental note before proceeding:

Hemolytic- and ghost-cell glaucoma follow a **vitreous** bleed, not an **AC** bleed!
Glaucoma 2ndry to hyphema  
Follows AC bleed

What causes of vitreous hemorrhage are involved?
What causes of vitreous hemorrhage are involved? The usual suspects—PDR, CRVO, etc, as well as trauma
Q

Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma  Ghost-cell glaucoma

Follow vitreous bleed

What causes of vitreous hemorrhage are involved?
The usual suspects—PDR, CRVO, etc, as well as trauma

How does the blood get from the vitreous cavity to the AC?
What causes of vitreous hemorrhage are involved?
The usual suspects—PDR, CRVO, etc, as well as trauma

How does the blood get from the vitreous cavity to the AC?
It can occur spontaneously, but more commonly there’s a hx of anterior hyaloid face disruption from trauma or surgery (eg, cataract; PPV) that provides a ready pathway for cells to reach the AC
In a nutshell, what is the mechanism underlying both hemolytic and ghost-cell glaucomas?
In a nutshell, what is the mechanism underlying both hemolytic and ghost-cell glaucomas?

TM clogging → impeded aqueous outflow → increased IOP
Ghost-cell glaucoma

Hemolytic glaucoma

TM clogged with…

TM clogged with…

In each condition, what is clogging the TM?
--Hemolytic glaucoma: ?
--Ghost-cell glaucoma: ?

Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed
Glaucoma secondary to hyphema

Follows AC bleed

**Open-angle Glaucoma: Secondary**

- **Hemolytic glaucoma**
  - TM clogged with...
  - Hgb-laden macrophages

- **Ghost-cell glaucoma**
  - TM clogged with...
  - Degenerated RBCs

---

*In each condition, what is clogging the TM?*

-- Hemolytic glaucoma: Hgb-laden macrophages
-- Ghost-cell glaucoma: Degenerated RBCs
Open-angle Glaucoma: Secondary

- **Hemolytic glaucoma**
  - TM clogged with...
  - *Hgb-laden macrophages*

- **Ghost-cell glaucoma**
  - TM clogged with...
  - Degenerated RBCs

**Make another mental note:** While ghost-cell glaucoma involves RBCs as would be expected in a hemorrhage-related condition, in hemolytic glaucoma the culprit is not RBCs—it’s *macrophages*
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...

Hgb-laden macrophages

Ghost-cell glaucoma

TM clogged with...

degenerated RBCs

What’s up with the macrophages? How do they figure in all this?
What’s up with the macrophages? How do they figure in all this? RBCs in a vitreous hemorrhage start to break down after a week or two. The degeneration of these cells attracts macrophages, which consume both the effete RBCs as well as the hemoglobin-related material they release. Heavy-laden with globules of degenerated Hgb and other RBC detritus, these macrophages end up in the AC, and ultimately the angle.
Hemolytic glaucoma. The anterior chamber angle contains macrophages with erythrocytic debris and rust-colored intracytoplasmic material (arrows).
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

What’s up with the macrophages? How do they figure in all this?
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‘Globules of degenerated Hgb’ are known by what eponymous name?

globules of degenerated Hgb
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

What’s up with the macrophages? How do they figure in all this?
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‘Globules of degenerated Hgb’ are known by what eponymous name?
Heinz bodies

Globules of degenerated Hgb
Open-angle Glaucoma: Secondary

Hemolytic glaucoma. The degenerating hemoglobin is present as small globules known as Heinz bodies (arrows).
What’s up with the macrophages? How do they figure in all this? RBCs in a vitreous hemorrhage start to break down after a week or two. The degeneration of these cells attracts macrophages, which consume both the effete RBCs as well as the hemoglobin-related material they release. Heavy laden with globules of degenerated Hgb and other RBC detritus, these macrophages end up in the AC, and ultimately the angle.

‘Globules of degenerated Hgb’ are known by what eponymous name?

Heinz bodies

‘Heinz bodies’? Bruh, the BCSC Glaucoma book does not mention Heinz bodies. Why are you including details we don’t need to know?
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

What’s up with the macrophages? How do they figure in all this?
RBCs in a vitreous hemorrhage start to break down after a week or two. The degeneration of these cells attracts ‘Globules of degenerated Hgb’ are known by what eponymous name?
Heinz bodies
and other RBC detritus to the AC, and ultimately the angle.

‘Heinz bodies’? Bruh, the BCSC Glaucoma book does not mention Heinz bodies. Why are you including details we don’t need to know?
I wouldn’t do you like that bruh—the Pathology book mentions Heinz bodies in its discussion of hemolytic- and ghost-cell glaucoma, so it’s fair game for the OKAP
Glaucoma 2ndry to hyphema  
Follows $\text{AC}$ bleed

Hemolytic glaucoma  
$\text{TM}$ clogged with…
$\text{macrophages}$

Ghost-cell glaucoma  
$\text{TM}$ clogged with…
degenerated RBCs

Finally: ‘Macrophages clogging the TM’ should bring to mind another form of 2ndry OAG—what is it?
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with... macrophages

Ghost-cell glaucoma
TM clogged with... degenerated RBCs

Finally: ‘Macrophages clogging the TM’ should bring to mind another form of 2ndry OAG—what is it?
Phacolytic glaucoma (addressed earlier in the slide-set)
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...

degenerated RBCs

Degenerated RBCs pose a special problem for the TM--why?
Degenerated RBCs pose a special problem for the TM—why?

Healthy RBCs are very pliable, and gloop through the TM fairly easily. In contrast, degenerated RBCs become spherical and stiff, and do not pass easily through it; instead, they pile up in and clog the angle, preventing aqueous egress.
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

Degenerated RBCs pose a special problem for the TM—why?
Healthy RBCs are very pliable, and gloop through the TM fairly easily. In contrast, degenerated RBCs become spherical and stiff, and \textbf{do not pass easily through it}; instead, they pile up in and clog the angle, preventing aqueous egress.

‘RBCs that do not pass easily through the TM’—what other clinical scenario does that sound like?
Degenerated RBCs pose a special problem for the TM—why? Healthy RBCs are very pliable, and gloop through the TM fairly easily. In contrast, degenerated RBCs become spherical and stiff, and do not pass easily through it; instead, they pile up in and clog the angle, preventing aqueous egress.

‘RBCs that do not pass easily through the TM’—what other clinical scenario does that sound like?

Hyphema in a sickle-cell pt. Recall that the relatively basic vs. acidic nature of aqueous promotes RBC sickling. Sickled RBCs are significantly stiffer, and thus unable to pass easily through the TM.
Glaucoma 2ndry to hyphema

Follows **AC** bleed

**Hemolytic glaucoma**

- TM clogged with...
- Hgb-laden macrophages

**Ghost-cell glaucoma**

- TM clogged with...
- degenerated RBCs

*Degenerated RBCs pose a special problem for the TM—why?*

Healthy RBCs are very pliable, and gloop through the TM fairly easily. In contrast, degenerated RBCs become spherical and stiff, and **do not pass easily through it**; instead, they pile up in and clog the angle, preventing aqueous egress.

*’RBCs that do not pass easily through the TM’—what other clinical scenario does that sound like?*

**Hyphema in a sickle-cell pt.** Recall that the relatively acidic nature of aqueous promotes RBC sickling. Sickled RBCs are significantly stiffer, and thus unable to pass easily through the TM.
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages
(Classic clinical description)

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs
(Classic clinical description)

What does examination of the AC reveal?
Open-angle Glaucoma: Secondary

Glucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma

- TM clogged with...
  - Hgb-laden macrophages

- Red-tinged cells
  - in AC

Ghost-cell glaucoma

- TM clogged with...
  - degenerated RBCs

- Tan-colored cells
  - in AC

What does examination of the AC reveal?
Glaucoma 2ndry to hyphema
Follows AC bleed

Open-angle Glaucoma: Secondary

Hemolytic glaucoma
- TM clogged with...
  - Hgb-laden macrophages
- Red-tinged cells in AC

Ghost-cell glaucoma
- TM clogged with...
  - degenerated RBCs
- Tan-colored cells in AC

What does examination of the AC reveal?
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
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Red-tinged cells in AC
Tan-colored cells in AC

Would these ‘red-tinged cells’ be Hgb-laden macrophages?
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

Red-tinged cells in AC
Tan-colored cells in AC

Would these ‘red-tinged cells’ be Hgb-laden macrophages?
Indeed they would
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
Hgb-laden macrophages

Red-tinged cells in AC

Ghost-cell glaucoma

TM clogged with...
degenerated RBCs

Tan-colored cells in AC

Would these ‘tan-colored cells’ be the ghost cells after which the condition was named?
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with...
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with...
degenerated RBCs

Red-tinged cells in AC

Would these ‘tan-colored cells’ be the ghost cells after which the condition was named?
Indeed they would
Open-angle Glaucoma: Secondary

Ghost-cell glaucoma. Copious tan-colored cells in the AC.
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
Hgb-laden macrophages

Red-tinged cells in AC

Ghost-cell glaucoma

TM clogged with...
degenerated RBCs

Tan-colored cells in AC

Would these ‘tan-colored cells’ be the ghost cells after which the condition was named?
Indeed they would

What’s the origin story of the ghost cells?
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
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Ghost-cell glaucoma

TM clogged with...
degenerated RBCs

Red-tinged cells in AC

Tan-colored cells in AC

Would these ‘tan-colored cells’ be the ghost cells after which the condition was named?
Indeed they would

What’s the origin story of the ghost cells?
They are RBCs from the vitreous bleed that have lost their hemoglobin
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
TM clogged with…
Hgb-laden macrophages

Ghost-cell glaucoma
TM clogged with…
degenerated RBCs

Red-tinged cells
in AC

Tan-colored cells
in AC

Would these ‘tan-colored cells’ be the ghost cells after which the condition was named?
Indeed they would.

How long does it take for RBCs to turn into ghost cells?
1-3 months

What’s the origin story of the ghost cells?
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Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
Hgb-laden macrophages

Red-tinged cells in AC

Ghost-cell glaucoma

TM clogged with...
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Open-angle Glaucoma: Secondary

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Ghost-cell glaucoma
- TM clogged with...
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- Tan-colored cells in AC

What does examination of the vitreous cavity reveal?

(Classic clinical description)
Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
Hgb-laden macrophages

Red-tinged cells in AC

Ghost-cell glaucoma

TM clogged with...
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Tan-colored cells in AC

Khaki-colored hemorrhage in the vitreous

What does examination of the vitreous cavity reveal?
Glaucoma 2ndry to hyphema
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  - Red-tinged cells in AC

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- TM clogged with...
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What does examination of the vitreous cavity reveal?
Khaki-colored hemorrhage in the vitreous

Open-angle Glaucoma: Secondary
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

Ghost-cell glaucoma

Do hemolytic- and ghost-cell glaucoma resolve spontaneously?

Khaki-colored hemorrhage in the vitreous
**Open-angle Glaucoma: Secondary**

- Glaucoma secondary to hyphema
  - Follows AC bleed

**Hemolytic glaucoma**

**Ghost-cell glaucoma**

---

*Do hemolytic- and ghost-cell glaucoma resolve spontaneously?*

*Usually, once the instigating vitreous hemorrhage has cleared*

*Khaki-colored hemorrhage in the vitreous*
Ghost-cell glaucoma

Hemolytic glaucoma

Follows AC bleed

Do hemolytic- and ghost-cell glaucoma resolve spontaneously? Usually, once the instigating vitreous hemorrhage has cleared

In the interim, how should the IOP be managed?

Open-angle Glaucoma: Secondary

Khaki-colored hemorrhage in the vitreous
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Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

Ghost-cell glaucoma

Do hemolytic- and ghost-cell glaucoma resolve spontaneously?
Usually, once the instigating vitreous hemorrhage has cleared

In the interim, how should the IOP be managed?
With aqueous suppressants if possible

Khaki-colored hemorrhage in the vitreous
Hemolytic glaucoma

Ghost-cell glaucoma

Do hemolytic- and ghost-cell glaucoma resolve spontaneously?

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If medical management fails, what is the next step?
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema
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Hemolytic glaucoma
Ghost-cell glaucoma

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AC washout

Khaki-colored hemorrhage in the vitreous
Ghost-cell glaucoma

Hemolytic glaucoma

Glaucoma 2ndry to hyphema

Follows AC bleed

Open-angle Glaucoma: Secondary

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In the interim, how should the IOP be managed?
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If medical management fails, what is the next step?
AC washout

And if the AC washout fails?

Khaki-colored hemorrhage in the vitreous
Glaucoma 2ndry to hyphema

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Hemolytic glaucoma

Ghost-cell glaucoma

Do hemolytic- and ghost-cell glaucoma resolve spontaneously?

Usually, once the instigating vitreous hemorrhage has cleared

In the interim, how should the IOP be managed?

With aqueous suppressants if possible

If medical management fails, what is the next step?

AC washout

And if the AC washout fails?

PPV (if the hemorrhage is persistent) vs filtering surgery should be considered

Khaki-colored hemorrhage in the vitreous
Changing gears slightly… There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?
Changing gears slightly…There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow? Rhegmatogenous retinal detachment (RRD)
Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

**Rhegmatogenous retinal detachment (RRD)**

Huh? I thought RRD was associated with reduced IOP. What gives?
Changing gears slightly…There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

Rhegmatogenous retinal detachment (RRD)

Huh? I thought RRD was associated with reduced IOP. What gives? Acute RRD is indeed associated with reduced IOP. Schwartz syndrome is associated with chronic RRD.
Changing gears slightly… There is another form of secondary OAG called Schwartz syndrome, which, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

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Huh? I thought RRD was associated with reduced IOP. What gives?

Acute RRD is indeed associated with reduced IOP. Schwartz syndrome is associated with chronic RRD.
Open-angle Glaucoma: Secondary

Schwartz syndrome
Follows...RRD

Hemolytic glaucoma

Ghost-cell glaucoma

Follow vitreous bleed

Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome, which, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow? Rhegmatogenous retinal detachment (RRD).

Huh? I thought RRD was associated with reduced IOP. What gives?

Acute RRD is indeed associated with reduced IOP. Schwartz syndrome is associated with chronic RRD.

What is the mechanism of reduced IOP in acute RRD?
Recall that one function of the RPE is to deturgesce the subretinal space by actively pumping fluid out of it. RRD allows intraocular fluid to pass into the subretinal space, where the RPE attempts to remove it.
Changing gears slightly… There is another form of secondary OAG called Schwartz syndrome, which, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

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Changing gears slightly, there is another form of secondary OAG called **Schwartz syndrome** that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

- Rhegmatogenous retinal detachment (RRD)

In both hemolytic and ghost-cell glaucomas, increased IOP results from clogging of the TM that impedes aqueous egress.

**What is the mechanism of IOP elevation in Schwartz syndrome?**

- TM clogged

---

**Open-angle Glaucoma: Secondary**

- **Schwartz syndrome**
  - ?

- **Hemolytic glaucoma**
  - TM clogged

- **Ghost-cell glaucoma**
  - TM clogged
Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow? Rhegmatogenous retinal detachment (RRD)

What is the mechanism of IOP elevation in Schwartz syndrome? The same thing—TM clogging.

In both hemolytic and ghost-cell glaucomas, increased IOP results from clogging of the TM that impedes aqueous egress.
Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome that, like hemolytic and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

- Rhegmatogenous retinal detachment (RRD)
- Ghost-cell glaucoma
- Hemolytic glaucoma

In hemolytic glaucoma, the TM is clogged with macrophages; in ghost-cell glaucoma, it’s degenerated RBCs.

<table>
<thead>
<tr>
<th>Condition</th>
<th>TM Clogged</th>
<th>Additional Details</th>
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<tbody>
<tr>
<td>Schwartz Syndrome</td>
<td>TM clogged</td>
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<td>Hemolytic Glaucoma</td>
<td>TM clogged with Hgb-laden macrophages</td>
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What is clogging the TM in Schwartz syndrome?

- TM clogged with... Hgb-laden macrophages
- TM clogged with... degenerated RBCs
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What is clogging the TM in Schwartz syndrome?
Photoreceptor outer segments

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What is clogging the TM in Schwartz syndrome?

Photoreceptor outer segments

In hemolytic glaucoma, the TM is clogged with macrophages; in ghost-cell glaucoma, it’s degenerated RBCs.

To sum it up: In Schwartz syndrome, chronic RRD allows enough time for liberated PR outer segs to migrate into the AC, where their accumulation in the angle ends up clogging the TM and elevating IOP.
Changing gears slightly… There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

- Rhegmatogenous retinal detachment (RRD)
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TM clogged with...
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Photoreceptor outer segments

In hemolytic glaucoma, the TM is clogged with macrophages; in ghost-cell glaucoma, it’s degenerated RBCs.

To sum it up: In Schwartz syndrome, chronic RRD allows enough time for liberated PR outer segs to migrate into the AC, where their accumulation in the angle ends up clogging the TM and elevating IOP.

All these PR outer segs floating around the AC—can they be mistaken for inflammatory cells?
Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

- Rhegmatogenous retinal detachment (RRD)
- Ghost-cell glaucoma
- Hemolytic glaucoma

In Schwartz syndrome, chronic RRD allows enough time for liberated PR outer segments to migrate into the AC, where their accumulation in the angle ends up clogging the TM and elevating IOP.

All these PR outer segs floating around the AC—can they be mistaken for inflammatory cells?
Yes, uveitic glaucoma is a common misdiagnosis in Schwartz syndrome.

To sum it up: In Schwartz syndrome, chronic RRD allows enough time for liberated PR outer segments to migrate into the AC, where their accumulation in the angle ends up clogging the TM and elevating IOP.

In hemolytic glaucoma, the TM is clogged with macrophages; in ghost-cell glaucoma, it’s degenerated RBCs.
Changing gears slightly…There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow? Rhegmatogenous retinal detachment (RRD)

What's the best way to manage Schwartz syndrome?
Changing gears slightly…There is another form of secondary OAG called Schwartz syndrome that, like hemolytic- and ghost-cell glaucoma, follows a posterior-segment event—but not a bleed. What event does it follow?

Rhegmatogenous retinal detachment (RRD)

What’s the best way to manage Schwartz syndrome?

Repair the RRD
Next let’s take a look at other trauma-related causes of secondary OAG
Three types of post-trauma angle changes:

1) Angle recession
   - Tear between longitudinal and circular CB fibers
   - Classic description on gonio: Wide CBB

2) Cyclodialysis cleft
   - CB separates from SS
   - Classic description on gonio: Glistening SS

3) Iridodialysis
   - Tear at iris root

Open-angle Glaucoma: Secondary
Three types of post-trauma angle changes:

1) **Angle recession**
2) **Cyclodialysis cleft**
3) **Iridodialysis**
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between longitudinal and circular CB fibers
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2) **Cyclodialysis cleft**

3) **Iridodialysis**
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between **longitudinal and circular** CB fibers

2) **Cyclodialysis cleft**

3) **Iridodialysis**

**Open-angle Glaucoma: Secondary**
Open-angle Glaucoma: Secondary

- Three types of post-trauma angle changes:
  1) **Angle recession**
     - Tear between **longitudinal and circular CB fibers**
     - Classic description on gonio: **CBB** (CBB = ciliary body band)
  2) **Cyclodialysis cleft**
  3) **Iridodialysis**
Three types of post-trauma angle changes:

1) *Angle recession*
   - Tear between longitudinal and circular CB fibers
   - Classic description on gonio: **Wide** CBB

2) *Cyclodialysis cleft*

3) *Iridodialysis*
Angle recession. Note the portion of normal angle with narrow CBB (black arrows), the point at which the recession starts (arrowhead), and the subsequent segment of recessed angle with widened CBB (red arrows)
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between *longitudinal and circular* CB fibers
   - Classic description on gonio: **Wide** CBB

2) **Cyclodialysis cleft**
   - Structure separates from structure

3) **Iridodialysis**

Open-angle Glaucoma: Secondary
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between longitudinal and circular CB fibers
   - Classic description on gonio: Wide CBB

2) **Cyclodialysis cleft**
   - CB separates from SS
     
   (SS = scleral spur)

3) **Iridodialysis**
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between **longitudinal and circular** CB fibers
   - Classic description on gonio: **Wide** CBB

2) **Cyclodialysis cleft**
   - CB separates from SS
   - Classic description on gonio: **adjective** SS

3) **Iridodialysis**
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between **longitudinal and circular** CB fibers
   - Classic description on gonio: **Wide** CBB

2) **Cyclodialysis cleft**
   - CB separates from SS
   - Classic description on gonio: **Glistening** SS

3) **Iridodialysis**
Cycloidalysis cleft. Racquetball vs eye. The broad white band is the cleft. Note the presence of angle recession on either side of the cleft.
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between **longitudinal and circular** CB fibers
   - Classic description on gonio: **Wide** CBB

2) **Cyclodialysis cleft**
   - CB separates from SS
   - Classic description on gonio: **Glistening** SS

3) **Iridodialysis**
   - Tear at **structure**
Three types of post-trauma angle changes:

1) **Angle recession**
   - Tear between longitudinal and circular CB fibers
   - Classic description on gonio: **Wide** CBB

2) **Cyclodialysis cleft**
   - CB separates from SS
   - Classic description on gonio: **Glistening** SS

3) **Iridodialysis**
   - Tear at iris root
Open-angle Glaucoma: Secondary

Iridodialysis
1) Angle recession glaucoma?

2) Cyclodialysis cleft glaucoma?

3) Iridodialysis glaucoma?

All three can be associated with the subsequent development of glaucoma, but for which of them is the association especially strong?
Angle recession glaucoma

All three can be associated with the subsequent development of glaucoma, but for which of them is the association especially strong?

Angle recession
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years
Angle recession glaucoma

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What is the classic presentation?
**Angle recession glaucoma**

*What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?*

It can be immediate, or delayed by months to many years

*What is the classic presentation?*

A pt with what seems to be unilateral POAG
**Angle recession glaucoma**

*What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?*

It can be immediate, or delayed by months to many years

*What is the classic presentation?*

A pt with what seems to be unilateral POAG

*Is there a correlation between the extent of angle recession and the risk of developing glaucoma?*
**Angle recession glaucoma**

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*Is there a correlation between the extent of angle recession and the risk of developing glaucoma?*
Yes
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years

What is the classic presentation?
A pt with what seems to be unilateral POAG

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes

Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years

What is the classic presentation?
A pt with what seems to be unilateral POAG

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes

Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—it will occur in as many as [percentage] of fellow eyes
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years

What is the classic presentation?
A pt with what seems to be unilateral POAG

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes

Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—it will occur in as many as half of fellow eyes
**Angle recession glaucoma**

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Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—**it will occur in as many as half of fellow eyes**

What does this fact suggest about eyes with angle-recession glaucoma?
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years

What is the classic presentation?
A pt with what seems to be unilateral POAG

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes

Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—its will occur in as many as half of fellow eyes

What does this fact suggest about eyes with angle-recession glaucoma?
It suggests they live in the head of a person who was predisposed to develop glaucoma in the first place
**Angle recession glaucoma**

*What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?*
It can be immediate, or delayed by months to many years

*What is the classic presentation?*
A pt with what seems to be unilateral POAG

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Yes—it will occur in as many as half of fellow eyes

*How should angle-recession glaucoma be managed?*
Angle recession glaucoma

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
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Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—it will occur in as many as half of fellow eyes

How should angle-recession glaucoma be managed?
With the standard complement of topical hypotensives
**Angle recession glaucoma**

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years.

What is the classic presentation?
A pt with what seems to be unilateral POAG.

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes.

Is there a correlation between angle-recession glaucoma in one eye and the development of elevated IOP in the fellow eye?
Yes—it will occur in as many as half of fellow eyes.

How should angle-recession glaucoma be managed?
With the standard complement of topical hypotensives, or SLT?
**Angle recession glaucoma**

What is the temporal relationship between the inciting trauma and the subsequent development of angle-recession glaucoma?
It can be immediate, or delayed by months to many years.

What is the classic presentation?
A pt with what seems to be unilateral POAG.

Is there a correlation between the extent of angle recession and the risk of developing glaucoma?
Yes.

Is there a correlation between angle-recession glaucoma and the development of elevated IOP in the fellow eye?
Yes—it will occur in as many as half of fellow eyes.

How should angle-recession glaucoma be managed?
With the standard complement of topical hypotensives, or SLT? **Nah**
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Drug-Induced

Next let’s look at drug-induced secondary OAG

Pigmentary

Tumor-induced

Lens-induced

Inflammation-Induced

EVP

Trauma-Related

Schwartz syndrome

PXS

Phacolytic

Phacoantigenic

Lens particle

Posner-Schlossman

Fuchs heterochromic iridocyclitis

AVM

Venous obstruction

SVC syndrome

C-C fistula

Angle recession

Cyclodialysis cleft

Hyphema

Hemolytic

Ghost cell
Which commonly-used compound is notorious for its propensity to elevate IOP?
Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids
Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
--Topical?
--Intravitreal injection?
--Intravitreal implant?
--Sub-Tenon’s/periocular depot?
--Periocular injection?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!

All can cause elevated IOP!
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?

--Topical!
--Intravitreal injection
--Intravitreal implant!
--Sub-Tenon’s/periocular
--Periocular injection!

What proportion of IVit steroid injection pts will develop at least a transient IOP spike?

About 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require topical therapy to control their IOP?

About 25%

About 2% of the 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require surgical (incisional) intervention?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
- Topical!
- Intravitreal injection!
- Intravitreal implant!
- Sub-Tenon’s/periocular depot!
- Periocular injection!

What proportion of IVit steroid injection pts will develop at least a transient IOP spike?
About 50%!
Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
- Topical!
- Intravitreal injection!
- Intravitreal implant!
- Sub-Tenon’s/periocular depot!
- Periocular injection!

What proportion of IVit steroid injection pts will develop at least a transient IOP spike?
About 50%!

Of the 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require topical therapy to control their IOP?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular
--Periocular injection!

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About 50%!

Of the 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require topical therapy to control their IOP?
About 25%
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
- Topical!
- Intravitreal injection! (circled)
- Intravitreal implant!
- Sub-Tenon’s/periocular implant!
- Periocular injection!

What proportion of IVit steroid injection pts will develop at least a transient IOP spike?
About 50%!

Of the 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require topical therapy to control their IOP?
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About 2%
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
--Topical!
--Intravitreal injection!
--**Intravitreal implant**!
--Sub-Tenon s/periocular
--Periocular injection!

How do *intravitreal implants* compare to injections in terms of producing IOP elevation?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation?
--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular
--Periocular injection!

How do intravitreal implants compare to injections in terms of producing IOP elevation?
They’re like intravitreal injections on steroids (if you’ll pardon the expression). That is, everything is worse—a greater proportion of implant pts develop IOP spikes, a greater proportion need tx, and a greater proportion require incisional surgery.
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?

--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic?
--Topical?
--Inhaled?
--Nasal?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
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--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!

Again, all can cause elevated IOP!
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
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--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!

What condition—very rare, but you know of it—is associated with inappropriately and chronically elevated corticosteroid levels?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
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--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!

What condition—very rare, but you know of it—is associated with inappropriately and chronically elevated corticosteroid levels?
Cushing syndrome
Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!
--Endogenous?

What condition—very rare, but you know of it—is associated with inappropriately and chronically elevated corticosteroid levels?
Cushing syndrome

Are Cushing pts at risk for developing endogenous steroid-response IOP elevation?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!
--Endogenous!

What condition—very rare, but you know of it—is associated with inappropriately and chronically elevated corticosteroid levels?
Cushing syndrome

Are Cushing pts at risk for developing endogenous steroid-response IOP elevation?
Yes
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

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--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!

Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to…
--Factors related to…
--Factors related to…
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
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--Systemic!
--Topical!
--Inhaled!
--Nasal!

Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to…the steroid itself
--Factors related to…the administration of the steroid
--Factors related to…the pt
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

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Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?

--Factors related to…the steroid itself
--Factors related to…the administration of the steroid
--Factors related to…the pt

Which property of a drug is the chief determinant re whether it will cause an IOP spike?

Dexamethasone

About 5%
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
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--Periocular injection!
--Systemic!
--Topical!
--Inhaled!
--Nasal!

Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to…the steroid itself
--Factors related to…the administration of the steroid
--Factors related to…the pt

Which property of a drug is the chief determinant re whether it will cause an IOP spike?
Its potency
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
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Which property of a drug is the chief determinant re whether it will cause an IOP spike? Its potency

Which steroid tops the list in this regard? Dexamethasone
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

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Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to…the steroid itself
--Factors related to…the administration of the steroid
--Factors related to…the pt

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--Factors related to…the administration of the steroid
--Factors related to…the pt

Which property of a drug is the chief determinant re whether it will cause an IOP spike?
Its potency

Which steroid tops the list in this regard?
Dexamethasone

What proportion of pts on topical dex will develop an IOP >30 after 6 weeks of therapy?
About 5%
Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?

--Topical!
--Intravitreal injection!
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--Topical!
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--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!

Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?

--Factors related to...the steroid itself
**Factors related to...the administration of the steroid**
--Factors related to...the pt
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?

--Topical!
--Intravitreal injection!
--Intravitreal implant!
--Sub-Tenon’s/periocular depot!
--Periocular injection!
--Systemic!
--Topical!
--Inhaled!

Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?

--The route
--The frequency
--The duration

Factors related to...the steroid itself

Factors related to...the administration of the steroid

Factors related to...the pt
Which commonly-used compound is notorious for its propensity to elevate IOP?
Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
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--Topical!
--Inhaled!

Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to the steroid itself
--Factors related to the administration of the steroid
--Factors related to the pt

Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?
--The route
--The frequency
--The duration

Which route of admin is more likely to elevate IOP: Topical, or systemic?
Topical
Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids

Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?
--Topical!
--Intravitreal injection!
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--Systemic!
--Topical!
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Factors related to...the administration of the steroid
--Factors related to...the pt
Open-angle Glaucoma: Secondary

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Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?

--Factors related to…the steroid itself
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--Factors related to…the pt

What is the relationship between the commencement of steroid therapy and the subsequent development of elevated IOP?

Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?

--The route
--The frequency
--The duration

What is the relationship between the commencement of steroid therapy and the subsequent development of elevated IOP?

If IOP elevation does not occur by 6 weeks, is it reasonable to assume it isn’t going to occur?

No! IOP elevation can occur at any point during extended steroid therapy.
Open-angle Glaucoma: Secondary

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Which of the common routes of ocular administration have been implicated in IOP elevation? How about common routes of non-ocular administration?

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What is the relationship between the commencement of steroid therapy and the subsequent development of elevated IOP?

It essentially never occurs in less than \( \text{time} \) of use, and is distinctly uncommon prior to at least \( \text{time} \) of use.

Factors related to...the administration of the steroid

Factors related to...the pt
Open-angle Glaucoma: Secondary

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What is the relationship between the commencement of steroid therapy and the subsequent development of elevated IOP?
It essentially never occurs in less than 5 days of use, and is distinctly uncommon prior to at least 2 weeks of use.

Factors related to...the administration of the steroid
--Factors related to...the pt

Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?
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Factors related to...the pt
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No! IOP elevation can occur at any point during extended steroid therapy.

What are the administration-related factors determining whether a steroid-induced IOP rise will occur?
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Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?

--Factors related to…the steroid itself
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Is steroid-induced IOP elevation a reversible condition, ie, does IOP return to baseline with cessation of steroid use?

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Yes, provided the steroid is stopped in time. What is the timeframe for stopping the steroid ‘in time’? If the steroid is stopped within 1 year of onset, IOP will likely normalize. OTOH, if it is continued longer than 18 months, IOP elevation will likely be permanent.
Open-angle Glaucoma: Secondary

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What proportion of people will manifest IOP elevation if treated with a prolonged course of steroids?

About one in three!

Of these 'steroid responders,' how many will develop clinically significant dz, ie, will need to be treated?

Only a "small percentage" (per the Glaucoma book)

What common ocular condition is a risk factor for developing elevated IOP as a result of steroid use?

POAG. Again per the Glaucoma book, a "high percentage" of POAG pts are steroid responders.
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Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Drug-Induced

Schwartz syndrome

Trauma-Related

Venous obstruction

SVC syndrome

C-C fistula

Hyphema

Hemolytic

Ghost cell

Angle recession

Cyclodialysis cleft

Steroids

Cycloplegics

Summary slide of the major secondary open-angle glaucomas (no question)