Before you begin: This is a big topic, and big topics beget big slide-sets. There’s a couple of natural breaks (around slide 235, and again at 399); I placed *break time!* slides at those locations.
Define glaucoma.
Define glaucoma.
A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss.
Define glaucoma.
A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss

Why isn’t elevated IOP mentioned above?
Define glaucoma.
A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss

Why isn’t elevated IOP mentioned above?
Elevated IOP is a strong risk factor for glaucoma, but it need not be present—IOP can be normal, or even low
Define glaucoma.
A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss

Why isn’t elevated IOP mentioned above?
Elevated IOP is a strong risk factor for glaucoma, but it need not be present—IOP can be normal, or even low

In addition to being the strongest risk factor for glaucoma, IOP has another quality that renders it unique—what is it?
Define glaucoma.
A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss

Why isn’t elevated IOP mentioned above?
Elevated IOP is a strong risk factor for glaucoma, but it need not be present—IOP can be normal, or even low

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
Define glaucoma. A group of optic neuropathies that present with progressive ONH damage and characteristic VF loss.

Why isn’t elevated IOP mentioned above? Elevated IOP is a strong risk factor for glaucoma, but it need not be present—IOP can be normal, or even low.

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…
Glaucoma

Open-angle Glaucoma: Secondary

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!

Open-angle Glaucoma: **Secondary**

---

**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?*
Untreated IOP consistently above 22 mmHg

Open-angle Glaucoma: Secondary

OAG

↑IOP

Normal-tension glaucoma (NTG)

Untreated IOP consistently below # mmHg

Untreated IOP consistently above # 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

Untreated IOP consistently below 22 mmHg

Open-angle Glaucoma: Secondary

Normal-tension glaucoma (NTG)

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

Normal-tension glaucoma is covered in its own slide-set (G21)
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?*
There are many forms of secondary open-angle glaucoma!
There are many forms of secondary open-angle glaucoma!
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Drug-Induced

↑ IOP OAG

Pigmentary

Tumor-Induced

Lens-Induced

Inflammation-Induced

PXS

Trauma-Related

Schwartz syndrome

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

Trauma-Related

Schwartz syndrome

PXS Pigmentary

Tumor-induced

Lens-induced

Inflammation-Induced

↑ EVP

PXS and pigmentary glaucoma are addressed in slide-set G4
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

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

1. The only one described in the *Glaucoma* book as ‘rare’:
   - Phacoantigenic
2. Mediated by inflammatory response to lens proteins in AC:
   - Phacoantigenic; phacolytic
3. 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
Q

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

<table>
<thead>
<tr>
<th>Glaucoma Book Reference</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
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<tr>
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<td>Phacoantigenic</td>
</tr>
<tr>
<td>TM is clogged with macrophages:</td>
<td></td>
</tr>
</tbody>
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**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 |

- 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**
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*.  

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?*
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?
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:

---

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

- Phacolytic glaucoma
- Phacoantigenic glaucoma
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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
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

1. The only one described in the *Glaucoma* book as ‘rare’: **Phacoantigenic**
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Is also known as [condition name] *uveitis*: Phacoantigenic

Capsule is intact:

---

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TM is clogged with macrophages: Phacolytic

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

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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?*
A

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

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

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Is a reaction to *normal* lens proteins:
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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.
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Mediated by IgG antibodies:

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TM is clogged with macrophages:

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AC reaction is granulomatous:

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

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Mediated by IgG antibodies: Phacoantigenic

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Capsule is intact: Phacolytic

AC reaction is granulomatous: Phacoantigenic

Is a reaction to *denatured* lens proteins: 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

**What does it mean to say a protein has been “denatured”?**

- 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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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

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Recall that normal lens proteins enjoy a degree of immunologic privilege. In contrast, denatured proteins enjoy no such privilege, and thus tend to attract macrophages in large numbers.

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**

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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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- 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?**
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 a reaction to normal lens proteins: Phacoantigenic
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- 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:
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: 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:
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
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.
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?*
Because the condition is not a Type 1 (anaphylactic) reaction

*What characteristics inherent to true anaphylaxis are missing in phacoantigenic glaucoma?*
phacoanaphylactic glaucoma: Phacoantigenic

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? The involvement of IgE, mast cells and basophils.
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:
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
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:
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:**
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

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
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?*
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 *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.
Phacoanaphylactic glaucoma
- Aka phacoantigenic 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.
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** ?
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  ?
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

*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:

Mature cataract → intumescent cataract → hypermature cataract

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

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

---

**A**

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

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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

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

*and 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**

- 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.

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**
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 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.
Phacoanaphylactic 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.

---

*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**
Q/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

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 steps:
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

---

**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:**

- 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?

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:**

- 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.

---

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
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?

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 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 \textbf{lens-related secondary OAG} with which it is associated (some have more than one answer)

\begin{itemize}
  \item \textit{aka phacoanaphylactic glaucoma:} Phacoantigenic
  \item Usually unilateral: All of them
  \item Is mediated by an \textit{adaptive} immune response: Phacoantigenic
  \item Associated with mature/hypermature cataract: Phacolytic
\end{itemize}

\textbf{Q}

\begin{itemize}
  \item What is a \textit{mature cataract}?
    A cortical cataract that has progressed to involve the entire lens cortex
  \item What is a \textit{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.
\end{itemize}

\textbf{Q}

\begin{itemize}
  \item Let's drill down on intumescent cataracts for a moment. In this context, what does \textit{intumescent} mean?
  \item As if obscuration of the red reflex wasn't enough, \textit{the increased intralenticular pressure of an intumescent cataract poses an additional challenge during capsulorrhexis—what is it?}
  \item What effect does swelling have on the internal dynamics of the lens? It \textbf{increases the pressure within the lens}
  \item What step do most surgeons take to facilitate capsulorrhexis in these cases? They stain the anterior capsule with \textbf{trypan blue}
\end{itemize}

\textbf{Q}

\begin{itemize}
  \item Take note of the stages:
    \hspace{1cm} \textbf{Mature cataract} \hspace{1cm} \textbf{intumescent cataract} \hspace{1cm} \textbf{hypermature cataract}
\end{itemize}
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 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 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
Phacoanaphylactic glaucoma: Phacoantigenic
Associated with mature/hypermature cataract.
Is mediated by an adaptive immune response: Phacoantigenic
Usually unilateral: All of them
aka phacoanaphylactic glaucoma: 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.

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

(intumescent 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.

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.

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

**Phacolytic glaucoma**: Phacoantigenic glaucoma

**Phacoantigenic glaucoma**

**Lens-particle glaucoma**

- Typically unilateral
- Mediated by an adaptive immune response

**Phacolytic glaucoma**

- Associated with mature/hypermature cataract

**Trypan Blue**

- Stains the anterior capsule with trypan blue
- Used in all cases

**Mature Cataract**

- Cortical cataract that has progressed to involve the entire lens cortex

**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?
- 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**

- 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

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

Phacolytic glaucoma: Phacoantigenic glaucoma

Phacoantigenic glaucoma: Phacoantigenic glaucoma

Hypermature cataract: Phacolytic glaucoma

**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.

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.

When the intumescent cataract begins to distend and uncontrollably extend to the periphery, trypan blue is used in all these cases. This appearance has led to a memorable name for this finding. 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. 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:

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 - Lens-particle glaucoma

1. Usually unilateral: All of them
2. Is mediated by an adaptive immune response: Phacoantigenic
3. 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

A intumescent cataract poses 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.

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.

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

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

Take note of the stages:

Mature cataract \(\rightarrow\) intumescent cataract \(\rightarrow\) hypermature cataract

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

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).
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

**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

---

**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

---

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?

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).

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

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

---

**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.

---

**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
- 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.

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) aka **phacoanaphylactic glaucoma**: Phacoantigenic

b) Usually unilateral: All of them

c) Is mediated by an **adaptive immune response**: Phacoantigenic

d) 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.

---

**What change occurs as a cortical cataract progresses from the hypermature to the morgagnian stage?**

Further and extensive liquefication of the cortical material
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

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.

Morganian 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.

**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
Morgagnian cataract
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.
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.

---

A mature cataract may also expand, also called *intumescent cortical cataract*. A *hypermature cataract* results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
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.**

- 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?*
Q/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

**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 [sign and sign]

Intumescent cortical cataract. A hypermature cataract results when an intumescent cataract begins leaking water and denatured proteins through its intact anterior capsule.
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 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 cataracts may absorb water, turning an otherwise *intumescent* cortical cataract into a *hypermature 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
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:
<table>
<thead>
<tr>
<th>Statement</th>
<th>Associated Lens-related OAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>aka <em>phacoanaphylactic glaucoma</em></td>
<td>Phacoantigenic</td>
</tr>
<tr>
<td>Usually unilateral:</td>
<td>All of them</td>
</tr>
<tr>
<td>Is mediated by an <em>adaptive</em> immune response:</td>
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</tr>
<tr>
<td>Associated with mature/hypermature cataract:</td>
<td>Phacolytic</td>
</tr>
<tr>
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<td>Phacoantigenic</td>
</tr>
</tbody>
</table>

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**
- 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**
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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**

- 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?*
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**

*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
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
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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: **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

*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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- 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.

*If medical management proves inadequate, what is the next step?*
Surgical removal of the offending material
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
- Vitritis may be present: Phacoantigenic
- Gonioscopy reveals cortical material in the angle: Lens particle
- Least likely to develop elevated IOP:
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
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- 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
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

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- 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:
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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● 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
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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- 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

_There are two broad categories of immune response—what are they?_
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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- Least likely to develop elevated IOP: Phacoantigenic
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*There are two broad categories of immune response—what are they?*

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

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- Is mediated by an **innate immune response**: Phacolytic

---

**Q** 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?**
A

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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- Least likely to develop elevated IOP: Phacoantigenic
- Is mediated by an **innate immune response**: Phacolytic

---

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.
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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- Is mediated by an **innate immune response**: Phacolytic

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.
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

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.

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

- Neutrophils
- Macrophages
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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- 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

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.

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.
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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 books that address them: Glaucoma, Uveitis, Lens and Path, and be prepared to encounter inconsistencies when doing so.
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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.
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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Is mediated by an *innate* immune response: Phacolytic

PAS development is not a concern: 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

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

- Phacoanaphylactic glaucoma
- Phacoantigenic glaucoma
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### Q
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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 their bad VA even worse.
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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)

Phacolytic glaucoma  Phacoantigenic glaucoma  Lens-particle glaucoma

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- Fellow eye may become involved:
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| Phacolytic glaucoma | Phacoantigenic glaucoma | Lens-particle glaucoma |

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

- Classic presentation: Elderly pt with hx longstanding poor vision in affected eye c/o new-onset redness/pain and worsening vision: Phacolytic
- Fellow eye may become involved: **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.

- Classic presentation: Elderly pt with hx longstanding poor vision in affected eye c/o new-onset redness/pain and worsening vision: Phacolytic

- **Fellow eye may become involved:** 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

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- Fellow eye may become involved: 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.
Phacoanaphylactic glaucoma is also known as phacoantigenic glaucoma. It is usually unilateral and mediated by an adaptive immune response. It is associated with mature or hypermature cataract and may lead to vitritis. Gonioscopy will show cortical material in the angle, which is most likely due to lens particle glaucoma. However, it is mediated by an innate immune response in phacolytic glaucoma.

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.

Classic presentation: Elderly pt with hx longstanding poor vision in affected eye c/o new-onset redness/pain and worsening vision. Fellow eye may become involved.
For each statement, identify the **lens-related secondary OAG** with which it is associated (some have more than one answer)

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- Fellow eye may become involved: **Phacoantigenic**
- The *absence* of KP is a key clinical finding:
<table>
<thead>
<tr>
<th>Statement</th>
<th>Lens-Related Secondary OAG</th>
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<tbody>
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Next let's take a look at some inflammatory causes of secondary OAG
Is elevated IOP a common manifestation of uveitis?
Is elevated IOP a common manifestation of uveitis?
No—in fact, a lower-than-normal IOP is expected
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No—in fact, a lower-than-normal IOP is expected

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 hyposcretion
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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

Open-angle Glaucoma: Secondary
Is elevated IOP a common manifestation of uveitis?
No—in fact, a lower-than-normal IOP is expected

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--And lest we forget, the classic iatrogenic cause of elevated IOP in uveitis:
Is elevated IOP a common manifestation of uveitis?
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Steroid-induced reduced TM outflow
Is elevated IOP a common manifestation of uveitis? No—in fact, a lower-than-normal IOP is expected.

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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? Inflammation causes the ciliary body to ‘shut down’ to some extent, resulting in aqueous hyposecretion.

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
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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? While still uncertain, it likely stems from impeded outflow at the TM owing to remodeling of the TM induced by the steroid.

Open-angle Glaucoma: Secondary
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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--Inflammation of the TM causing it to swell
--Blocking of the angle by inflammatory material
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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
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(Note: All of the others are covered extensively in other slide-sets; see the Table of Contents)
Two forms of uveitic 2ndry OAG
addressed in the Glaucoma book

Posner-Schlossman syndrome
(aka Fuchs heterochromic iridocyclitis)

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

Posner-Schlossman syndrome
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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)
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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?
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

Fuchs heterochromic iridocyclitis

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

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--Unilateral
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Fuchs heterochromic iridocyclitis
--Unilateral
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--Inflammation is...

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

- Posner-Schlossman syndrome
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- Unilateral
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**Fuchs heterochromic iridocyclitis**
- Unilateral
- Young to middle-aged adults
- Inflammation is...mild
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Is IOP elevation typically mild, or severe?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

Posner-Schlossman syndrome (aka glaucomatocyclitic crisis)

--Unilateral
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Is it an **acute**, **chronic**, or **recurrent** condition?

What does it mean to say a uveitic condition is acute, recurrent or chronic?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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*What does it mean to say a uveitic condition is acute, recurrent or chronic?*
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Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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What does it mean to say a uveitic condition is acute, recurrent or chronic?
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Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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

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

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**Is it an acute, chronic, or recurrent condition?**

What does it mean to say a uveitic condition is acute, recurrent or chronic?

- **Acute uveitis**: comes on suddenly, and resolves fairly quickly
- **Recurrent uveitis**: eventually relapses, but **is quiescent off-treatment for at least 3 months**
- **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.
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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--Unilateral
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--Yellow response to steroids

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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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*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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- KP are ‘white and stellate’

**What is the classic descriptor of the shape of KP for each?**
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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Are the KP distributed diffusely, or limited to Arlt’s triangle?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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

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

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

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Which is associated with heterochromia iridis?
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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) 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?

The lighter eye...with one exception

heterochromia iridis

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 eye with one exception
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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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...with one exception...which is associated with heterochromia iridis...
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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**In addition to heterochromia, the atrophic changes give the iris an appearance that has been likened to damage caused by an insect.**

What is the two-word description for this appearance?

**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.**

Is the affected eye the darker eye of the lighter eye?

The lighter (with one exception)

Which is associated with heterochromia iridis?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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In addition to heterochromia, the atrophic changes give the iris an appearance that has been likened to damage caused by an insect. What is the two-word description for this appearance? ‘Moth eaten’

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 in the affected eye the darker eye of the lighter eye?

The lighter (with one exception) which is associated with heterochromia iridis?
Open-angle Glaucoma: Secondary

FHI: ‘Moth eaten’ iris. Note the smooth stromal architecture and loss of iris crypts
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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*Which is associated with NVI and NVA?*
Two forms of uveitic 2ndry OAG
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Which is associated with NVI and NVA?
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Which is associated with...

Do NVI and NVA in FHI lead to PAS and NVG?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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--Is a chronic condition
--Poor response to steroids
--KP are ‘white and stellate’
--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
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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

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- Unilateral
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- Associated with heterochromia iridis
- Associated with NVI and NVA, but PAS and/or NVG rarely develop

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

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--Is a chronic condition
--Poor response to steroids
--KP are ‘white and stellate’
--Associated with heterochromia iridis
--Associated with NVI and NVA, but PAS and/or NVG rarely develop

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 sign

Is Amsler’s sign pathognomonic for FHI?
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
--IOP elevation usually...severe
--Is a recurrent condition
--Good response to steroids
--KP are ‘white and round’

Fuchs heterochromic iridocyclitis
--Unilateral
--Young to middle-aged adults
--Inflammation is...mild
--IOP elevation usually...mild (or absent)
--Is a chronic condition
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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. Can other clinical maneuvers cause these vessels to bleed?

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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.

Can other clinical maneuvers cause these vessels to bleed?
Yes—hyphema in FHI can occur subsequent to two words, and even two words

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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 a cataract surgery.

Can other clinical maneuvers cause these vessels to bleed?
Yes—hyphema in FHI can occur subsequent to gonioscopy, and even applanation tonometry

Is Amsler’s sign pathognomonic for FHI?
No
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Which has a strong association with cataract, and with what type of cataract is it associated?
Two forms of uveitic 2ndry OAG addressed in the Glaucoma book

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--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
(This is a good point in the set to take a break)
Next let’s take a look at OAG secondary to increased EVP
Q

Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

What does EVP stand for in this context?
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Episcleral venous pressure, ie, the BP in the episcleral venous plexus
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What is the episcleral venous plexus?
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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.
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What is the episcleral venous plexus?
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What is the episclera?
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?
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?
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
--
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?
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
What does EVP stand for in this context?
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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 [two words] carry aqueous to it that drained from Schlemm’s canal via collector channels.
What does EVP stand for in this context?
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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
**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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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP
**Open-angle Glaucoma: Secondary**

**OAG 2ndry to ↑ EVP**

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There are two main pathways for blood leaving the globe. What are they?
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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
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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?
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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)
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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?
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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
Vortex veins. Their ampullae are visible during DFE (the large circle is approximating the equator of the globe)
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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.

What ocular structures does each pathway drain?
--The CRV:
--The vortex veins:
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What ocular structures does each pathway drain?
--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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The uvea, ie, the three parts of the uvea
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The superior ophthalmic vein (SOV)
Superior ophthalmic vein

Superior ophthalmic vein
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Into what structure does the SOV empty?
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What ocular structures does each pathway drain?
--The CRV: The retina
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What venous structure receives the majority of CRV and vortex veins outflow?
The superior ophthalmic vein (SOV)

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

Superior ophthalmic vein

Cavernous sinus

Cavernous sinus
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What is the normal range for EVP?
Q/A

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

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**What is the normal range for EVP?**
5-9 mmHg—same as [abb.](#)
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
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5-9 mmHg—same as CVP

What does CVP stand for in this context?
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What is the normal range for EVP?
5-9 mmHg—same as CVP

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

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What is the normal range for EVP?
5-9 mmHg—same as CVP

What does CVP stand for in this context?
Central venous pressure, ie, the blood pressure in the right atrium

Open-angle Glaucoma: Secondary

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?
Open-angle Glaucoma: Secondary 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.
**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? To where does it subsequently discharge that intake?*  
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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.  
*And if IOP is elevated high enough for long enough, the pt will develop OAG 2ndry to the increased EVP.*
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What happens if EVP increases significantly?
If EVP is high, back-pressure will be transmitted to the AC via the aqueous veins, collector channels and Schlemm’s canal, resulting in a proportional increase in IOP. And if IOP is elevated high enough for long enough, the pt will develop OAG 2ndry to the increased EVP.

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

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

---Sign-wise…
The episcleral veins will be ‘prominent’—dilated and/or tortuous
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?
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. The plexus eventually discharges into uveal vessels that subsequently empty into the vortex veins.

What is the normal range for EVP? 5-9 mmHg—same as CVP.

In addition to elevated IOP, what other sign/symptoms might result from elevated EVP? The pt may c/o and present with a chronic ‘red eye’.

If EVP is high, back-pressure will be transmitted to the AC via the aqueous veins, collector channels and Schlemm’s canal, resulting in a proportional increase in IOP. And if IOP is elevated high enough for long enough, the pt will develop OAG 2ndry to the increased EVP.

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

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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 and Schlemm’s canal, resulting in a proportional increase in IOP. And if IOP is elevated high enough for long enough, the pt will develop OAG 2ndry to the increased EVP.

In addition to elevated IOP, what other sign/symptoms might result from elevated EVP?
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…
--Sign-wise…
What does EVP stand for in this context?
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In addition to elevated IOP, what other sign/symptoms might result from elevated EVP?
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…
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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What is the normal range for EVP?
5-9 mmHg—same as CVP

In addition to elevated IOP, what other sign/symptoms might result from elevated EVP?
The pt may c/o and present with a chronic ‘red eye’

If EVP is high.
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What does EVP stand for in this context?
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What is the episcleral venous plexus? From where does it receive its intake? To where does it subsequently discharge that 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. The plexus eventually discharges into uveal vessels that subsequently empty into the vortex veins.

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

*The Glaucoma book mentions three arterial/venous abnormalities as causes—what are they?*
It mentions two causes of venous obstruction—what are they?
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

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? **Idiopathic**
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

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

 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)
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

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

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

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 internal carotid artery and its branches) wholly within the confines of a venous structure (ie, the CS itself)
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 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

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?
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)

What is the fundamental problem that results from a fistula within the CS?
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 internal carotid artery and its dural branches) wholly within the confines of a venous structure (ie, the CS itself)

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

Orbital varix

Venous obstruction

- Retrobulbar tumor
- Thyroid eye dz

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?
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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. Further, if the pressure increase within the CS is significant enough, reversal of blood flow through the venous structures that drain into the CS will occur--that is, blood will circulate from the CS to the eye and orbit.
Open-angle Glaucoma: Secondary

Carotid-CS fistula
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction
- Retrobulbar tumor
- Thyroid eye dz

A-V fistula

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

The cavernous sinus (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).

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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. Further, if the pressure increase within the CS is significant enough, reversal of blood flow through the venous structures that drain into the CS will occur--that is, blood will circulate from the CS to the eye and orbit.

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
- Thyroid eye dz

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

The cavernous sinus (CS) 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 (i.e., the CS itself).

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. Further, if the pressure increase within the CS is significant enough, reversal of blood flow through the venous structures that drain into the CS will occur—that is, blood will circulate from the CS to the eye and orbit.

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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

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 internal carotid artery and its dural branches) wholly within the confines of a **venous** structure (ie, the CS itself)

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.** Further, if the pressure increase within the CS is significant enough, reversal of blood flow through the venous structures that drain into the CS will occur--that is, blood will circulate from the CS to the eye and orbit.

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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

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

The cavernous sinus (CS)

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What was it again?
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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
- Thyroid eye dz

The A-V fistula is implicated in OAG 2ndry to increased EVP. Where are they located?

The cavernous sinus (CS) is involved.

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 (i.e., the CS itself).

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For more on A-V fistulas, see slide-set N19
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

Orbital varix

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

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?
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 in a dependent position 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 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?
P: Orbital venous malformations

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

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

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

- AOG 2ndry to ↑ EVP
- Venous obstruction
  - Retrobulbar tumor
  - Thyroid eye dz
- Arterial and/or venous abnormalities
  - A-V fistula
  - Orbital varix
  - Sturge-Weber syndrome

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

What is the classic presenting sign?
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How should orbital varices be managed?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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  - 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 Valsalvas

What is the best means of diagnosing an orbital varix?
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 Valsalvas

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

Idiopathic

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

- A-V fistula
- Orbital varix
- Orbital varices

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 Valsalvas

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

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

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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?
Orbital venous malformations

What is the classic presenting sign?
Proptosis that occurs or worsens when the pt Valsalves

Why spiral CT?
Because it's a relatively fast imaging modality

Why is speed important?

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

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

- A-V fistula
- Orbital varix
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Venous obstruction

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Orbital varices are known also by what other name?
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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?**
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

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

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

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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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
- 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

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

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

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

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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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

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

Q/A

OAG 2ndry to ↑ EVP

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Briefly, what is a phakomatosis?
A congenital condition involving hamartomatous lesions of multiple organ systems, usually including the

Abb., , and

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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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As neuro…
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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As neuro-oculocutaneous syndromes
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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Open-angle Glaucoma: Secondary

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

A phakomatosis

Encephalotrigeminal angiomatosis

The port wine stain, aka 'nevus flammeus'

At birth

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
Q/A

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 'two words'
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities
- A-V fistula
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Venous obstruction
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What facial lesion is a hallmark of Sturge-Weber syndrome?
The port wine stain, aka ‘nevus flammeus’
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
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- Venous obstruction
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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?
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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Sturge-Weber syndrome

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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

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

OAG 2ndry to ↑ EVP

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When does it present?
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It comports to the distribution of one or more divisions of CN5
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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- A-V fistula
- Orbital varix
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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

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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

Idiopathic

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

Venous obstruction
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**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

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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
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Venous obstruction
- Retrobulbar tumor
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What facial lesion is a hallmark of Sturge-Weber syndrome?

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

What is the typical pattern of distribution of Sturge-Weber syndrome?

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
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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

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- 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

What is 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
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- **Sturge-Weber syndrome**
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When does it present?
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What is the typical pattern of distribution?
- It comports to the distribution of one or more divisions of CN5

All infants with Sturge-Weber 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

**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

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’
Sturge-Weber: Tomato catsup fundus OD
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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---

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 CNV.

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.

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

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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

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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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When does it present?

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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?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction

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Arterial and/or venous abnormalities

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

Orbital varix

Sturge-Weber syndrome

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Sturge-Weber syndrome is 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**
- **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'.

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 have a port wine stain.

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

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No.

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

A phakomatosis.
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

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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

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

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

Does the choroidal hemangioma have malignant potential?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

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Sturge-Weber syndrome

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When does it present?
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Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

Venous obstruction abnormalities

Idiopathic

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Glaucmatous cupping

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Sturge-Weber syndrome

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

All infants with Sturge-Weber do not develop glaucoma.

Do all infants with a port wine stain develop glaucoma?

No

Does the choroidal hemangioma have malignant potential?

No
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

Idiopathic

Arterial and/or venous abnormalities

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All infants with Sturge-Weber syndrome develop 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

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Sturge-Weber syndrome

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

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Open-angle Glaucoma: Secondary

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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 SWS have a port wine stain?

All infants

Does the choroidal hemangioma have malignant potential?

No

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

Do all infants with a port wine stain have SWS?

No

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

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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?
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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 secondary 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

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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.
Open-angle Glaucoma: Secondary

**OAG 2ndry to ↑ EVP**

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Which two therapies are off the table?
-- Hints forthcoming…
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Which two therapies are off the table?
-- (this one is NBD, because you never use it anyway)
-- (this one you use a lot)
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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?
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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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Which two therapies are off the table?
--Topical tx with…pilo
--Surgical tx with…SLT
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Which two therapies are off the table?
--Topical tx with pilo
--Surgical tx with MIGS?

If you answered MIGS…
Open-angle Glaucoma: Secondary

OAG 2ndry to ↑ EVP

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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?
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OK, so what treatments should be employed?
Drops that decrease aqueous production should be used, along with those that increase uveoscleral outflow.
Open-angle Glaucoma: Secondary

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If medical management fails, should filtering surgery be pursued?
Q/A

Open-angle Glaucoma: Secondary

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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

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Open-angle Glaucoma: Secondary

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OK, so what treatments should be employed?
Drops that decrease aqueous production should be used, along with those that increase uveoscleral outflow.

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.
(This is a good point in the set to take a break)
Next let’s take a look at certain trauma-related causes of secondary OAG, along with Schwartz syndrome.
<table>
<thead>
<tr>
<th>Glaucoma 2dry to hyphema</th>
<th>Hemolytic glaucoma</th>
<th>Ghost-cell glaucoma</th>
</tr>
</thead>
</table>

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

Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
Follow vitreous bleed

Ghost-cell glaucoma
Open-angle Glaucoma: Secondary

Glaucoma 2ndry 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

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

Follow vitreous bleed

Ghost-cell glaucoma

The remainder of this set will focus on hemolytic- and ghost-cell glaucoma
Open-angle Glaucoma: Secondary

Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma
Ghost-cell glaucoma

Follow vitreous bleed

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!
What causes of vitreous hemorrhage are involved?

### Glaucoma 2ndry to hyphema
Follows AC bleed

### Open-angle Glaucoma: Secondary

- **Hemolytic glaucoma**
- **Ghost-cell glaucoma**

Follow *vitreous* bleed
Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma  
Ghost-cell glaucoma

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

Glaucoma secondary to hyphema
Follows AC bleed

Hemolytic glaucoma

Ghost-cell glaucoma
In a nutshell, what is the mechanism underlying both hemolytic and ghost-cell glaucomas? TM clogging $\rightarrow$ impeded aqueous outflow $\rightarrow$ increased IOP
In each condition, what is clogging the TM?
--Hemolytic glaucoma: ?
--Ghost-cell glaucoma: ?
Glaucoma 2ndry 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

Glaucoma 2ndry to hyphema
- Follows AC bleed

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).
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?
Glaucoma secondary to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...

Hgb-laden macrophages

Ghost-cell glaucoma

TM clogged with...

degenerated RBCs

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

Heinz bodies

globules of degenerated Hgb
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?
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?

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‘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?

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

Hgb-laden macrophages

degenerated RBCs

TM clogged with...

Hgb-laden macrophages

TM clogged with...

AC bleed
Ghost-cell glaucoma

Hemolytic glaucoma

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?*
Glaucoma 2ndry to hyphema
Follows AC bleed

Hemolytic glaucoma

Ghost-cell glaucoma

TM clogged with...

macrophages

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)
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

Hemolytic glaucoma

Ghost-cell glaucoma

Follows AC bleed

TM clogged with...

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‘RBCs that do not pass easily through the TM’—what other clinical scenario does that sound like?
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‘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 nature of aqueous promotes RBC sickling. Sickled RBCs are significantly stiffer, and thus unable to pass easily through the TM.
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

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Open-angle Glaucoma: Secondary

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?

Glaucoma 2ndry to hyphema

Follows AC bleed
Glaucoma 2ndry to hyphema

Hemolytic glaucoma

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

- color cells in AC

Ghost-cell glaucoma

- TM clogged with...
- degenerated RBCs

- color 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?
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?
A

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?
**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.
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?
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What’s the origin story of the ghost cells?
Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

TM clogged with...
Hgb-laden macrophages

Red-tinged cells in AC

Ghost-cell glaucoma

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What’s the origin story of the ghost cells?
They are RBCs from the vitreous bleed that have lost their hemoglobin
Hemolytic glaucoma

Ghost-cell glaucoma

Glaucoma 2ndry to hyphema

Follows AC bleed

TM clogged
with...

Hgb-laden macrophages

Tan-colored cells in AC

Red-tinged cells in AC

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

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What’s the origin story of the ghost cells?

They are RBCs from the vitreous bleed that have lost their hemoglobin.

How long does it take for RBCs to turn into ghost cells?

1-3 months.
Glaucoma 2ndry to hyphema
Follows AC bleed

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

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

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Glaucoma 2ndry to hyphema
Follows AC bleed

**Open-angle Glaucoma: Secondary**

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  - **Red-tinged cells in AC**

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

*(Classic clinical description)*

What does examination of the vitreous cavity reveal?
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

**What does examination of the vitreous cavity reveal?**

- Khaki-colored hemorrhage 
  - in the vitreous
A

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

Khaki-colored hemorrhage in the vitreous

What does examination of the vitreous cavity reveal?
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

Glucoma 2ndry to hyphema

Follows **AC** bleed

**Hemolytic glaucoma**

**Ghost-cell glaucoma**

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

Khaki-colored hemorrhage _in the vitreous_
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?

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

Glaucoma secondary to hyphema

Hemolytic glaucoma

Follows AC bleed

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?
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?

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

Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic glaucoma

Ghost-cell glaucoma

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AC washout

Khaki-colored hemorrhage in the vitreous
**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.

*If medical management fails, what is the next step?*

AC washout.

*And if the AC washout fails?*
Glaucoma 2ndry to hyphema

Follows AC bleed

Hemolytic 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

Ghost-cell glaucoma

Khaki-colored hemorrhage in the vitreous

Open-angle Glaucoma: Secondary
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)
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)**
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?

Rhegmatogenous retinal detachment (RRD)

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

Acute RRD is indeed associated with reduced IOP.
Changing gears slightly... There is another form of secondary OAG called Schwartz syndrome, 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.
Schwartz syndrome
  Follows…**RRD**

Hemolytic glaucoma

Ghost-cell glaucoma
  Follows vitreous bleed

**Open-angle Glaucoma: Secondary**

*What is the mechanism of reduced IOP in acute RRD?*

Recall that one function of the RPE is to deturgesc 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. If a significant enough portion of this fluid is removed, IOP will go down.

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

**Acute RRD is indeed associated with reduced IOP**

Secondary OAG called Schwartz syndrome, 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)
Changing gears slightly, there is another form of secondary glaucoma, *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?**
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)

**Open-angle Glaucoma: Secondary**

- **Schwartz syndrome**
  - TM clogged

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

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

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)
- Ghost-cell glaucoma
- Hemolytic glaucoma
- Schwartz syndrome

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

What is clogging the TM in 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 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.
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 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)
- Ghost-cell glaucoma
- Hemolytic glaucoma

Rhegmatogenous retinal detachment (RRD)

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?

In hemolytic glaucoma, the TM is clogged with macrophages; in ghost-cell glaucoma, it’s degenerated RBCs.
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- Rhegmatogenous retinal detachment (RRD)
- Ghost-cell glaucoma
- Hemolytic glaucoma
- Schwartz syndrome

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.

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.
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
Three types of post-trauma angle changes:

1) *Angle recession*

2) *Cyclodialysis cleft*

3) *Iridodialysis*
Three types of post-trauma angle changes:

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   - Tear between longitudinal and circular CB fibers

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3) **Iridodialysis**
Three types of post-trauma angle changes:

1) *Angle recession*
   - Tear between *longitudinal and circular* CB fibers

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

**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*
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**
Open-angle Glaucoma: Secondary

Cyclodialysis 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?
Three types of post-trauma angle changes:

1) 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**

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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?
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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?
Three types of post-trauma angle changes:

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Yes
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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 [50%] 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?
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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
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What does this fact suggest about eyes with angle-recession glaucoma?
**Angle recession glaucoma**

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*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.

Is there a correlation between the extent of angle recession and the risk of developing glaucoma? Yes.

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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?*

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
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.

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A pt with what seems to be unilateral POAG.

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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, or SLT?
Angle recession glaucoma

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A pt with what seems to be unilateral POAG

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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, or SLT? Nah

What about SLT?
While not contraindicated, it is of limited usefulness in angle-recession eyes.
Open-angle Glaucoma: Secondary

↑ IOP OAG

Primary

Secondary

Drug-Induced

Next let's look at drug-induced secondary OAG

PXS Pigmentary

Tumor-induced

Lens-induced

Inflammation-Induced

↑ EVP

Trauma-Related

Schwartz syndrome

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
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP?
Open-angle Glaucoma: Secondary

Which commonly-used compound is notorious for its propensity to elevate IOP? Corticosteroids
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?
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!
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--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?

About 25%

Of the 50% of IVit steroid injection pts who experience an IOP spike, what proportion will require surgical (incisional) intervention?

About 2%
Open-angle Glaucoma: Secondary

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--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?
--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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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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--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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--Intravitreal implant!
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--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
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!
--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?
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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--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
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!

Broadly, three sorts of factors determine whether a pt will develop elevated IOP in response to steroid therapy. What are they?
--Factors related to…
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Which two properties of a steroid are key in determining whether it will cause an IOP spike?

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Dexamethasone

What proportion of pts on topical dex will develop an IOP >30 after 6 weeks of therapy?
About 5%
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Which two properties of a steroid are key in determining whether it will cause an IOP spike? Its potency, and its ability to reach the AC
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--The frequency
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Which route of admin is more likely to elevate IOP: Topical, or systemic?

Topical
Open-angle Glaucoma: Secondary

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**Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?**

--The route
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--The duration

**Which route is even more likely than topical to elevate IOP?** Intravitreal. At least 50% of pts receiving intravitreal steroids develop an IOP spike, and 25% will require IOP-lowering tx.
Open-angle Glaucoma: Secondary

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--Factors related to…the administration of the steroid
--Factors related to…the pt

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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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--Factors related to…the administration of the steroid  
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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 [time] of use

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 administration of the steroid  
Factors related to…and 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.

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
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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?
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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 time of use

The frequency

The duration

Factors related to…the administration of the steroid
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What factors are related to the administration of the steroid?
--Factors related to...the administration of the steroid

What factors are related to the pt?
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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?

If IOP elevation does not occur by 6 weeks, is it reasonable to assume it isn’t going to occur?

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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.
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Which administration-related factors play a role in determining whether a steroid-induced IOP rise will occur?
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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?
--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…the steroid itself
--Factors related to…the administration of the steroid
--Factors related to…the pt

Is steroid-induced IOP elevation a reversible condition, ie, does IOP return to baseline with cessation of steroid use?
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.

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.

**The duration**
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What proportion of people will manifest an IOP elevation of 6-15 mmHg if treated with a prolonged course of steroids?
About 33%!

What proportion of people will have an IOP rise >15?
About 5%

What common ocular condition is a risk factor for developing elevated IOP as a result of steroid use?
POAG. Per the Glaucoma book, up to 95% of POAG pts are steroid responders

In terms of aqueous dynamics (ie, its production, outflow, etc), what is the cause of a steroid-induced IOP spike?
Increased resistance to outflow at the TM

---

Factors related to...the pt
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--?
--?
[Hints forthcoming]
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Q/A

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What other pt factors increase the risk of a steroid-induced IOP spike? --Pt age [but being very old, or very young?]
--?
--?
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--Myopia
--?
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---DM type I or II

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Finally: What sort of compound—used a kajillion times a day in eye-dentist clinics around the world—can induce IOP elevation?

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↑ IOP OAG

Primary

Secondary

PXS Pigmentary
Tumor-Induced
Lens-Induced
Inflammation-Induced

Phacolytic
Phacoantigenic
Lens particle

Posner-Schlossman
Fuchs heterochromic iridocyclitis

AVM
Venous obstruction
SVC syndrome
C-C fistula

EVS

Trauma-Related
Schwartz syndrome

Drug-Induced

Steroids
Cycloplegics

↑ EVS

Summary slide of the major secondary open-angle glaucomas (no question)