For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage:
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Involves intraocular bleeding/hemorrhage: All of them

Where is the hemorrhage found in:
--Purtscher's?
--Valsalva?
--Terson's?
For each statement, assign the proper condition(s): Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them

Where is the hemorrhage found in:
-- Purtscher’s? Intraretinal
-- Valsalva?
-- Terson’s?
For each statement, assign the proper condition(s):

Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Purtscher retinopathy: Intraretinal hemorrhage
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them

Where is the hemorrhage found in:
--Purtscher’s: **Intraretinal**
--Valsalva?
--Terson?

What section of the retina is most commonly involved in Purtscher’s?
Involves intraocular bleeding/hemorrhage: All of them

Where is the hemorrhage found in:
--Purtscher’s? **Intraretinal**
--Valsalva?
--Terson?

What section of the retina is most commonly involved in Purtscher’s?
The peripapillary area
Involves **intraocular bleeding/hemorrhage**: All of them

*Where is the hemorrhage found in:*

-- **Purtscher’s**? Intraretinal
-- **Valsalva**?
-- **Terson’s**?
Involves **intraocular bleeding/hemorrhage**: All of them

*Where is the hemorrhage found in:*
-- **Purtscher's?** Intraretinal
-- **Valsalva?** Sub-ILM
-- **Terson's?**
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Valsalva retinopathy: Sub-ILM hemorrhage
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves **intraocular bleeding/hemorrhage**: All of them

**Where is the hemorrhage found in:**
--- Purtscher’s?
  - Intraretinal
--- Valsalva?
  - Sub-ILM
--- Terson’s?
Involves intraocular bleeding/hemorrhage: All of them

Where is the hemorrhage found in:
--Purtscher’s? Intraretinal
--Valsalva? Sub-ILM
--Terson’s? Sub-ILM, sub-hyaloid, or intra-vitreal
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Terson syndrome: Sub-ILM, sub-hyaloid, intra-vitreal
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves **intraocular bleeding/hemorrhage**: All of them

As we shall see, this is the first of many ways in which Purtscher’s differs from Valsalva and Terson’s retinopathies!

- Where is the hemorrhage found in:
  - Purtscher’s? Intraretinal
  - Valsalva? Sub-ILM
  - Terson’s? Sub-ILM, sub-hyaloid, or intra-vitreal
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head:
Involves intraocular bleeding/hemorrhage: All of them
2ndry to compression injury of chest, head: Purtscher
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: **Purtscher**

What is the pathologic process underlying Purtscher’s?
Involves intraocular bleeding/hemorrhage: All of them
2ndry to compression injury of chest, head: Purtscher

For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

What is the pathologic process underlying Purtscher’s?

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head

What is the pathologic process underlying Purtscher’s?
- Complement activation
- Aggregation
- Occlusion of small retinal arterioles

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?
Occlusion of small retinal arterioles
Q

For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: **Purtscher**

What is the pathologic process underlying Purtscher’s?

1. Complement activation
2. Granulocyte aggregation
3. Leukoembolization
4. Occlusion of small retinal arterioles

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?

Occlusion of small retinal arterioles

What is the cause of the occlusion?
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: **Purtscher**

**What is the pathologic process underlying Purtscher's?**

- Complement activation → granulocyte aggregation → leukoembolization → occlusion of small retinal arterioles

Let's tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher's?

**Occlusion of small retinal arterioles**

What is the cause of the occlusion? **Leukoembolization**
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher

**What is the pathologic process underlying Purtscher’s?**

- Complement activation → granulocyte aggregation → leukoembolization → occlusion of small retinal arterioles

**Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?**

**Occlusion of small retinal arterioles**

**What is the cause of the occlusion?** Leukoembolization

**Aggregates of what sort of immune cells form the emboli?**
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher

What is the pathologic process underlying Purtscher’s?

- Complement activation → granulocyte aggregation → leukoembolization → occlusion of small retinal arterioles

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?

- Occlusion of small retinal arterioles

What is the cause of the occlusion?

- Leukoembolization

Aggregates of what sort of immune cells form the emboli?

- Granulocytes
And lastly: Activation of which aspect of the immune system begins the cascade?

What is the pathologic process underlying Purtscher’s?
- Activation ➔ granulocyte aggregation ➔ leukoembolization ➔ occlusion of small retinal arterioles

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?
- Occlusion of small retinal arterioles

What is the cause of the occlusion?
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Aggregates of what sort of immune cells form the emboli?
- Granulocytes
Purtscher

And lastly: Activation of which aspect of the immune system begins the cascade?
The complement system

What is the pathologic process underlying Purtscher’s?
Complement activation → granulocyte aggregation → leukoembolization → occlusion of small retinal arterioles

Let’s tackle this topic in reverse. What is the direct, proximal cause of retinal hemorrhages in Purtscher’s?
Occlusion of small retinal arterioles

What is the cause of the occlusion? Leukoembolization

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For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected:
For each statement, assign the proper condition(s): Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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- 2ndry to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher
For each statement, assign the proper condition(s):
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- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
- **Cotton-wool spots common, expected:** Purtscher

A classic finding in Purtscher’s is ‘polygonal-shaped areas of retinal whitening.’
What is the eponymous name for these areas?
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher

A classic finding in Purtscher’s is ‘polygonal-shaped areas of retinal whitening.’
What is the eponymous name for these areas?
‘Purtscher flecken’
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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‘Areas of retinal whitening’--isn’t this the same thing as CWS?
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‘Areas of retinal whitening’--isn’t this the same thing as CWS?
Yes and no…

Cotton-wool spots occur when branches of the pre-capillary arteriolar network are occluded. These vessels are located in the superficial (ie, inner) portion of the retina; thus, the layer of the retina most affected by their occlusion is the

three words
Involves intraocular bleeding/hemorrhage: All of them
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Cotton-wool spots common, expected: **Purtscher**

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- 2ndry to compression injury of chest, head: Purtscher
- **Cotton-wool spots common, expected: Purtscher**

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**What is the eponymous name for these areas?**

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Yes and no…

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In contrast, **Purtscher flecken** develop when occlusion occurs at the level of retinal circulation.
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‘Areas of retinal whitening’--isn’t this the same thing as CWS?
Yes and no…

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In contrast, Purtscher flecken develop when occlusion occurs at the capillary level of retinal circulation.
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
- **Cotton-wool spots common, expected:** Purtscher

A classic finding in Purtscher’s is ‘polygonal-shaped areas of retinal whitening.’
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‘Areas of retinal whitening’ -- isn’t this the same thing as CWS?
Yes and no...

Cotton-wool spots

How can Purtscher flecken and CWS be differentiated at DFE?

CWS have indistinct borders (like puffs of cotton wool—get it?), and obscure vessels running through them. In contrast, Purtscher flecken are more sharply demarcated and do not obscure adjacent vessels—in fact, a ‘clear zone’ appears between vessels and the surrounding flecken.

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Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Purtscher flecken
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Purtscher flecken

Purtscher flecken and cotton-wool spots
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
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Flecken, flecken…where have I heard that before? You’re probably thinking of glaukomflecken
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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- 2ndry to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher

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Flecken, flecken…where have I heard that before? You’re probably thinking of glaukomflecken

That’s it! Clinically speaking, what are glaukomflecken?

Small white patches ('flecks') beneath the anterior capsule of the lens

With what clinical event are they associated?

Acute angle-closure glaucoma with severe IOP elevation

How do they form, ie, what is the pathophysiology?

The high IOP damages lens epithelial cells just beneath the capsule, and the damaged cells subsequently necrose.
Involves intraocular bleeding/hemorrhage: All of them
2ndry to compression injury of chest, head: Purtscher
Cotton-wool spots common, expected: Purtscher

A classic finding in Purtscher's is 'polygonal-shaped areas of retinal whitening.'
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Small white patches (‘flecks’) beneath the anterior capsule of the lens
For each statement, assign the proper condition(s):

Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Glaukomflecken
Involves intraocular bleeding/hemorrhage: All of them
2ndry to compression injury of chest, head: Purtscher
Cotton-wool spots common, expected: Purtscher

A classic finding in Purtscher's is 'polygonal-shaped areas of retinal whitening.'
What is the eponymous name for these areas?
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Areas of retinal whitening— isn’t this the same thing as CWS?
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Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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- 2ndry to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher

A classic finding in Purtscher's is 'polygonal-shaped areas of retinal whitening.'

What is the eponymously correct name for these areas?
- 'Purtscher flecken'
- Areas of retinal whitening

Yes and no…
- Cotton-wool spots

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- Secondary to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher

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Cotton-wool spots

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'Cotton-wool spots'—occlusion occurs at the pre-capillary arteriolar network.

Yes and no…

Cotton-wool spots occur when branches of the pre-capillary arteriolar network are occluded. These vessels are located in the superficial (ie, inner) portion of the retina; thus, the layer of the retina most affected by their occlusion is the nerve fiber layer. Obstruction of the RNFL causes axoplasmic stasis in the nerve fibers served by the obstructed vessel. Axoplasmic stasis renders the affected nerve fibers white—ie, a CWS.

In contrast, Purtscher flecken develop when occlusion occurs at the capillary level of retinal circulation. These vessels are located deeper in the retina, and thus their occlusion doesn’t affect the retina nerve fiber layer—so no CWS.

Flecken, flecken…where have I heard that before? You’re probably thinking of glaukomflecken
That’s it! Clinically speaking, what are glaukomflecken?
Small white patches (‘flecks’) beneath the anterior capsule of the lens

With what clinical event are they associated?
Acute angle-closure glaucoma with severe IOP elevation

How do they form, ie, what is the pathophysiology?
The high IOP damages lens epithelial cells just beneath the capsule, and the damaged cells subsequently necrose
Q

For each statement, assign the proper condition(s): Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
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*Wadda ya mean, none? Everyone knows these cause Purtscher's. What's the dealio?*
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It’s true that these conditions can cause a retinopathy identical in appearance to Purtscher’s. That said, Dr Purtscher’s original description was in the context of thoracic or head trauma. Thus, technically speaking, the term Purtscher retinopathy is reserved for only situations in which the retinopathy results from thoracic/head trauma.
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OK then, what is the name for the Purtscher’s-like retinopathy due to pancreatitis, SLE, amniotic-fluid embolization, long-bone fracture, etc?
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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Does Terson’s follow a subarachnoid hemorrhage, a subdural hemorrhage, or either/both?
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Cotton-wool spots common, expected: Purtscher
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Does Terson’s follow a subarachnoid hemorrhage, a subdural hemorrhage, or either/both?
Either/both

Does Terson’s represent the direct extension of an intracranial bleed into the eye via dural compartments?
For each statement, assign the proper condition(s):
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- 2ndry to abrupt *intracranial hemorrhage*: Terson

**Does Terson’s follow a subarachnoid hemorrhage, a subdural hemorrhage, or either/both?**
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OK, then what is the cause?
For each statement, assign the proper condition(s):
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OK, then what is the cause?
We’ll get to that shortly
Involves intraocular bleeding/hemorrhage: All of them
2ndry to compression injury of chest, head: Purtscher
Cotton-wool spots common, expected: Purtscher
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2ndry to pancreatitis, SLE, amniotic-fluid embolization, long-bone fracture: None (but…)
2ndry to abrupt intracranial hemorrhage: Terson
Vision loss often permanent:

For each statement, assign the proper condition(s):
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What is the visual prognosis in Terson or Valsalva retinopathy?
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
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- Vision loss often permanent: Purtscher

What is the visual prognosis in Terson or Valsalva retinopathy? Great!
For both, vision is expected to return to baseline
For each statement, assign the proper condition(s):
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- 2ndry to abrupt intracranial hemorrhage: Terson
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As we shall see, this is the first of many ways in which Purtscher’s differs from Valsalva and Terson’s retinopathies!

After Terson and Valsalva? Great!

What is the visual prognosis in Terson or Valsalva retinopathy? For both, vision is expected to return to baseline
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

- Involves intraocular bleeding/hemorrhage: All of them
- 2ndry to compression injury of chest, head: Purtscher
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- 2ndry to abrupt intracranial hemorrhage: Terson
- Vision loss often permanent: Purtscher
- 2ndry to an acute increase in intraocular venous pressure:

Note: Not IOP!
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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Note that Valsalva retinopathy and Terson’s share a common final pathway—an acute rise in intraocular venous pressure produces backpressure in the capillary and arteriolar beds, causing some of these vessels to rupture.
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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Note that Valsalva retinopathy and Terson’s share a common final pathway—an acute rise in intraocular venous pressure produces backpressure in the capillary and arteriolar beds, causing some of these vessels to rupture.

In sharp contrast, Purtscher’s results from an occlusive process occurring within the arterial side of the peripapillary vascular bed.
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As we shall see, this is the first of many ways in which Purtscher’s differs from Valsalva and Terson’s retinopathies!

Yet another example

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- 2ndry to an acute increase in intraocular venous pressure: Valsalva; Terson
- FA→arteriolar obstruction, leakage:
Involves intraocular bleeding/hemorrhage: All of them
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For each statement, assign the proper condition(s):
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Purtscher retinopathy: Arteriolar obstruction
For each statement, assign the proper condition(s):
Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

Purtscher retinopathy: Arteriolar obstruction

Capillary flow voids at both superficial capillary plexus (B) and deep (C) capillary plexus are visualized by optical coherence tomography angiography. Fluorescein angiography showed multifocal filling defect and irregularly enlarged foveal avascular zone (D).
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For each statement, assign the proper condition(s):
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Purtscher retinopathy: Retinal edema
Q

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Valsalva retinopathy; Terson syndrome; Purtscher retinopathy

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Valsalva vs Terson vs Purtscher: Highlights
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- 2ndry to compression injury of chest, head: Purtscher
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For each statement, assign the proper condition(s):
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**Valsalva vs Terson vs Purtscher: Highlights**
- Involves intraocular bleeding/hemorrhage: All of them
- 2ndary to compression injury of chest, head: Purtscher
- Cotton-wool spots common, expected: Purtscher
- 2ndary to coughing, vomiting, straining at stool: Valsalva
- 2ndary to pancreatitis, SLE, amniotic-fluid embolization, long-bone fracture: None (but...)
- 2ndary to abrupt intracranial hemorrhage: Terson
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| CWS present? | No | No | Yes |
| Retinal edema present? | No | No | Yes |
| Visual prognosis? | Good | Good | Bad |
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Valsalva and Terson’s are very similar, and differ greatly from Purtscher’s!