Pediatric Orbital Cellulitis

In a child with orbital cellulitis, whether s/he is older or younger than 9 years is important. Why?
Pediatric Orbital Cellulitis

In a child with orbital cellulitis, whether s/he is older or younger than 9 years is important. Why? In children under 9, the bug is usually a single pathogen.
Pediatric Orbital Cellulitis

In a child with orbital cellulitis, whether s/he is older or younger than 9 years is important. Why? In children under 9, the bug is usually a single aerobic pathogen.
A/Q

- **Pediatric Orbital Cellulitis**
  - In a child with orbital cellulitis, whether s/he is older or younger than 9 years is important. Why? *In children under 9, the bug is usually a single aerobic pathogen; older than 9, the infection is usually polymicrobial and includes both*
A

- **Pediatric Orbital Cellulitis**
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  *Which bug(s) are most often implicated?*
Q/A

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Which bug(s) are most often implicated? This is a function of the child’s one word and two words.

Which bug(s) are most often implicated? This is a function of the child’s age and immune status.
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This is a function of the child’s age and immune status.
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Which bug(s) are most often implicated?
This is a function of the child’s age and immune status:

--Neonates:
--Older children:
--Immunocompromised:
**Q/A**

**Pediatric Orbital Cellulitis**

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*Which bug(s) are most often implicated?*

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--Neonates: *S aureus*; G(-) bacilli
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Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection?
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Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection?
Adjacent sinusitis
Q

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Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection? Adjacent sinusitis

What proportion of orbital cellulitis cases are secondary to sinus dz?
Pediatric Orbital Cellulitis

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Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection? Adjacent **sinusitis**

*What proportion of orbital cellulitis cases are secondary to sinus dz? A whopping 90%!*
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Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection? Adjacent sinusitis

Which sinus is most often implicated, and which comes in a distant second?
Pediatric Orbital Cellulitis

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*Assuming no hx of penetrating orbital trauma, where do the bugs come from, ie, what is the original nidus of infection?*
Adjacent sinusitis

**Which sinus is most often implicated, and which comes in a distant second?**
The ethmoid is #1; the frontal, 2
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The sinuses are not yet aerated in very young infants, and thus cannot be a source of infection. Infection of what structure should be considered if a very young infant presents with orbital cellulitis?

Which sinus is most often implicated, and which comes in a distant second?
The ethmoid is #1; the frontal, 2
A

Pediatric Orbital Cellulitis

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The sinuses are not yet aerated in very young infants, and thus cannot be a source of infection. Infection of what structure should be considered if a very young infant presents with orbital cellulitis?
The lacrimal sac, ie, dacryocystitis. (Saw, and missed, one as a resident myself—very embarrassing. Thankfully, the baby recovered fully.)

Which sinus is most often implicated, and which comes in a distant second?
The ethmoid is #1; the frontal, 2
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In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis?
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- In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? When s/he is immunocompromised.
**Pediatric Orbital Cellulitis**

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- In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? *When s/he is immunocompromised.*
- Orbital cellulitis presents with rapid-onset proptosis and ophthalmoplegia…
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*Before we get to this question…In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis?*
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Orbital cellulitis presents with rapid-onset proptosis and ophthalmoplegia...

Before we get to this question…In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis?

--Lid edema
--Chemosis
--Orbital pain and tenderness
--Globe displacement
--Elevated IOP
--Decreased visual function (ie, acuity, VF, color)
--An RAPD
Pediatric Orbital Cellulitis

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What is the mechanism responsible for increasing IOP?
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--Globe displacement
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What is the mechanism responsible for increasing IOP?
Orbital congestion → compression of two words → increased EVP → increased IOP
**Pediatric Orbital Cellulitis**

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**Elevated IOP**

What is the mechanism responsible for increasing IOP?

Orbital congestion → compression of vortex veins → increased EVP → increased IOP
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--Lid edema
--Chemosis
--Orbital pain and tenderness
--Globe displacement
--Elevated IOP

What is the mechanism responsible for increasing IOP?
Orbital congestion \(\rightarrow\) compression of vortex veins \(\rightarrow\) increased EVP \(\rightarrow\) increased IOP

What does EVP stand for in this context?
Pediatric Orbital Cellulitis

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What is the mechanism responsible for increasing IOP?
Orbital congestion → compression of vortex veins → increased EVP → increased IOP

What does EVP stand for in this context?
Episceral venous pressure
Q

Pediatric Orbital Cellulitis

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- Orbital pain and tenderness
- Globe displacement
- Elevated IOP
- Decreased visual function (ie, acuity, VF, color)
- An RAPD

What is the mechanism responsible for increasing IOP?
Orbital congestion → compression of vortex veins → increased EVP → increased IOP

What does EVP stand for in this context?
Episcleral venous pressure

What is the eponymous name of the equation delineating the relationship between EVP and IOP?
Goldmann equation
Pediatric Orbital Cellulitis

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Orbital congestion leads to compression of vortex veins, increased EVP, increased IOP.

What does EVP stand for in this context?
Episcleral venous pressure

What is the eponymous name of the equation delineating the relationship between EVP and IOP?
The Goldmann equation (yes, that Goldmann)

Before we get to this question…In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis?
- Lid edema
- Chemosis
- Orbital pain and tenderness
- Globe displacement
- Elevated IOP
- Decreased visual function (ie, acuity, VF, color)
- An RAPD

What is the mechanism responsible for increasing IOP?
Orbital congestion → compression of vortex veins → increased EVP → increased IOP

What is the Goldmann equation? (Meaning, write it out)
IOP = something + something else
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  - Lid edema
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What is the mechanism responsible for increasing IOP?

Orbital congestion → compression of vortex veins → increased EVP → increased IOP

What does EVP stand for in this context?

Episcleral venous pressure

What is the Goldmann equation? (Meaning, write it out)

The Goldmann equation (yes, that Goldmann)

\[
IOP = \frac{\text{Rate of aqueous formation}}{\text{Rate of aqueous outflow}} + \text{EVP}
\]

Note: In the interest of simplicity, I fudged a little on the denominator—technically, it’s outflow facility, not outflow rate.
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In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? When s/he is immunocompromised.

Orbital congestion presents with rapid-onset proptosis and ophthalmoplegia. Before we get to this question…In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis? Lid edema, Chemosis, Orbital pain and tenderness, Globe displacement, Elevated IOP, Decreased visual function (ie, acuity, VF, color), An RAPD.

What is the mechanism responsible for increasing IOP? Orbital congestion → compression of vortex veins → increased EVP → increased IOP.

What does EVP stand for in this context? Episcleral venous pressure.

What is the eponymous name of the equation delineating the relationship between EVP and IOP? The Goldmann equation (yes, that Goldmann).

What does the Goldmann equation imply about the relationship between EVP and IOP? It implies a 1:1 relationship; ie, that every 1mm increase in EVP will produce a 1mm increase in IOP.

What is the Goldmann equation? Rate of aqueous formation - Rate of aqueous outflow + EVP = IOP.

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- What is the mechanism responsible for increasing IOP?
  - Orbital congestion → compression of vortex veins → increased EVP → increased IOP

- What does the Goldmann equation imply about the relationship between EVP and IOP?
  - It implies a 1:1 relationship; ie, that every 1mm increase in EVP will produce a 1mm increase in IOP.

- What is the Goldmann equation? (Meaning, write it out)
  - \[ \text{IOP} = \frac{\text{Rate of aqueous formation}}{\text{Rate of aqueous outflow}} + \text{EVP} \]

  - Note: In the interest of simplicity, I fudged a little on the denominator—technically, it’s outflow facility, not outflow rate.

- What is the eponymous name of the equation delineating the relationship between EVP and IOP?
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- What does EVP stand for in this context?
  - Episcleral venous pressure
## Pediatric Orbital Cellulitis

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- In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? When s/he is *immunocompromised*.

- Orbital cellulitis presents with rapid-onset **proptosis** and **ophthalmoplegia**…

*Before we get to this question…In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis?*

--Lid edema
--Chemosis
--Orbital pain and tenderness
--Globe displacement
--Elevated IOP
--Decreased visual function (ie, acuity, VF, color)
--An RAPD

*These findings indicate what?*
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In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? When s/he is immunocompromised.

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These findings indicate what?
Optic nerve (ON) involvement
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These findings indicate what?
Optic nerve (ON) involvement

What does (ON) involvement indicate about the clinical status?
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These findings indicate what?
Optic nerve (ON) involvement

What does (ON) involvement indicate about the clinical status?
It’s an ophthalmic emergency
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In what clinical scenario is a young child at risk for polymicrobial orbital cellulitis? When s/he is immunocompromised.

Orbital cellulitis presents with rapid-onset proptosis and ophthalmoplegia...

Before we get to this question...In addition to proptosis and ophthalmoplegia, what other ophthalmic signs/symptoms are associated with orbital cellulitis?

- Lid edema
- Chemosis
- Orbital pain and tenderness
- Globe displacement
- Elevated IOP
- Decreased visual function (ie, acuity, VF, color)
- An RAPD

These findings indicate what?
Optic nerve (ON) involvement

What does (ON) involvement indicate about the clinical status?
It's an ophthalmic emergency

What management is indicated?
Emergent surgery
**Pediatric Orbital Cellulitis**

- In a child with orbital cellulitis, whether s/he is older or younger than 9 years is important. Why? In children under 9, the bug is usually a single aerobic pathogen; older than 9, the infection is usually polymicrobial and includes both aerobes and anaerobes.

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What nonocular signs/symptoms (including vitals, lab findings) might the child display?
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What nonocular signs/symptoms (including vitals, lab findings) might the child display?
--Leukocytosis
--Fever
--Headache
--Fussiness, or lethargy
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- A child presents with ophthalmoplegia out of proportion to proptosis. There is no pain with EOMs; the orbit is nontender. What is your chief concern?
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A child presents with ophthalmoplegia out of proportion to proptosis. There is no pain with EOMs; the orbit is nontender. What is your chief concern? Cavernous sinus thrombosis.
Cavernous sinus thrombosis
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*Three signs/symptoms of cavernous sinus involvement:*
1) Ophthalmoplegia out of proportion to proptosis
2) Absence of pain (with eye movements, and of the orbit)
*The third is:*
3)
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Caveat 1: This is per the Peds book; the Orbit book states that cavernous sinus thrombosis is associated with “rapid progression of proptosis”

Three signs/symptoms of cavernous sinus involvement:

1. **Ophthalmoplegia out of proportion to proptosis**
2. Absence of pain (with eye movements, and of the orbit)
   
   *The third is:*
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Caveat 2: Per the Peds book the distribution is V2; per the Orbit book, it’s both V1 and V2

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- A child presents with ophthalmoplegia out of proportion to proptosis. There is no pain with EOMs; the orbit is nontender. *What is your chief concern? Cavernous sinus thrombosis.*

- A child presents with an apparent bilateral orbital cellulitis. What is your chief concern?
**Pediatric Orbital Cellulitis**

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- A child presents with an apparent bilateral orbital cellulitis. What is your chief concern? **Cavernous sinus involvement; bilateral cellulitis is virtually diagnostic of it**.
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- What other entity—uncommon but not unknown in children—can present with what looks like a bilateral orbital cellulitis? Orbital pseudotumor.

- Orbital pseudotumor in childhood has another manifestation not commonly associated with the adult version. What is it? Uveitis is common, and can even be the dominant manifestation.

- A child presents with an apparent bilateral orbital cellulitis. What is your chief concern? Cavernous sinus thrombosis.
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What other entity—uncommon but not unknown in children—can present with what looks like a bilateral orbital cellulitis? **Orbital pseudotumor**. In childhood, it can be associated with fever, headache, and nausea/vomiting.
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Pediatric Orbital Cellulitis: Management

1) Admit
2) Broad-spectrum IV antibiotics
3) Consider pan-culturing
4) Image the patient

You have to do 4 things for your patient—other than imaging, what are they?
**Pediatric Orbital Cellulitis: Management**

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What is the preferred imaging study?
Pediatric Orbital Cellulitis: Management

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What is the preferred imaging study? CT is probably superior, although some clinicians are understandably reluctant to irradiate the rapidly-developing head of a very young child.
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CT showing a medial orbital subperiosteal abscess on the left side associated with ethmoid and sphenoid sinusitis
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- If a subperiosteal abscess is present, how should it be managed?

You have to do 4 things for your patient—other than imaging, what are they?
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