Q

Pediatric Orbital Cellulitis

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

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  - 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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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 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:
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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
**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?*
● **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%!*
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

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

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-- Neonates: S. aureus; G(-) bacilli
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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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Orbital cellulitis presents with rapid-onset proptosis and ophthalmoplegia…
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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
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Globe displacement suggests the presence of 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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*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**
- Reduced visual function (impairment of VF, etc.)

**What is the mechanism responsible for increasing IOP?**
Pediatric Orbital Cellulitis

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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 → compression of two words → increased abbrev. → increased IOP.
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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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What is the mechanism responsible for increasing IOP?
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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 \(\rightarrow\) compression of vortex veins \(\rightarrow\) increased EVP \(\rightarrow\) increased IOP

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

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- An RAPD

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

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
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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, **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 eponymous name of the equation delineating the relationship between EVP and IOP?**

*The Goldmann equation* (yes, *that* Goldmann)

- Rate of aqueous formation
- Rate of aqueous outflow

**IOP = \text{something} - \text{something else} + \text{something else}**

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**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?**

*Episceral 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 congestion leads to increased EVP, increased EVP leads to increased IOP.

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

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

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

What does EVP stand for in this context?

Episceral venous pressure

What is the eponymous name of the equation delineating the relationship between EVP and IOP?

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

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

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
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- What other ophthalmic signs/symptoms are associated with orbital cellulitis? Lid edema, chemosis, orbital pain and tenderness, globe displacement, elevated IOP, decreased visual function (acuity, VF, color), an RAPD.
- What is the mechanism responsible for increasing IOP? Orbital congestion → compression of vortex veins → increased EVP → increased IOP.
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- What is the eponymous name of the equation delineating the relationship between EVP and IOP? The Goldmann equation (yes, that Goldmann).
- What is the Goldmann equation? (Meaning, write it out) Rate of aqueous formation + EVP Rate of aqueous outflow
- What does EVP stand for in this context? Episcleral venous pressure.
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 \textit{aerobic} pathogen; older than 9, the infection is usually polymicrobial and includes both \textit{aerobes} and \textit{anaerobes}.
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- Chemosis
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These findings indicate what?
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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?
Pediatric Orbital Cellulitis

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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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--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.
- 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

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What does (ON) involvement indicate about the clinical status?
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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. So can rhabdomyosarcoma. How might the presentations differ?
Pediatric Orbital Cellulitis

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Orbital cellulitis presents with rapid-onset proptosis and ophthalmoplegia. So can rhabdomyosarcoma. How might the presentations differ? In orbital cellulitis the child is **sick**—systemic findings abound. In contrast, the rhabdo child seems otherwise healthy and happy.
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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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*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)
Pediatric Orbital Cellulitis

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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) Hypoesthesia in the distribution of the trigeminal nerve
Pediatric Orbital Cellulitis

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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”.

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   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.
**Q**

**Pediatric Orbital Cellulitis**

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

What other entity—uncommon but not unknown in children—can present with what looks like a bilateral orbital cellulitis?

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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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  Orbital pseudotumor in childhood has another manifestation not commonly associated with the adult version. What is it?

- A child presents with an apparent bilateral orbital cellulitis. What is your chief concern? Cavernous sinus thrombosis.

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Orbital pseudotumor. In childhood, it can be associated with fever, headache, and nausea/vomiting.

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.
Q

- Pediatric Orbital Cellulitis: Management
  1) 
  2) 
  3) 
  4) *Image the patient*

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

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

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

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

   - 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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When reviewing the imaging, what two findings should you look for?
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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.
- When reviewing the imaging, what two findings should you look for? A subperiosteal abscess with adjacent sinusitis.
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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.
- When reviewing the imaging, what two findings should you look for? A subperiosteal abscess with adjacent sinusitis.
- If a subperiosteal abscess is present, how should it be managed?
Pediatric Orbital Cellulitis: Management

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

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.

When reviewing the imaging, what two findings should you look for? A subperiosteal abscess with adjacent sinusitis.

If a subperiosteal abscess is present, how should it be managed? This is controversial. In adults, most clinicians advocate immediate drainage. However, for children, many clinicians advocate close observation (ie, serial exams q 6-8 hr around the clock) in hopes of resolution with antibiotics alone. If the ocular exam worsens, immediate drainage should be performed.