Fungal pathogens come in two very basic flavors—what are they?
Fungal pathogens come in two very basic flavors—what are they?

Yeast

Molds

A basic division among classes of fungi
**Fungal pathogens**

- Yeasts
- Molds

A basic division among classes of fungi

**Fungal pathogens come in two very basic flavors—what are they?**

**What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?**
Fungal pathogens come in two very basic flavors—what are they?

What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?

Their appearance
Fungal pathogens come in two very basic flavors—what are they?

What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?

Their appearance

What do yeasts look like?
Fungal pathogens come in two very basic flavors—what are they?

*What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?*

**Their appearance**

*What do yeasts look like?*

Round, single-celled organisms
Common Ocular Fungal Pathogens

Fungal pathogens come in two very basic flavors—what are they?

What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?

Their appearance

What do yeasts look like?
Round, single-celled organisms

What do molds look like?
**Fungal pathogens**

A basic division among classes of fungi

**Yeast**
Round, single-celled organisms

**Molds**
Multicellular, filamentous organisms

---

**Fungal pathogens come in two very basic flavors—what are they?**

**What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?**

**Their appearance**

**What do yeasts look like?**
Round, single-celled organisms

**What do molds look like?**
Multicellular, filamentous organisms
Common Ocular Fungal Pathogens

Yeast vs Molds
Fungal pathogens come in two very basic flavors—what are they?

What forms the basis for this distinction, i.e., what characteristic of the organisms led us to divvy them up into these classes?

**Their appearance**

What do yeasts look like?
Round, single-celled organisms

What do molds look like?
Multicellular, filamentous organisms

What’s the formal term for the filaments formed by molds?
Fungal pathogens come in two very basic flavors—what are they?

What forms the basis for this distinction, ie, what characteristic of the organisms led us to divvy them up into these classes?

**Their appearance**

What do yeasts look like?
Round, single-celled organisms

What do molds look like?
Multicellular, **filamentous** organisms

What’s the formal term for the filaments formed by molds?
Hyphae
Yeast vs Molds (vs bacteria for scale)
Fungal pathogens

Yeast

Molds

A basic division among molds

Molds are further divided into two broad categories—what are they?
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Based on the appearance of their hyphae, they are classified as either septate or nonseptate.
Molds are further divided into two broad categories—what are they? Based on the appearance of their hyphae, they are classified as either septated or nonseptated.

What are septa?
Yeasts

Fungal pathogens

Molds

Septate

Nonseptate

Molds are further divided into two broad categories—what are they? Based on the appearance of their hyphae, they are classified as either septated or nonseptated.

What are septa? Cross-walls within hyphae that subdivide them into a series of individual compartments.
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast

Molds

Septate

Nonseptate

Molds are further divided into two broad categories—what are they?
Based on the appearance of their hyphae, they are classified as either septated or nonseptated.

What are septa?
Cross-walls within hyphae that subdivide them into a series of individual compartments.
Septate molds have these cross-walls; nonseptate molds do not.
Common Ocular Fungal Pathogens

Molds

Septate

Nonseptate
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast

Molds

Septate

Nonseptate

Two species account for the majority of yeast-mischief involving the eyes—what are they?
Two species account for the majority of yeast-mischief involving the eyes—what are they?
Common Ocular Fungal Pathogens

Candida. The ‘budding’ appearance is typical, and is a good field mark for the species.

Cryptococcus. Note the ‘India ink’ look—this is a good way to identify this species.

Yeast
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
- Candida
- Cryptococcus

Molds
- Septate
  - ?
- Nonseptate
  - ?

Two species account for the majority of septated-mold eye issues—what are they?
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate

Two species account for the majority of septated-mold eye issues—what are they?
**Common Ocular Fungal Pathogens**

*Fusarium*

*Aspergillus*. Note the blue-bulb looking whatchamacallits

Sepated molds
A high-mag *Aspergillus* photo may demonstrate ‘broad hyphae,’ a classic descriptor of the bug.
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - ?
  - ?

*Two species account for the majority of non-septated-mold eye issues—what are they?*
Common Ocular Fungal Pathogens

Fungal pathogens

- Yeasts
  - Candida
  - Cryptococcus

- Molds
  - Septate
    - Fusarium
    - Aspergillus
  - Nonseptate
    - Mucor
    - Rhizopus

Two species account for the majority of non-septated-mold eye issues—what are they?
Common Ocular Fungal Pathogens

No pic of *Mucor/Rhizopus*, as I don’t think you’ll be asked to ID it. Caveat emptor.
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
  - *Candida*
  - *Cryptococcus*

Molds
  - Septate
    - *Fusarium*
    - *Aspergillus*
  - Nonseptate
    - *Mucor*
    - *Rhizopus*

*What is the go-to stain for fungi?*
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

What is the go-to stain for fungi?
Gomori methenamine (many others work as well)
Common Ocular Fungal Pathogens

Aspergillus

Cryptococcus

Gomori methenamine stain
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast

- *Candida*
- *Cryptococcus*

Molds

Septate

- *Fusarium*
- *Aspergillus*

Nonseptate

- *Mucor*
- *Rhizopus*

What is the go-to stain for fungi?
Gomori methenamine (many others work as well)

Which is the only fungus that will take a Gram stain?
What is the go-to stain for fungi?
Gomori methenamine (many others work as well)

Which is the only fungus that will take a Gram stain?
Candida
Common Ocular Fungal Pathogens

Candida: Gram stain
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

What is the go-to stain for fungi?
Gomori methenamine (many others work as well)

When working up a suspected fungal keratitis, what culture medium should you use?
What is the go-to stain for fungi?
Gomori methenamine (many others work as well)

When working up a suspected fungal keratitis, what culture medium should you use?
Sabouraud
Common Ocular Fungal Pathogens

Candida growing on Sabouraud
Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind?

Cool, northern climes:
Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind?

Cool, northern climes: Yeasts, especially **Candida**.
Fungal pathogens

Yeasts
  - *Candida*
  - *Cryptococcus*

Molds
  - Septate
    - *Fusarium*
    - *Aspergillus*
  - Nonseptate
    - *Mucor*
    - *Rhizopus*

Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind? Cool, northern climes: Yeasts, especially *Candida*
Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind?

Cool, northern climes: Yeasts, especially **Candida**

Warm, humid climes:
Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind?

Cool, northern climes: Yeasts, especially *Candida*

Warm, humid climes: Septated molds, especially *Fusarium* and *Aspergillus*
Certain fungi have a strong association with particular climates. When you hear the following climate descriptions, which fungi should come to mind?

Cool, northern climes: Yeasts, especially *Candida*

Warm, humid climes: Septated molds, especially *Fusarium*
Fungal pathogens

Yeast
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

These are the associations to bear in mind:

Cool, northern climes → Candida
Warm, humid climes → Fusarium

No question—proceed when ready
Final basic-science topic: Some fungi exist as yeast in the body, but as mold in the environment. What is the term for such fungi?
Final basic-science topic: Some fungi exist as yeast in the body, but as mold in the environment. What is the term for such fungi?
Two species account for the majority of dimorphic fungi issues—what are they?
Common Ocular Fungal Pathogens

Fungal pathogens

Yeasts
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

Dimorphic
- Coccidiodes
- Histoplasma

Two species account for the majority of dimorphic fungi issues—what are they?
Coccidioides and Histoplasma have definite geographic preponderances in the United States. What are they?

**Coccidioides:**

**Histoplasma:**
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

Dimorphic
- Coccidiodes
- Histoplasma

Coccidiodes and Histoplasma have definite geographic preponderances in the United States. What are they? 
*Coccidiodes*: The Southwest, particularly the two words Valley in Cali 
*Histoplasma*: The and River valleys
**Common Ocular Fungal Pathogens**

Fungal pathogens

- Yeasts
  - *Candida*
  - *Cryptococcus*

- Molds
  - Septate
    - *Fusarium*
    - *Aspergillus*
  - Nonseptate
    - *Mucor*
    - *Rhizopus*

**Dimorphic**

- *Coccidioides*
- *Histoplasma*

*Coccidioides* and *Histoplasma* have definite geographic preponderances in the United States. What are they?  
*Coccidioides*: The Southwest, particularly the San Joaquin Valley in California.  
*Histoplasma*: The Ohio and Mississippi River valleys.
Common Ocular Fungal Pathogens

*H. capsulatum*: Mold (filamentous) form

*H. capsulatum*: Yeast form
Common Ocular Fungal Pathogens

*Histoplasma*, yeast form, in a macrophage

*Coccidioides*: Note the ‘spherule’ shape

Dimorphic pathogens
Common Ocular Fungal Pathogens

Fungal pathogens

Yeastss
- *Candida*
- *Cryptococcus*

Molds
- Septate
  - *Fusarium*
  - *Aspergillus*
- Nonseptate
  - *Mucor*
  - *Rhizopus*

Dimorphic
- *Coccidiodes*
- *Histoplasma*

*These eight species account for most of the fungal issues addressed in the BCSC*

No question—review slide
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast
- Candida
- Cryptococcus

Molds
- Septate
  - Fusarium
  - Aspergillus
- Nonseptate
  - Mucor
  - Rhizopus

Dimorphic
- Coccidiodes
- Histoplasma

Head’s up:
The Neuro book states that Coccidiodes and Histoplasma are yeasts. This is incorrect; both are dimorphic.

No question
Common Ocular Fungal Pathogens

Fungal pathogens

- Yeasts
  - Candida
  - Cryptococcus

- Molds
  - Septate
    - Fusarium
    - Aspergillus
  - Nonseptate
    - Mucor
    - Rhizopus

- Dimorphic
  - Coccidiodes
  - Histoplasma

---

**Head’s up:**
The *Neuro* book states that *Coccidiodes* and *Histoplasma* are yeasts. This is incorrect; both are dimorphic. What is true is that it is the yeast form which is infectious in humans.
Common Ocular Fungal Pathogens

Fungal pathogens

Yeast
- *Candida*
- *Cryptococcus*

Molds
  - Septate
    - *Fusarium*
    - *Aspergillus*
  - Nonseptate
    - *Mucor*
    - *Rhizopus*

Dimorphic
- *Coccidioides*
- *Histoplasma*

Head’s up part deaux:
The *Neuro* book states that *Candida* is dimorphic. This is incorrect; it is a yeast.

No question yet
Head’s up part deaux:
The *Neuro* book states that *Candida* is dimorphic. This is incorrect; it is a yeast. What is true is that *Candida* can form pseudohyphae, which give it the appearance of having a mold phase and thus being dimorphic.
Head’s up part deaux:
The *Neuro* book states that *Candida* is dimorphic. This is incorrect; it is a yeast. What *is* true is that *Candida* can form pseudohyphae, which give it the appearance of having a mold phase and thus being dimorphic.
Candida. This pic was shown earlier in the set. The ‘budding’ structure that was remarked upon then is a pseudohyphae.

*Candida*
Next we’ll shift gears and talk about the fungal conditions you need to know in order to do well on the OKAP (oh sure, and to take care of pts too).
Common Ocular Fungal Pathogens

Fungal pathogens cause six general conditions—what are they?
Fungal pathogens cause six general conditions—what are they?
Important foreshadowing: These conditions are not thrown up here rando. As we will see, the conditions on the right are often (in some cases always) caused by the condition on the left.
Important foreshadowing: These conditions are not thrown up here rando. As we will see, the conditions on the right are often (in some cases always) caused by the condition on the left. Committing the diagram to memory in the manner it’s presented above will help you hang on to that key fact.
Fungal pathogenic conditions

Keratitis
- Orbital disease
- Chorioretinitis
- Sceritis
- Optic neuropathy
- Endophthalmitis

In terms of presentation, how does fungal keratitis differ from bacterial?
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be **fulminant**, whereas fungal tends to be **insidious**.
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be fulminant, whereas fungal tends to be insidious.
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be fulminant, whereas fungal tends to be insidious.

With respect to keratitis, fungi have a capacity that renders them arguably more dangerous than bacteria—what is it?
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be fulminant, whereas fungal tends to be insidious.

With respect to keratitis, fungi have a capacity that renders them arguably more dangerous than bacteria—what is it? Unlike (most) bacteria, fungi can breach Descemet’s to enter the AC.
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be fulminant, whereas fungal tends to be insidious.

With respect to keratitis, fungi have a capacity that renders them arguably more dangerous than bacteria—what is it? Unlike (most) bacteria, fungi can breach Descemet’s to enter the AC.

There are three main risk factors for fungal keratitis—what are they?

- Trauma, especially involving vegetative matter
- Chronic topical steroid use
- Contact lens wear

Common Ocular Fungal Pathogens

Fungal pathogens ic conditions

Keratitis

Orbital disease

Chorioretinitis

Sceritis

Optic neuropathy

Endophthalmitis
In terms of presentation, how does fungal keratitis differ from bacterial? Bacterial tends to be fulminant, whereas fungal tends to be insidious.

With respect to keratitis, fungi have a capacity that renders them arguably more dangerous than bacteria—what is it? Unlike (most) bacteria, fungi can breach Descemet’s to enter the AC.

There are three main risk factors for fungal keratitis—what are they?
--Trauma, especially involving vegetative matter
--Chronic topical steroid use
--Contact lens wear
In terms of presentation, how does fungal keratitis differ from bacterial?

Bacterial tends to be fulminant, whereas fungal tends to be insidious.

With respect to keratitis, fungi have a capacity that renders them arguably more dangerous than bacteria—what is it?

Unlike (most) bacteria, fungi can breach Descemet’s to enter the AC.

There are three main risk factors for fungal keratitis—what are they?

--Trauma, especially involving vegetative matter
--Chronic topical steroid use
--Contact lens wear
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Orbital disease

Scleritis

Optic neuropathy

Chorioretinitis

Endophthalmitis

Which two species are responsible for the vast majority of fungal keratitis cases?

Fungal pathogens

Yeast

Candida

Cryptococcus

Molds

Septate

Fusarium

Aspergillus

Nonseptate

Mucor

Rhizopus

Dimorphic

Coccidioides

Histoplasma
Which two species are responsible for the vast majority of fungal keratitis cases? The septated molds—Aspergillus and (especially) Fusarium
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Sceritis

Orbital disease

Optic neuropathy

Chorioretinitis

Endophthalmitis

Fusarium

Aspergillus

Which two species are responsible for the vast majority of fungal keratitis cases?
The septated molds—Aspergillus and (especially) Fusarium

For more of fungal keratitis, see slide-set K32
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Chorioretinitis
- Sceritis
- Optic neuropathy
- Endophthalmitis

*Is fungal scleritis common, or rare?*
Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Chorioretinitis
- Optic neuropathy
- Endophthalmitis
- Sceritis

*Is fungal scleritis common, or rare?*

*It is very rare*
Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Chorioretinitis
- Optic neuropathy
- Endophthalmitis
- Scleritis

*Is fungal scleritis common, or rare?*

It is very rare

*How do most cases of fungal scleritis start?*
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Chorioretinitis
- Endophthalmitis
- Optic neuropathy
- Scleritis

Is fungal scleritis common, or rare?
It is very rare

How do most cases of fungal scleritis start?
As a keratitis that crosses the limbus
Fungal pathogenic conditions

Orbital disease

- Keratitis
- Scleritis
- Chorioretinitis
- Optic neuropathy
- Endophthalmitis

Common Ocular Fungal Pathogens

Three fungi cause orbital disease— which ones?--?
--?
--?

Fungal pathogens

- Yeasts
  - *Candida*
  - *Cryptococcus*

- Molds
  - Septate
    - *Fusarium*
    - *Aspergillus*
  - Nonseptate
    - *Mucor*
    - *Rhizopus*

- Dimorphic
  - *Coccidioides*
  - *Histoplasma*
Three fungi cause orbital disease— which ones?
--Aspergillus
--Mucor
--Rhizopus
Three fungi cause orbital disease— which ones?

--Aspergillus
--Mucor
--Rhizopus

Aspergillus is responsible for three forms of orbital disease that all fall under the umbrella term aspergillosis (aka sino-orbital aspergillosis)
Three fungi cause orbital disease— which ones? --Aspergillus --Mucor --Rhizopus

In contrast, *Mucor* and *Rhizopus* both cause the same clinical condition.
Orbital disease

Fungal pathogenic conditions

Keratitis

Scleritis

Optic neuropathy

Endophthalmitis

Chorioretinitis

Zygomycosis

Aspergillosis

Candida

Cryptococcus

Septate

Nonseptate

Molds

Yeast

In contrast, *Mucor* and *Rhizopus* both cause the same clinical condition. Because of this, the condition is named after the class of organism (Zygomycetes) to which both species belong.
Orbital disease can be caused by fungal pathogens, including:

- Aspergillus
- Mucor
- Rhizopus

In contrast, Mucor and Rhizopus both cause the same clinical condition. Because of this, the condition is named after the class of organism (Zygomycetes) to which both species belong.
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

Zygomycosis
Common Ocular Fungal Pathogens

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It is the most virulent.

So, these are highly virulent pathogens?
Common Ocular Fungal Pathogens

Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?
It is the most common

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence?
It is the **most virulent**

So, *these are highly virulent pathogens*?
Actually no—they are ubiquitous, and normally pose little or no threat

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?
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It is the most virulent.

So, these are highly virulent pathogens?
Actually no—they are ubiquitous, and normally pose little or no threat.

So then, under what circumstance are they highly virulent?
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the **most virulent**.

*So, these are highly virulent pathogens?* Actually no—they are ubiquitous, and normally pose little or no threat.

*So then, under what circumstance are they highly virulent?* When the individual is debilitated.

Zygomycosis
Common Ocular Fungal Pathogens

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So, these are highly virulent pathogens? Actually no—they are ubiquitous, and normally pose little or no threat.

So then, under what circumstance are they highly virulent? When the individual is debilitated.

What is the classic debilitating factor/scenario?

Zygomycosis
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What is the classic debilitating factor/scenario? A pt in DKA.

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?
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What is the classic debilitating factor/scenario?
A pt in DKA.

What other scenarios do the BCSC books mention? --?
--?
--?

Zygomycosis
Zygomycosis

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What is the classic debilitating factor/scenario? A pt in DKA.

What other scenarios do the BCSC books mention? --A pt with extensive burns --Malignancy, both solid and hematologic --Neutropenic pts, especially if they’re on abx.
Common Ocular Fungal Pathogens

Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

So, these are highly virulent pathogens? Actually no—they are ubiquitous, and normally pose little or no threat.

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Zygomycosis

What is the classic debilitating factor/scenario? A pt in DKA

What other scenarios do the BCSC books mention?--A pt with extensive burns
---Malignancy, both solid and hematologic
---Neutropenic pts, especially if they’re on abx
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

How does the organism get into orbit?

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

How does the organism get into orbit? Via direct extension of infection from an adjacent sinus.

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Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

How does the organism get into orbit? Via direct extension of infection from an adjacent sinus.

How does the organism get into the sinus? Via fungemia.

Zygomycosis
Common Ocular Fungal Pathogens

Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

How does the organism get into orbit? Via direct extension of infection from an adjacent sinus.

How does the organism get into the sinus? Via fungemia.

How does the organism get into the body in the first place? Via inhalation.

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality? It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence? It is the most virulent.

How does the organism get into orbit? Via direct extension of infection from an adjacent sinus.

Zygomycosis

**How does the organism get into the sinus?**
Via fungemia

**How does the organism get into the body in the first place?**
The lungs, ie, inhalation
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?
It is the most common.

Among fungal causes of orbital dz, where does zygomycosis rank in terms of virulence?
It is the most virulent.

How does the organism get into orbit?
Via direct extension of infection from an adjacent sinus.

The organism has a strong predilection for a particular sort of anatomic structure—what is it?

Zygomycosis
Among fungal causes of orbital dz, where does zygomycosis rank in terms of commonality?
It is the most common.

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Blood vessels. This is a key fact to remember about zygomycosis—all of the badness stems from derangements of blood flow.

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Zygomycosis
Common Ocular Fungal Pathogens

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In addition to its myriad deleterious effects on tissue, this thrombosing vasculitis can produce a misleading general clinical picture. In what way?
If the ‘right’ vessels become thrombosed, the eye and orbit will be deceptively quiet in appearance, giving the impression that the process is milder than it actually is.
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Zygomycosis

What are the exam findings in orbital apex syndrome?
--?
--?
--?
--?
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--?
--?
--?
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Zygomycosis

What are the exam findings in orbital apex syndrome?
--Complete ptosis
--Ophthalmoplegia (both internal and external)
--?
--?

Spotting a black eschar on the nasopharyngeal mucosa. By biopsying the eschar and finding nonseptated hyphae on it.

How is zygomycosis managed?
--The underlying debilitating condition must be reversed—get IM to resolve the DKA
--The infected tissue must be debrided—get your friends in ENT involved
--Get Ampho B on board.
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How do these pts typically present? With proptosis and **orbital apex syndrome**.

**Zygomycosis**

**What are the exam findings in orbital apex syndrome?**

-- Complete ptosis
-- Ophthalmoplegia (both internal and external)
--?
--?

(Note: It's not ophthalmic.) How is the diagnosis confirmed?

Spotting a black eschar on the nasopharyngeal mucosa. By biopsying the eschar and finding nonseptated hyphae on it.

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-- Complete ptosis
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What is an external ophthalmoplegia?


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Zygomycosis

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---Complete ptosis
---Ophthalmoplegia (both internal and external)
---?

--- What is an external ophthalmoplegia?
Paralysis of the extraocular muscles
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What is an external ophthalmoplegia? Internal?
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**Zygomycosis**

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-- Complete ptosis
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-- ?

\textbf{What is an external ophthalmoplegia? Internal?} Paralysis of the extraocular muscles. Paralysis of the muscles inside the eye, ie, the pupillary and ciliary muscles.
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Zygomycosis

What are the exam findings in orbital apex syndrome?
--Complete ptosis
--Ophthalmoplegia (both internal and external)
--Corneal sensation is blunted
--?
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What are the exam findings in orbital apex syndrome?

- Complete ptosis
- Ophthalmoplegia (both internal and external)
- Corneal sensation is decreased
- Vision is affected vs unaffected

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(Note: It’s not ophthalmic.)
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Zygomycosis: Necrotic sinus tissue with eschar
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A, A patient with zygomycosis eroding the hard palate

Zygomycosis
Common Ocular Fungal Pathogens

A, A patient with zygomycosis eroding the hard palate
B, Biopsy specimen demonstrates typical nonseptate hyphae

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How is zygomycosis managed?  
--?
--? Three things have to happen…
--?
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How is zygomycosis managed?
-- [what got the pt in this mess in the first place]
--
--
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How is zygomycosis managed? --The underlying debilitating condition must be reversed—get IM to resolve the DKA
-- [this surgical goal is pretty obvious]
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How is zygomycosis managed? --The underlying debilitating condition must be reversed—get IM to resolve the DKA
--The infected tissue must be debrided—get ENT and Oculoplastics involved
-- [this medical step is pretty obvious too]
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Zygomycosis in a patient with diabetic ketoacidosis. A, Complete right upper eyelid ptosis and ophthalmoplegia are present in the patient.
Zygomycosis in a patient with diabetic ketoacidosis. A, Complete right upper eyelid ptosis and ophthalmoplegia are present in the patient. B, Wide surgical debridement consisting of orbital exenteration and sinus surgery was life-saving.
Zygomycosis in a patient with diabetic ketoacidosis. **A,** Complete right upper eyelid ptosis and ophthalmoplegia are present in the patient. **B,** Wide surgical debridement consisting of orbital exenteration and sinus surgery was life-saving. CT (C) and MRI (D) axial scans show orbital and sinus involvement as well as cavernous sinus thrombosis **(arrow).**
Aspergillosis can produce orbital dz via three distinct mechanisms:
Aspergillosis can produce orbital dz via three distinct mechanisms:
--By orbital tissue
--
**Orbital disease**

- Keratitis
- Sceritis
- Optic neuropathy
- Endophthalmitis
- Chorioretinitis
- Zygomycosis
- Aspergillosis

**Aspergillosis** can produce orbital dz via three distinct mechanisms:
-- By infecting orbital tissue
Aspergillosis can produce orbital dz via three distinct mechanisms:

- By infecting orbital tissue. The BCSC refers to this as invasive aspergillosis.
Aspergillosis can produce orbital dz via three distinct mechanisms:
--By infecting orbital tissue. The BCSC refers to this as invasive aspergillosis.
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--By infecting orbital tissue. The BCSC refers to this as invasive aspergillosis.

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--By forming a space-occupying mass in the orbit.
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--By forming a space-occupying mass in the orbit. This is noninvasive aspergillosis.
Orbital disease

**Common Ocular Fungal Pathogens**

**Fungal pathogenic conditions**

- Keratitis
- Scleritis
- Zygomycosis
- Chorioretinitis
- Invasive
- Noninvasive
- Allergic

**Aspergillosis**

**What is the chief predisposing factor in invasive aspergillosis?**

- Being immunocompromised/debilitated

**How does the fungus gain access to the orbit?**

- By direct spread from adjacent sinusitis

**How does it present?**

It is highly variable—it can be fulminant, or chronic. Fulminant cases present with severe pain, proptosis, and decreased VA. Intracranial spread is common, and results in a high mortality rate. Chronic cases mimic malignancy—less pain, more gradual proptosis, and loss of function. The mortality rate is lower, but still significant. (Note: The *Plastics* book reserves the term *invasive aspergillosis* for fulminant cases, and refers to chronic cases as *chronic necrotizing aspergillosis*.)
Orbital disease

Fungal pathogenic conditions

Keratitis

Scleritis

Optic neuropathy

Sceritis

Ocular immunity

Zygomycosis

What is the chief predisposing factor in invasive aspergillosis?

Being immunocompromised/debilitated

Invasive

Aspergillosis
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Scleritis
- Conjunctivitis
- Optic neuropathy

Orbital disease

- Zygomycosis
- Aspergillosis

- Choroiditis

What is the chief predisposing factor in invasive aspergillosis?
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How does the fungus gain access to the orbit?
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What is the chief predisposing factor in invasive aspergillosis?
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Orbital disease
Aspergillosis
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Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Orbital disease

Keratitis

Scleritis

Chorioretinitis

Optic neuropathy

Zygomycosis

Aspergillosis

Invasive
Orbital disease

Keratitis

Scleritis

Optic neuropathy

Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Aspergillosis

What is the chief predisposing factor in invasive aspergillosis?
Being immunocompromised/debilitated

How does the fungus gain access to the orbit?
By direct spread from adjacent sinusitis

How does it present?
It is highly variable—it can be fulminant, or chronic
**Orbital disease**

- **Keratitis**
- **Scleritis**

**Fungal pathogenic conditions**

- **Keratitis**
- **Scleritis**
- **Optic neuropathy**

**Common Ocular Fungal Pathogens**

- **Zygomycosis**
- **Chorioretinitis**

**Aspergillosis**

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This 82-year-old woman presented with a 6-week history of left brow and orbital pain. A, 4 weeks before evaluation, she suddenly lost vision in her left eye, and ptosis and proptosis developed 1 week later.
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This 82-year-old woman presented with a 6-week history of left brow and orbital pain. A, 4 weeks before evaluation, she suddenly lost vision in her left eye, and ptosis and proptosis developed 1 week later. B, CT scan revealed a destructive lesion at the orbital apex. C, Biopsy of the lesion showed septate hyphae consistent with aspergillosis.
Who is the typical allergic aspergillosis pt?

An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis.

What would a blood draw reveal?
The usual atopic/allergic findings: Lots of eos and high levels of IgE.

Fundamentally, allergic aspergillosis is a garden-variety IgE-mediated hypersensitivity reaction of the sort often seen in atopic pts.

OK, so these pts have a stuffy nose. Why is this worth talking about?
Because this inflammatory sinus-mucosa response can spread to the mucosa of the orbit. (This is especially the case if the sphenoid sinus is involved.) Further, the mucosal inflammatory response is severe enough to erode bone, allowing the fungus access to the intracranial space.

How is allergic aspergillosis diagnosed?
Via sinus biopsy

How is it treated?
Via surgical debridement of the sinuses, and steroids
Who is the typical allergic aspergillosis pt?

An individual with a PMHx of [atopy], chronic [sinusitis], and nasal [polyposis].

What would a blood draw reveal?

The usual atopic/allergic findings: Lots of [eos] and high levels of [IgE].

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How is allergic aspergillosis diagnosed?

Via sinus biopsy.

How is it treated?

Via surgical debridement of the sinuses, and steroids.
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis

Fungal pathogenic conditions

Common Ocular Fungal Pathogens

Keratitis

Orbital disease

Zygomycosis

Aspergillosis

Invasive

Allergic

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Via sinus biopsy
How is it treated?
Via surgical debridement of the sinuses, and steroids
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis

Do they tend to be immunocompromised, like invasive aspergillosis pts?

Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Orbital disease

Zygomycosis

Aspergillosis

Invasive

Allergic
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis

Do they tend to be immunocompromised, like invasive aspergillosis pts?
No, just the opposite—these pts are almost always immunocompetent (the condition requires the mounting of a robust immune response)
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis

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Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Orbital disease

Chorioretinitis

Zygomycosis

Aspergillosis

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**Common Ocular Fungal Pathogens**

- Endophthalmitis
- Fungal pathogen
- Ic conditions
- Sceritis
- Keratitis
- Optic neuropathy

**Common Ocular Fungal Pathogens**

- Zygomycosis
- Chorioretinitis
- Invasive
- Noninvasive

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Via sinus biopsy

**How is it treated?**
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- Aspergillosis
  - Allergic
    - Invasive
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CT demonstrating allergic aspergillosis involving the left posterior ethmoid and sphenoid sinus with bony expansion and compression of the left optic nerve
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Because this inflammatory sinus-mucosa response can spread to the mucosa of the orbit. (This is especially the case if the sphenoid sinus is involved.)

When this occurs, how does it manifest clinically, ie, what S/S will be present?
In effect, the inflammation will act like a space-occupying mass near the orbital apex, thereby producing some combination of proptosis, ophthalmoplegia, and optic neuropathy, as well as pain localizing to the retrobulbar region.
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Endophthalmitis
Keratitis
Orbital disease
Zygomycosis

Invasive

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Allergic
**Common Ocular Fungal Pathogens**

### Fungal pathogenic conditions

- **Endophthalmitis**
- **Fungal pathogen**
- **ic conditions**

### Common Ocular Fungal Pathogens

- **Zygomycosis**
- **Chorioretinitis**
- **Keratitis**

### Orbital disease

- **Invasive**
- **Zygomycosis**

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**How is allergic aspergillosis diagnosed?**

Via sinus biopsy.

**How is it treated?**

Via surgical debridement of the sinuses, and steroids.
**Common Ocular Fungal Pathogens**

### Fungal pathogenic conditions

- **Endophthalmitis**
- **Fungal pathogen**
- **Ic conditions**
- **Sceritis**
- **Keratitis**
- **Optic neuropathy**

### Common Ocular Fungal Pathogens

- **Zygomycosis**
- **Chorioretinitis**

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**Common Ocular Fungal Pathogens**

**Fungal pathogenic conditions**

- **Endophthalmitis**
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**Keratitis**

**Orbital disease**

**Zygomycosis**

**Invasive**

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Because this inflammatory sinus-mucosa response can spread to the mucosa of the orbit. (This is especially the case if the sphenoid sinus is involved.)

Further, the mucosal inflammatory response is severe enough to erode bone, allowing the fungus access to the intracranial space.

No question—proceed when ready
Common Ocular Fungal Pathogens

Allergic aspergillosis: Bony destruction
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis

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How is allergic aspergillosis diagnosed?
Via sinus biopsy

How is it treated?
Via surgical debridement of the sinuses, and steroids
**Who is the typical allergic aspergillosis pt?**
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**How is allergic aspergillosis diagnosed?**
Via sinus biopsy
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Orbital disease

Chorioretinitis

Zygomycosis

Aspergillosis

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What does the biopsy reveal?
Thick mucus (the classic description is 'peanut-butter like') containing fungal hyphae

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**Common Ocular Fungal Pathogens**

**Fungal pathogenic conditions**

**Endophthalmitis**

**Fungal pathogen**

**ic conditions**

**Sceritis**

**Keratitis**

**Optic neuropathy**

**Common Ocular Fungal Pathogens**

**Zygomycosis**

**Chorioretinitis**

**Invasive Noninvasive**

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Aspergillosis

Orbital disease

Zygomycosis

Invasive
Common Ocular Fungal Pathogens

Allergic aspergillosis: Biopsy specimen plated on whole-wheat agar
Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis.

What would a blood draw reveal?
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Via sinus biopsy.

How is it treated?
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Common Ocular Fungal Pathogens

Fungal pathogenic conditions

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How is allergic aspergillosis diagnosed?
Via sinus biopsy

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You forgot to say ‘antifungals.’ And antifungals, right?
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How is allergic aspergillosis diagnosed?
Via sinus biopsy

How is it treated?
Via surgical debridement of the sinuses, and steroids

You forgot to say ‘antifungals.’ And antifungals, right?
Nope—antifungals are not indicated (unless this is a very unusual case of allergic aspergillosis in an immunocompromised pt)
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis

Orbital disease

Chorioretinitis

Zygomycosis

Aspergillosis

Who is the typical allergic aspergillosis pt?
An individual with a PMHx of atopy, chronic sinusitis, and nasal polyposis.

What would a blood draw reveal?
The usual atopic/allergic findings: Lots of eos and high levels of IgE. Fundamentally, allergic aspergillosis is a garden-variety IgE-mediated hypersensitivity reaction of the sort often seen in atopic pts.

OK, so these pts have a stuffy nose. Why is this worth talking about?
Because this inflammatory sinus-mucosa response can spread to the mucosa of the orbit. (This is especially the case if the sphenoid sinus is involved.) Further, the mucosal inflammatory response is severe enough to erode bone, allowing the fungus access to the intracranial space.

How is allergic aspergillosis diagnosed?
Via sinus biopsy

How is it treated?
Via surgical debridement of the sinuses, and steroids

You forgot to say ‘antifungals.’ And antifungals, right?
Nope—antifungals are not indicated (unless this is a very unusual case of allergic aspergillosis in an immunocompromised pt)
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In a nutshell, what is the pathologic process in noninvasive aspergillosis?

The fungus proliferates within the air space of the sinus—ie, not within the mucosa so much as upon it. This extramucosal proliferation eventually fills the air space and forms a 'fungal ball' that acts as a space-occupying lesion. If an aspergilloma forms near the orbital apex, it will produce the same signs and symptoms as any other mass—proptosis, decreased VA, ophthalmoplegia, and pain.

In addition to orbital S/S, what other complaints are typical?

Nasal congestion and rhinorrhea, and HA localizing to the periorbital region

How much inflammation is typically associated with noninvasive aspergillosis?

Little to none

How much bony erosion typically occurs?

Little to none

How is noninvasive aspergillosis managed?

Surgically
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What is the formal name for an Aspergillus fungal ball? Aspergilloma.
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Which sinuses are adjacent to the orbital apex?
The sphenoid and ethmoid

Which sinuses are especially prone to hosting aspergillomas?
The sphenoid and ethmoid

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Little to none

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CT showing large aspergilloma invading the sphenoid sinus and extending posteriorly with compression of the left optic nerve.
**Fungal pathogenic conditions**

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Common Ocular Fungal Pathogens

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Surgically

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Unclear. The Plastics book states that it occurs in immunocompetent individuals. The Neuro book says it occurs in both immunocompetent and compromised individuals. Eyewiki says it occurs ‘primarily in immunocompetent pts.’ FWIW, I think an OKAP/Boards pt would be presented as immunocompetent. Caveat emptor.
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<td>High</td>
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#### Fungal conditions

- Zygomycosis
- Aspergillosis
  - Invasive
  - Noninvasive
  - Allergic

#### Ocular conditions

- Orbital disease
- Keratitis
- Chorioretinitis
Orbital disease

**Fungal pathogens**

- Zygomycosis
- Aspergillosis
- Chorioretinitis
- Optic neuropathy
- Keratitis
- Sceritis

**Common Ocular Fungal Pathogens**

- **Zygomycosis**
- **Aspergillosis**
  - **Invasive aspergillosis**
  - **Allergic aspergillosis**
  - **Noninvasive aspergillosis**

**Immunostatus**

- Compromised
- Competent

**Bony erosions?**

- ?

**Orbital aspergillosis tl;dr**

- **Invasive**
- **Noninvasive**
- **Allergic**

**Mortality rate?**

- High
- Lower
- Lowest

**Treat with**

- Surgery?
  - Yes
  - Yes
  - Yes

- Antifungals?
  - Yes
  - No
  - No
## Common Ocular Fungal Pathogens

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### Orbital disease

- Zygomycosis
- Aspergillosis
  - Invasive
  - Noninvasive
  - Allergic

- Keratitis
- Chorioretinitis
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- Sceritis
- Keratitis

- Orbital disease

- Immunostatus
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### Aspergillosis

- **Invasive**
- **Noninvasive**
- **Allergic**

### Fungal conditions
- Orbital disease
- Keratitis
- Chorioretinitis
- Zygomycosis

### Invasive vs. Noninvasive vs. Allergic

- **Invasive aspergillosis**
- **Noninvasive aspergillosis**
- **Allergic aspergillosis**

- **Immunostatus**
  - Compromised
  - Competent

- **Bony erosions?**
  - Yes
  - No

- **Inflammation present?**
  - Yes
  - No

- **Treat with surgery?**
  - ?
  - ?
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- **Mortality rate?**
  - High
  - Lower
  - Lowest
### Common Ocular Fungal Pathogens

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<td>High</td>
<td>Lower</td>
<td>Lowest</td>
</tr>
</tbody>
</table>

## Fungal Diseases

- **Orbital aspergillosis**
  - Invasive
  - Noninvasive
  - Allergic

- **Keratitis**
  - Invasive
  - Noninvasive
  - Allergic

- **Orbital disease**
  - Invasive
  - Noninvasive
  - Allergic

- **Chorioretinitis**
  - Invasive
  - Noninvasive
  - Allergic

- **Zygomycosis**

## Immunostatus

- **Compromised**
- **Competent**

## Inflammation

- **Present**
- **Not present**

## Treatment

- **Yes**
- **No**

## Mortality Rate

- **High**
- **Lower**
- **Lowest**
Fungal optic neuropathy can occur via several means:

- As we have seen in some detail, zygomycosis and aspergillosis can produce optic neuropathy by one of several mechanisms.
- The other fungal optic neuropathy addressed in the BCSC is papilledema secondary to cryptococcal meningitis in pts with HIV/AIDS.

**Common Ocular Fungal Pathogens**

- **Fungal pathogenic**ic conditions
- **Keratitis**
- **Scleritis**
- **Orbital disease**
- **Optic neuropathy**
- **Chorioretinitis**
- **Endophthalmitis**

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-- The other fungal optic neuropathy addressed in the BCSC is 2ndry to cryptococcal meningitis in pts with HIV/AIDS.

Common Ocular Fungal Pathogens

Fungal pathogenic conditions:

- Keratitis
- Scleritis
- Orbital disease
- Chorioretinitis
- Endophthalmitis
- Optic neuropathy

Fungal optic neuropathy can occur via several means:

- Zygomycosis
- Aspergillosis

name of fungal optic neuropathy 2ndry to name of fungus meningitis in pts with name of underlying condition meningitis
Fungal optic neuropathy can occur via several means:
--As we have seen in some detail, *zygomycosis* and *aspergillosis* can produce optic neuropathy by one of several mechanisms.
--The other fungal optic neuropathy addressed in the *BCSC* is papilledema secondary to cryptococcal meningitis in pts with HIV/AIDS.
Is fungal chorioretinitis a common, or rare entity?
Is fungal chorioretinitis a common, or rare entity? It is quite rare.
Is fungal chorioretinitis a common, or rare entity?
It is quite rare

*It occurs almost exclusively in one sort of pt—what sort is that?*
Is fungal chorioretinitis a common, or rare entity?
It is quite rare

It occurs almost exclusively in one sort of pt—what sort is that?
Debilitated via AIDS, malignancy, steroids, chronic illness, etc
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Scleritis
- Orbital disease
- Optic neuropathy
- Chorioretinitis
- Endophthalmitis

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*It occurs almost exclusively via one mechanism—what it is?*
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Scleritis
- Orbital disease
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Is fungal chorioretinitis a common, or rare entity?
It is quite rare

It occurs almost exclusively in one sort of pt—what sort is that?
Debilitated via AIDS, malignancy, steroids, chronic illness, etc

It occurs almost exclusively via one mechanism—what it is?
Fungemia, ie, hematogenous spread from elsewhere
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Endophthalmitis
- Scleritis
- Optic neuropathy

Chorioretinitis

Which three species are responsible for the majority of fungal chorioretinitis cases?

Fungal pathogens

- Yeasts
  - Candida
  - Cryptococcus
- Molds
  - Septate
    - Fusarium
    - Aspergillus
  - Nonseptate
    - Mucor
    - Rhizopus
- Dimorphic
  - Coccidioides
  - Histoplasma
Which three species are responsible for the majority of fungal chorioretinitis cases?
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Orbital disease
- Sceritis
- Optic neuropathy
- Endophthalmitis

Chorioretinitis

- Candida
- Aspergillus
- Cryptococcus
- Histoplasma?

Fungal pathogenic conditions

- Yeasts
  - Candida
  - Cryptococcus
- Molds
  - Septate
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    - Aspergillus
  - Nonseptate
    - Mucor
    - Rhizopus

Dimorphic

What about Histoplasma, the causative agent in POHS? Why isn’t it on this list?
What about Histoplasma, the causative agent in POHS? Why isn’t it on this list?

Good question. The Path, Uveitis, and Retina books all acknowledge POHS is a chorioretinitis caused by Histoplasma, but none discuss it alongside other causes of fungal chorioretinitis.
Fungal pathogenic conditions

- Keratitis
- Scleritis
- Orbital disease
- Optic neuropathy
- Endophthalmitis

Chorioretinitis
- Candida?
- Aspergillus?
- Cryptococcus?

Which three species are responsible for the majority of fungal keratitis cases?

Of the three, which is the most common?
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Of the three, which is the most common? Candida
Which three species are responsible for the vast majority of fungal keratitis cases?

Of the three, which is the most common?

Generally speaking, who is at risk for Candida chorioretinitis?

- Hospitalized, debilitated individuals
- Major GI surgery
- Chronic lines/catheters (Classic story: Pt s/p GI surgery is NPO and receiving TPN)
- Systemic antibiotics (think sepsis pt)

This does not seem to be a risk factor (eg, HIV/AIDS is not a risk factor for Candida chorioretinitis)
Orbital disease
Endophthalmitis
Fungal pathogenic conditions

Keratitis
Scleritis
Optic neuropathy
Orbital disease
Endophthalmitis

Chorioretinitis
Candida
Aspergillus
Cryptococcus

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Aspergillus
Cryptococcus
Common Ocular Fungal Pathogens

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- Keratitis
- Orbital disease
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Chorioretinitis

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Which three species are responsible for the vast majority of fungal keratitis cases?

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- Candida

Generally speaking, who is at risk for Candida chorioretinitis?

Hospitalized, debilitated individuals

Is there anything in particular that puts them at risk?

- Hospitalized, debilitated individuals
- Major GI surgery
- Chronic lines/catheters (classic story: Pt s/p GI surgery is NPO and receiving TPN)
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- Immunocompromised (eg, HIV/AIDS is not a risk factor for Candida chorioretinitis)
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Orbital disease
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Chorioretinitis

- Candida
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**Chorioretinitis**

- **Candida**
- Aspergillus
- Cryptococcus

**Common Ocular Fungal Pathogens**

- Candida
- Aspergillus
- Cryptococcus
- Yeasts
- Molds
- Septate
- Nonseptate
- Dimorphic
- Fusarium
- Coccidioides
- Histoplasma

**Which three species are responsible for the vast majority of fungal keratitis cases?**

- Candida
- Aspergillus
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**Of the three, which is the most common?**

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**How about being immunocompromised?**

- This does not seem to be a risk factor (e.g., HIV/AIDS is not a risk factor for Candida chorioretinitis)
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

Keratitis
Scleritis
Optic neuropathy
Orbital disease
Endophthalmitis

Chorioretinitis

Candida
Aspergillus
Cryptococcus

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This does not seem to be a risk factor (eg, HIV/AIDS is not a risk factor for Candida chorioretinitis)

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Candida

Of the three, which is the most common?
Candida
There are three subtypes of endophthalmitis—what are they?
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Post-traumatic, post-surgical, and endogenous
There are three subtypes of endophthalmitis—what are they? Post-traumatic, post-surgical, and endogenous.

Are post-traumatic and/or post-surgical endophthalmitis common entities?
There are three subtypes of endophthalmitis—what are they?

- Post-traumatic
- Post-surgical
- Endogenous

Are post-traumatic and/or post-surgical endophthalmitis common entities?
Not in the US, no
There are three subtypes of endophthalmitis—what are they?

Post-traumatic, post-surgical, and endogenous

Orbital disease

Keratitis

Sceritis

Optic neuropathy

Chorioretinitis

Endophthalmitis

Are post-traumatic and/or post-surgical endophthalmitis common entities?

Not in the US, no

There is a country where fully 20% of post-surgical and post-traumatic endophthalmitis cases are fungal—which one?
There are three subtypes of endophthalmitis—what are they?
Post-traumatic, post-surgical, and endogenous

Are post-traumatic and/or post-surgical endophthalmitis common entities?
Not in the US, no

There is a country where fully 20% of post-surgical and post-traumatic endophthalmitis cases are fungal—which one?
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There are three subtypes of endophthalmitis—what are they? Post-traumatic, post-surgical, and **endogenous**

How does endogenous endophthalmitis come to happen, ie, what’s the mechanism?
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Post-traumatic, post-surgical, and endogenous

How does endogenous endophthalmitis come to happen, ie, what’s the mechanism?
It develops when an endogenous chorioretinitis breaks through the ILM to enter the vitreous cavity.
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We said these are the common causes of endogenous chorioretinitis.
Fungal pathogenicic conditions

- Keratitis
- Orbital disease
- Sceritis
- Optic neuropathy

Chorioretinitis → Endophthalmitis

- Candida
- Aspergillus
- Cryptococcus

Endogenous

Post-traumatic
Post-surgical

How does endogenous endophthalmitis come to happen, ie, what's the mechanism? It develops when an endogenous chorioretinitis breaks through the ILM to enter the vitreous cavity.

We said these are the common causes of endogenous chorioretinitis. It should follow that they are the common causes of endogenous fungal endophthalmitis. Are they?
How does endogenous endophthalmitis come to happen, ie, what's the mechanism?
It develops when an endogenous chorioretinitis breaks through the ILM to enter the vitreous cavity.

We said these are the common causes of endogenous chorioretinitis. It should follow that they are the common causes of endogenous fungal endophthalmitis. Are they? Indeed they are.
As noted earlier, Candida is the most common cause of fungal chorioretinitis. Is it also the most common cause of endogenous fungal endophthalmitis?
As noted earlier, Candida is the most common cause of fungal chorioretinitis. Is it also the most common cause of endogenous fungal endophthalmitis? Indeed it is
Recall that these are the two species responsible for most fungal keratitis cases.
Recall that these are the two species responsible for most fungal keratitis cases. The *Retina* book goes out of its way to state that fungal keratitis can progress to endophthalmitis. It also indicates that one of these two pathogens is particularly likely to do so. Which one?
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*Fusarium*
Common Ocular Fungal Pathogens

Fungal pathogenic conditions

- Keratitis
- Sceritis
- Orbital disease
- Chorioretinitis
- Endophthalmitis

For more on endophthalmitis, see slide-set U23

Recall that these are the two species responsible for most fungal keratitis cases. The *Retina* book goes out of its way to state that fungal keratitis can progress to endophthalmitis. It also indicates that one of these two pathogens is particularly likely to do so. Which one? *Fusarium*