Hypersensitivity Reactions of the Ocular Surface
Firstly: What is a Hypersensitivity Reaction? of the Ocular Surface
Firstly: What is a **Hypersensitivity Reaction? of the Ocular Surface**
An exaggerated version of a normal immune response—ie, too much of a good thing
How many *Hypersensitivity Reactions of the Ocular Surface* are there?
How many Hypersensitivity Reactions of the Ocular Surface are there?

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cell-mediated</td>
<td></td>
</tr>
</tbody>
</table>
How many *Hypersensitivity Reactions of the Ocular Surface* are there?

Type I  Type II  Type III  Type IV

*Four? But I seem to recall from med school that there are five hypersensitivity reactions. What gives?*
How many **Hypersensitivity Reactions of the Ocular Surface** are there?

**Type I**  **Type II**  **Type III**  **Type IV**  **Type V?**

Four? But I seem to recall from med school that there are **five** hypersensitivity reactions. What gives? There is a fifth, but it plays no role regarding the ocular surface.
Before proceeding further, it should be noted that the conceptualization of 4 (or 5) distinct hypersensitivity reactions is considered outdated by modern immunologists. In truth, most clinical conditions represent a blend of the proposed hypersensitivity mechanisms. That said, this framework for categorizing hypersensitivity reactions persists in the literature, and thus familiarity with it remains an obligation of ophthos-in-training.
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve...

Type II reactions involve...

Type III reactions involve...

Type IV reactions involve...

Type I reactions involve... [One word that captures the nature of this rxn]
Hypersensitivity Reactions of the Ocular Surface

**Type I**
- Anaphylaxis

**Type II**

**Type III**
- Immune-complex reactions

**Type IV**
- Cell-mediated reactions

*Type I reactions involve... Anaphylaxis
Type II reactions involve...
Type III reactions involve...
Type IV reactions involve...*
### Hypersensitivity Reactions of the Ocular Surface

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<tbody>
<tr>
<td>Anaphylaxis</td>
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</tr>
</tbody>
</table>

**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...**

**Type III reactions involve...**

**Type IV reactions involve...**

*Briefly, how does an anaphylactic reaction proceed?*
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve... Anaphylaxis
Type II reactions involve...
Type III reactions involve... Immune-complex reactions
Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?
The binding of one word, + its abb. to receptors on cell type causes the cells to one word.
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve... Anaphylaxis
Type II reactions involve...
Type III reactions involve... Immune-complex reactions
Type IV reactions involve...

Briefly, how does an anaphylactic reaction proceed?
The binding of antigen (Ag) to IgE receptors on mast cells causes the cells to degranulate.
Hypersensitivity Reactions of the Ocular Surface

**Type I** reactions involve... *Anaphylaxis*

**Type II** reactions involve...

**Type III** reactions involve...

**Type IV** reactions involve...

**Briefly, how does an anaphylactic reaction proceed?**

The binding of antigen (Ag) to IgE receptors on mast cells causes the cells to degranulate, with the subsequent release of histamine and other pre-formed inflammatory mediators.
**Hypersensitivity Reactions of the Ocular Surface**

**Anaphylaxis**

**Type I**

*Type I reactions involve...* Anaphylaxis

*Type II reactions involve...*

*Type III reactions involve...*

*Type IV reactions involve...*

**Briefly, how does an anaphylactic reaction proceed?**

The binding of *antigen (Ag)* to *IgE* receptors on *mast cells* causes the cells to *degranulate*, with the subsequent release of *histamine* and other pre-formed inflammatory mediators.
Hypersensitivity Reactions of the Ocular Surface

**Type I**

Anaphylaxis

**Type II**

**Type III**

**Type IV**

**Briefly, how does an anaphylactic reaction proceed?**

The binding of antigen (Ag) to IgE receptors on mast cells causes the cells to degranulate, with the subsequent release of histamine and other pre-formed inflammatory mediators.

*Sounds fast. How long does it take to become clinically apparent?*
**Hypersensitivity Reactions of the Ocular Surface**

- **Type I** reactions involve... **Anaphylaxis**
  - The binding of antigen (Ag) to IgE receptors on mast cells causes the cells to degranulate, with the subsequent release of histamine and other pre-formed inflammatory mediators.
  - Briefly, how does an anaphylactic reaction proceed?
  - Sounds fast. How long does it take to become clinically apparent?
    - Only minutes (which is why this reaction is often referred to as immediate hypersensitivity)

- **Type II** reactions involve...

- **Type III** reactions involve...

- **Type IV** reactions involve...
Hypersensitivity Reactions of the Ocular Surface

Type I: Anaphylaxis

Type II: [Two words capturing this rxn]

Type III: Immune-complex reactions

Type IV: Immune-complex reactions

Type I reactions involve... Anaphylaxis

Type II reactions involve... [Two words capturing this rxn]

Type III reactions involve...

Type IV reactions involve...
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...** Cytotoxic antibodies

**Type III reactions involve...** Immune-complex reactions

**Type IV reactions involve...**
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

Type I reactions involve...
Anaphylaxis

Type II reactions involve...
Cytotoxic antibodies

Type III reactions involve...
Immune-complex reactions

Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?
**Hypersensitivity Reactions of the Ocular Surface**

**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...** Cytotoxic antibodies

**Type III reactions involve...**

**Type IV reactions involve...**

*Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?*

No, it is IgG and/or IgM
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve...
- Anaphylaxis

Type II reactions involve...
- Cytotoxic antibodies

Type III reactions involve...
- Immune-complex reactions

Type IV reactions involve...

Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?
No, it is IgG and/or IgM

How does a Type II reaction proceed?
**Hypersensitivity Reactions of the Ocular Surface**

**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...** Cytotoxic antibodies

**Type III reactions involve...** Immune-complex reactions

**Type IV reactions involve...**

*Is the antibody (Ab) involved in Type II reactions IgE, as it is in Type I?*
No, it is IgG and/or IgM

*How does a Type II reaction proceed?*
Antibodies bind to antigens located on cell membranes. These cell-membrane bound Ag-Ab complexes prompt complement-system attacks on the cell.
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

- **Type I reactions involve...** Anaphylaxis
- **Type II reactions involve...** Cytotoxic antibodies
- **Type III reactions involve...** Immune-complex reactions
- **Type IV reactions involve...** [Three words for this one]
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

- **Type I** reactions involve... *Anaphylaxis*
- **Type II** reactions involve... *Cytotoxic antibodies*
- **Type III** reactions involve... *Immune-complex reactions*
- **Type IV** reactions involve...
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

Type I reactions involve... Anaphylaxis
Type II reactions involve... Cytotoxic antibodies
Type III reactions involve... Immune-complex reactions
Type IV reactions involve...

Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II?
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve...
Anaphylaxis

Type II reactions involve...
Cytotoxic antibodies

Type III reactions involve...
Immune-complex reactions

Type IV reactions involve...

Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II? IgG and/or IgM
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

Type I reactions involve…

Type II reactions involve…

Type III reactions involve…

Type IV reactions involve…

Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II?

IgG and/or IgM

How does a Type III reaction proceed?
Hypersensitivity Reactions of the Ocular Surface

**Type I** reactions involve...Anaphylaxis
**Type II** reactions involve...Cytotoxic antibodies
**Type III** reactions involve...Immune-complex reactions
**Type IV** reactions involve...

Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II? IgG and/or IgM

How does a Type III reaction proceed?
Antibodies bind to antigens circulating in the bloodstream. The resulting Ab-Ag complexes get deposited somewhere (often on the lining of a blood vessel).
Hypersensitivity Reactions of the Ocular Surface

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**Type I reactions involve...** Anaphylaxis
**Type II reactions involve...** Cytotoxic antibodies
**Type III reactions involve...** Immune-complex reactions
**Type IV reactions involve...**

Is the antibody involved in Type III IgE a la Type I, or IgG and IgM as in Type II? IgG and/or IgM

How does a Type III reaction proceed?
Antibodies bind to antigens circulating in the bloodstream. The resulting Ab-Ag complexes get deposited somewhere (often on the lining of a blood vessel). Once ensconced in tissue, the Ab-Ag complexes precipitate attacks on the tissue by PMNs.
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

Type I reactions involve...

Type II reactions involve...

Type III reactions involve...

Types II and III are easily confused with one another. Note the key differences:
-- In Type II, Ab attach to cell-bound Ag, whereas in Type III they attach to circulating Ag, and --
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

Type I reactions involve...
- Anaphylaxis

Type II reactions involve...
- Cytotoxic antibodies

Type III reactions involve...
- Immune-complex reactions

Type IV reactions involve...

Types II and III are easily confused with one another. Note the key differences:
-- In Type II, Ab attach to cell-bound Ag, whereas in Type III they attach to circulating Ag, and
-- In Type II, the damage is caused by complement, whereas in Type III it is caused by PMNs
### Hypersensitivity Reactions of the Ocular Surface

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Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve… [Three words again]
Hypersensitivity Reactions of the Ocular Surface

Anaphylaxis  Cytotoxic Ab  Immune-complex reactions  Cell-mediated reactions

**Type I**  **Type II**  **Type III**  **Type IV**

*Type I reactions involve...*Anaphylaxis
*Type II reactions involve...*Cytotoxic antibodies
*Type III reactions involve...*Immune-complex reactions
*Type IV reactions involve...*Cell-mediated reactions
## Hypersensitivity Reactions of the Ocular Surface

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'Seasoned scientists, do you know which sort of immune cell is doing the mediating in a **cell-mediated reaction**?'
Hypersensitivity Reactions of the Ocular Surface

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Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

‘Cell-mediated reaction’...Which sort of immune cell is doing the mediating?
T-helper cells
### Hypersensitivity Reactions of the Ocular Surface

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**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...** Cytotoxic antibodies

**Type III reactions involve...** Immune-complex reactions

**Type IV reactions involve...** Cell-mediated reactions

‘Cell-mediated reaction’…Which sort of immune cell is doing the mediating? T-helper cells

*In what way are T-helper cells mediating the reaction?*
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Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

‘Cell-mediated reaction’…Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated.
Hypersensitivity Reactions of the Ocular Surface

Type I reactions involve...Anaphylaxis
Type II reactions involve...Cytotoxic antibodies
Type III reactions involve...Immune-complex reactions
Type IV reactions involve...Cell-mediated reactions

‘Cell-mediated reaction’...Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

**Type I reactions involve...** Anaphylaxis

**Type II reactions involve...** Cytotoxic antibodies

**Type III reactions involve...** Immune-complex reactions

**Type IV reactions involve...** Cell-mediated reactions

‘Cell-mediated reaction’...Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

That’s a convoluted process. How long does it take to become clinically apparent?
Hypersensitivity Reactions of the Ocular Surface

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‘Cell-mediated reaction’…Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

That’s a convoluted process. How long does it take to become clinically apparent?
24-72 hours, which is why this reaction is often referred to as delayed hypersensitivity.
‘Cell-mediated reaction’…Which sort of immune cell is doing the mediating?
T-helper cells

In what way are T-helper cells mediating the reaction?
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

That’s a convoluted process. How long does it take to become clinically apparent?
24-72 hours, which is why this reaction is often referred to as delayed hypersensitivity.
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<tr>
<td><strong>Type IV</strong></td>
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**Type I reactions involve...** Anaphylaxis  
**Type II reactions involve...** Cytotoxic antibodies  
**Type III reactions involve...** Immune-complex reactions  
**Type IV reactions involve...** Delayed hypersensitivity

‘Cell-mediated reaction’...Which sort of immune cell is doing the mediating?  
T-helper cells

In what way are T-helper cells mediating the reaction?  
In Type IV reactions, T-helpers interact with antigens, thereby becoming activated. Once activated, the T-helpers release chemotactic factors that recruit and activate macrophages.

That’s a convoluted process. How long does it take to become clinically apparent?  
24-72 hours, which is why this reaction is often referred to as **delayed hypersensitivity**

**Note that if you remember Type IV as ‘delayed hypersensitivity’... the four forms can be remembered with the mnemonic ACID**

ACID:  
- **A** - Anaphylaxis  
- **C** - Cytotoxic Ab  
- **I** - Immune-complex reactions  
- **D** - Delayed hypersensitivity
### Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

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**Topical anesthetics**
- Neomycin
- Anaphylaxis
- IgE
- Histamine release

**Start here**

---

**Work down the list assigning each term to the form of hypersensitivity with which it is most closely associated**

- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis
### Hypersensitivity Reactions of the Ocular Surface

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#### Anaphylaxis
- Neomycin
- Anaphylaxis
- IgE
- Histamine release
- Cicatricial pemphigoid
- Mast-cell degranulation
- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis

**Next**
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

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Anaphylaxis
- IgE
- Histamine release
- Cicatricial pemphigoid
- Mast-cell degranulation
- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red exccematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
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Etc
Hypersensitivity Reactions of the Ocular Surface

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**IgE**
- Histamine release
- Cicatricial pemphigoid
- Mast-cell degranulation
- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis

Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

- Anaphylaxis
- Cytotoxic Ab
- Immune-complex reactions
- Cell-mediated reactions

Type I
- Topical anesthetics

Type II
- Neomycin

Type III
- IgE
  - Histamine release
  - Cicatricial pemphigoid
  - Mast-cell degranulation
  - Vasculitis
  - Atropine
  - Contact dermatitis
  - Chemosis
  - PK rejection
  - SLE
  - Red excematous periorbital skin
  - Peripheral ulcerative keratitis
  - Involves complement
  - Phlyctenulosis

Type IV
- Neomycin
### Hypersensitivity Reactions of the Ocular Surface

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**Histamine release**
- Cicatricial pemphigoid
- Mast-cell degranulation
  - Vasculitis
  - Atropine
- Contact dermatitis
- Chemosis
- PK rejection
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- Red excematous periorbital skin
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- **Anaphylaxis**
  - Topical anesthetics
  - Neomycin

- **Cytotoxic Ab**
  - Type II
  - Histamine release

- **Immune-complex reactions**
  - Type III
  - Cicatricial pemphigoid
    - Mast-cell degranulation
    - Vasculitis
    - Atropine
    - Contact dermatitis
    - Chemosis
    - PK rejection
    - SLE
    - Red excematous periorbital skin
    - Peripheral ulcerative keratitis
    - Involves complement
    - Phlyctenulosis

- **Cell-mediated reactions**
  - Type IV
  - Neomycin
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

Anaphylaxis
Type I
Topical anesthetics
Anaphylaxis
IgE
Histamine release

Cytotoxic Ab
Type II

Immune-complex reactions
Type III

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Peripheral ulcerative keratitis
Involves complement
Phlyctenulosis

(No question on this slide—advance to the next one)
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

- **Anaphylaxis**
- **Cytotoxic Ab**
- **Immune-complex reactions**
- **Cell-mediated reactions**

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Cicatricial pemphigoid *is now referred to by what name in the BCSC Cornea book?*

- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis
# Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

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Cicatricial pemphigoid *is now referred to by what name in the BCSC Cornea book?*

**Mucous membrane pemphigoid (MMP)**

- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red exccematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

OCP/MMP
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

For more on OCP/MMP, see slide-set K29
**Hypersensitivity Reactions of the Ocular Surface**

*Divvy 'em up*

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**Topical anesthetics**
- Neomycin

**Anaphylaxis**
- Topical anesthetics

**Type I**
- IgE
- Histamine release

**Cytotoxic Ab**
- IgE
- Histamine release

**Type II**
- Neomycin

**Immune-complex reactions**
- Anaphylaxis
- Cytotoxic Ab

**Type III**
- Cicatricial pemphigoid
- Mast-cell degranulation
  - Vasculitis
  - Atropine
  - Contact dermatitis
  - Chemosis
  - PK rejection
  - SLE
  - Red excematous periorbital skin
  - Peripheral ulcerative keratitis
  - Involves complement
  - Phlyctenulosis

**Type IV**
- Neomycin

Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up
### Hypersensitivity Reactions of the Ocular Surface:

#### Divvy 'em up:

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**Vasculitis**
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red exematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

**Anaphylaxis**  
Type I  
Topical anesthetics  
Anaphylaxis  
IgE  
Histamine release  
Cicatricial pemphigoid  
Mast-cell degranulation

**Cytotoxic Ab**  
Type II

**Immune-complex reactions**  
Type III

**Cell-mediated reactions**  
Type IV  
Neomycin

**Atropine**  
Contact dermatitis  
Chemosis  
PK rejection  
SLE  
Red exccematous periorbital skin  
Peripheral ulcerative keratitis  
Involves complement  
Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface
Divvy ‘em up

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Cell-mediated reactions

Type I
Topical anesthetics

Anaphylaxis
IgE
Histamine release

Type II
Cicatricial pemphigoid

Mast-cell degranulation

Type III
Vasculitis

Contact dermatitis
Chemosis
PK rejection
SLE

Type IV
Neomycin

Atropine

Red excematous periorbital skin
Peripheral ulcerative keratitis
Involves complement
Phlyctenulosis

(No question on this slide—advance to the next one)
Hypersensitivity Reactions of the Ocular Surface
Divvy ‘em up

Patient using 1% atropine eye drops showing periocular diffuse redness and swelling involving both the lids, skin erosions with focal crusting (black arrow), post inflammatory irregular hypopigmentation around lids, and madarosis of both lower lids, with erosion around lower eye lid. (b and c) Magnified picture of right and left eyes showing the typical signs of periocular dermatitis.
Hypersensitivity Reactions of the Ocular Surface

*Divvy ‘em up*

Type I
- Topical anesthetics
- Anaphylaxis
  - IgE
- Histamine release
- Mast-cell degranulation

Type II
- Cytotoxic Ab

Type III
- Immune-complex

Type IV
- Cell-mediated

Contact dermatitis
- Chemosis
- PK rejection
- SLE
- Red excematosus periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis

Neomycin

Atropine

Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

**Type I**
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**Type IV**
- Cell-mediated reactions
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  - Atropine
  - Contact dermatitis

**Chemosis**
- PK rejection
- SLE
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- Phlyctenulosis
Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Hypersensitivity Reactions of the Ocular Surface

*Divvy ‘em up*

Contact dermatitis
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

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  - Cicatricial pemphigoid
  - Chemosis
- Type IV
  - Cell-mediated reactions
  - Neomycin
  - Atropine
  - Contact dermatitis
  - PK rejection

**PK rejection** *(PK = Penetrating keratoplasty)*
- SLE
- Red excematous periorbital skin
- Peripheral ulcerative keratitis
- Involves complement
- Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

*Divvy 'em up*

**Type I**
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  - Atropine
  - Contact dermatitis
  - PK rejection

- SLE
  - Red excematous periorbital skin
  - Involves complement
  - Phlyctenulosis

(No question on this slide—advance)
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

**Type I**
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Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

**Immune-complex reactions**
- Anaphylaxis
- Cytotoxic Ab

**Cell-mediated reactions**
- Atropine
- Contact dermatitis

**Which layer of the graft is involved in PK rejection?**

PK rejection

Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

Type I
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Which layer of the graft is involved in PK rejection?
The endothelium

PK rejection

Phlyctenulosis
**Hypersensitivity Reactions of the Ocular Surface**

**Divvy ‘em up**

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- Anaphylaxis
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- Chemosis
- PK rejection

**Type III**
- Immune-complex reactions
- Atropine
- Contact dermatitis
- Phlyctenulosis

**Type IV**
- Cell-mediated reactions
- Neomycin

---

**Which layer of the graft is involved in PK rejection?**
- The endothelium

**What is the classic exam finding in endothelial rejection?**
- Khodadoust line
Hypersensitivity Reactions of the Ocular Surface

*Divvy ‘em up*

**Type I**
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- Cell-mediated reactions
- Atropine
- Contact dermatitis

Which layer of the graft is involved in PK rejection?
The endothelium

What is the classic exam finding in endothelial rejection?
A line of inflammatory precipitates on the endothelial surface
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

Type I
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Which layer of the graft is involved in PK rejection?
The endothelium

What is the classic exam finding in endothelial rejection?
A line of inflammatory precipitates on the endothelial surface

What is the eponymous name for this finding?
Khodadoust line
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

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**Type IV**
- Neomycin
- Atropine
- Contact dermatitis
- Vasculitis

**Which layer of the graft is involved in PK rejection?**
The endothelium

**What is the classic exam finding in endothelial rejection?**
A line of inflammatory precipitates on the endothelial surface

**What is the eponymous name for this finding?**
A Khodadoust line

PK rejection
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

Khodadoust line
Hypersensitivity Reactions of the Ocular Surface
Divvy ‘em up

- Anaphylaxis
  - Type I
    - Topical anesthetics
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    - IgE
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  - Type II
- Immune-complex reactions
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  - Atropine
  - Contact dermatitis
  - PK rejection

- Vasculitis
- SLE
  - Red excematous periorbital skin
  - Peripheral ulcerative keratitis
  - Involves complement
  - Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

- **Anaphylaxis**
  - Type I
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  - Type III
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    - Cicatricial pemphigoid
    - Mast-cell degranulation
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    - Neomycin
    - Atropine
    - Contact dermatitis
    - PK rejection

- **Red excematous periorbital skin**
  - Peripheral ulcerative keratitis
  - Involves complement
  - Phlyctenulosis
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

**Anaphylaxis**  
- Type I: Topical anesthetics  
  - Anaphylaxis
  - IgE
  - Histamine release
  - Mast-cell degranulation
  - Chemosis
  - Cicatricial pemphigoid

**Cytotoxic Ab**  
- Type II: Involves complement
  - Peripheral ulcerative keratitis (PUK)
  - Phlyctenulosis

**Immune-complex reactions**  
- Type III: Neomycin
  - Neomycin
  - SLE

**Cell-mediated reactions**  
- Type IV: Atropine
  - Contact dermatitis
  - PK rejection
  - Red excematous periorbital skin
Hypersensitivity Reactions of the Ocular Surface
Divvy ‘em up

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- **Type IV**
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  - Neomycin
  - Atropine
  - PK rejection
  - Contact dermatitis

  **(No question here—¡Vamos!)**

  - SLE
  - PUK

  Involves complement
  Phlyctenulosis

Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there? Divvy ‘em up

- Immune-complex reactions
- Cell-mediated reactions
- Type IV
- Atropine
- Contact dermatitis
- PK rejection
- Red excematous periorbital skin
- SLE
- PUK

Involves complement
Phlyctenulosis
**Hypersensitivity Reactions of the Ocular Surface**

*Divvy 'em up*

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**Firstly:** How many Hypersensitivity Reactions of the Ocular Surface are there?

Divvy 'em up

- Anaphylaxis
- Cytotoxic Ab
- Immune-complex reactions
- Cell-mediated reactions

**Anaphylaxis**
- Topical anesthetics
- Neomycin

**Cytotoxic Ab**
- IgE
- Histamine release

**Immune-complex reactions**
- Mast-cell degranulation
- Contact dermatitis
- Chemosis

**Cell-mediated reactions**
- PK rejection
- Vasculitis
- Atropine

**What classes of systemic conditions are associated with PUK?**

- Connective-tissue diseases (CTDs) and vasculitides
- With which CTDs and/or vasculitides has PUK been associated?
  - Pretty much all of them
- Which three conditions are most likely to present with PUK?
  - Rheumatoid arthritis, Wegener's granulomatosis, and polyarteritis nodosa
- Of these three, which is most likely to be associated with PUK?
  - RA, by a substantial margin
# Hypersensitivity Reactions of the Ocular Surface

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Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there? **Divvy ‘em up**

**What classes of systemic conditions are associated with PUK?**

*Connective-tissue diseases (CTDs) and vasculitides*

*What are some of the non-ocular conditions associated with PUK?*

*Almost all systemic conditions can be associated with PUK.*

*Which three conditions are most likely to present with PUK?*

*Rheumatoid arthritis, Wegener’s granulomatosis, and polyarteritis nodosa.*

*Of these three, which is most likely to be associated with PUK?* **RA, by a substantial margin**

*What is Phlyctenulosis?*

*A noninfectious inflammatory condition of the peripheral skin.*
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

PUK 2ndry to CTD/vasculitis
**Hypersensitivity Reactions of the Ocular Surface**

*Divvy 'em up*

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**What classes of systemic conditions are associated with PUK?**

Connective-tissue diseases (CTDs) and vasculitides

**With which CTDs and/or vasculitides has PUK been associated?**

Pretty much all of them

Rheumatoid arthritis, Wegener's granulomatosis, and polyarteritis nodosa

Of these three, which is most likely to be associated with PUK?

RA, by a substantial margin
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

- Anaphylaxis
- Cytotoxic Ab
- Immune-complex reactions
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Type IV
- Atropine
- PK rejection
- Transient红 excematous periorbital skin

What classes of systemic conditions are associated with PUK?
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Which three conditions are most likely to present with PUK?
Rheumatoid arthritis, Wegener's granulomatosis, and polyarteritis nodosa

Of these three, which is most likely to be associated with PUK?
RA, by a substantial margin
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

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Cell-mediated reactions
Contact dermatitis
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PK rejection
Transient red excematous periorbital skin

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*What classes of systemic conditions are associated with PUK?*
Connective-tissue diseases (CTDs) and vasculitides

*With which CTDs and/or vasculitides has PUK been associated?*
Pretty much all of them

*Which three conditions are most likely to present with PUK?*
Rheumatoid arthritis, Wegener’s granulomatosis, and polyarteritis nodosa
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What classes of systemic conditions are associated with PUK?
Connective-tissue diseases (CTDs) and vasculitides

With which CTDs and/or vasculitides has PUK been associated?
Pretty much all of them

Which three conditions are most likely to present with PUK?
Rheumatoid arthritis, Wegener’s granulomatosis, and polyarteritis nodosa

Of these three, which is most likely to be associated with PUK?
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

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**Which three conditions are most likely to present with PUK?**
Rheumatoid arthritis, Wegener’s granulomatosis, and polyarteritis nodosa

**Of these three, which is most likely to be associated with PUK?**
RA, by a substantial margin
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

- **Type I**
  - Anaphylaxis
  - Topical anesthetics
  - Neomycin
  - Chemosis
  - SLE
  - PUK

- **Type II**
  - Cytotoxic Ab
  - IgE
  - Histamine release
  - Mast-cell degranulation

- **Type III**
  - Immune-complex reactions
  - Cicatricial pemphigoid
  - Vasculitis

- **Type IV**
  - Cell-mediated reactions
  - Neomycin
  - Atropine
  - Contact dermatitis
  - PK rejection

Involves complement

Phlyctenulosis

Next
Hypersensitivity Reactions of the Ocular Surface

Divvy 'em up

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- Anaphylaxis
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**Type III**
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  - Vasculitis
  - Atropine
  - Contact dermatitis
  - PK rejection
  - SLE
  - PUK
  - Red exematous periorbital skin
  - PUK

**Type IV**
- Phlyctenulosis
  - Involves complement
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

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- **Cytotoxic**
  - Cytotoxic
  - Chemosis

- **Immune-complex reactions**
  - Type IV
  - PK rejection
  - Contact dermatitis
  - Red excematous periorbital skin

- **Cell-mediated reactions**
  - Type I
  - Type II
  - Phlyctenulosis

---

**What is phlyctenulosis?**

Phlyctenulosis is an inflammatory condition characterized by the presence of phlyctenules.

**Phlyctenules**

- Nodules composed of chronic inflammatory cells
- Look like small nodules, gray or yellow in color, associated with exuberantly hyperemic vessels
- Located on the conjunctiva, at the limbus, or on the cornea
- Inciting antigen: In developed nations, usually *S. aureus*; however, in developing nations it is often *TB* (especially for cases involving malnourished children).
Hypersensitivity Reactions of the Ocular Surface

**Divvy ‘em up**

- **Type I**
  - Anaphylaxis
  - Topical anesthetics

- **Type II**
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  - IgE

- **Type III**
  - Immune-complex reactions
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**Phlyctenulosis**

*What is phlyctenulosis?*

An inflammatory condition characterized by the presence of phlyctenules

- **Anaphylaxis**
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  - TB (especially for cases involving malnourished children)

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- **Chemosis**

- **Atropine**

- **Cicatricial pemphigoid**

- **Histamine release**

- **Vasculitis**

- **Mast-cell degranulation**

---

Firstly: How many Hypersensitivity Reactions of the Ocular Surface are there?

*Divvy ’em up*

**Anaphylaxis**

**Cytotoxic Ab**

**Immune-complex reactions**

**Cell-mediated reactions**

**Type I**

**Topical anesthetics**

**Type II**

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**Type IV**

**Neomycin**

**PK rejection**

**Red excematous periorbital skin**

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**What is phlyctenulosis?**
An inflammatory condition characterized by the presence of phlyctenules.

**OK, what are phlyctenules?**

- Nodules composed of chronic inflammatory cells
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*What is phlyctenulosis?*
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## Hypersensitivity Reactions of the Ocular Surface

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### Cell-mediated reactions

- Neomycin

### Type IV

- Atropine
- Contact dermatitis
- PK rejection
- Red excematous periorbital skin

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**Phlyctenulosis**

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Hypersensitivity Reactions of the Ocular Surface

*Divvy ’em up*

Phlyctenules
**Hypersensitivity Reactions of the Ocular Surface**

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  - Neomycin

- **Cytotoxic Ab**
  - Histamine release
  - Mast-cell degranulation
  - Vasculitis

- **Immune-complex reactions**
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- **Cell-mediated reactions**
  - Chemosis
  - PK rejection
  - Contact dermatitis
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**Where are phlyctenules located?**
They can be on the conj, at the limbus or on the cornea
Hypersensitivity Reactions of the Ocular Surface

*Divvy 'em up*

**Phlyctenule**

**Same phlyctenule (pic to show elevation)**

Corneal phlyctenule
Hypersensitivity Reactions of the Ocular Surface

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Anaphylaxis

Cell-mediated reactions

Anaphylaxis

Cytotoxic Ab

Immune-complex reactions

Type I

Topical anesthetics

Type II

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Type III

Histaminergic

Mast-cell degranulation

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What is the inciting antigen?
Hypersensitivity Reactions of the Ocular Surface

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Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

Type I: Anaphylaxis
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- Mast-cell degranulation
- Vasculitis
- Atropine
- Contact dermatitis
- Chemosis
- PK rejection
- Transient
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Type II: Cytotoxic Ab
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Type III: Immune-complex reactions

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**Anaphylaxis**

- **IgE**
- **Histamine release**
- **Type I**
- **Topical anesthetics**

**Cytotoxic Ab**

- **Contact dermatitis**
- **Chemosis**
- **Type II**
- **Phlyctenulosis**

**Immune-complex reactions**

- **Cicatricial pemphigoid**
- **Histamine release**
- **Mast-cell degranulation**
- **Type III**

**Cell-mediated reactions**

- **Anaphylaxis**
- **Atropine**
- **PK rejection**
- **Type IV**

- **Red excematous periorbital skin**

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**Phlyctenulosis**

*What is phlyctenulosis?*
An inflammatory condition characterized by the presence of phlyctenules

*OK, what are phlyctenules?*
Nodules composed of chronic inflammatory cells

*What do phlyctenules look like?*
They are small nodules, gray or yellow in color, that are associated with exuberantly hyperemic vessels

*Where are phlyctenules located?*
They can be on the conj, at the limbus or on the cornea

*What is the inciting antigen?*
In developed nations, usually *S. aureus*; however, in developing nations it is often TB (especially in cases involving *classic at-risk pop. (two words)*).
Hypersensitivity Reactions of the Ocular Surface

Divvy ‘em up

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaphylaxis</td>
<td>Cytotoxic Ab</td>
<td>Immune-complex reactions</td>
<td>Cell-mediated reactions</td>
</tr>
<tr>
<td>Topical anesthetics</td>
<td></td>
<td></td>
<td>Neomycin</td>
</tr>
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