

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Diffuse Lamellar
Keratitis
(DLK)
Diagnosis, treatment
& Prevention**

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**Refractive
Surgery
Didactic
Course**



Additional Terms Describing DLK

- Sands of Sahara (SOS) Syndrome
- **Shifting Sands**
- **Sterile Interface Keratitis**
- **Lamellar keratitis**
- **Diffuse Interlamellar Keratitis (DIK)**
- **Non specific Diffuse Interlamellar Keratitis (NSDIK)**
- **Post-LASIK Interface Keratitis & inflammation (PLIK)**



Etiology

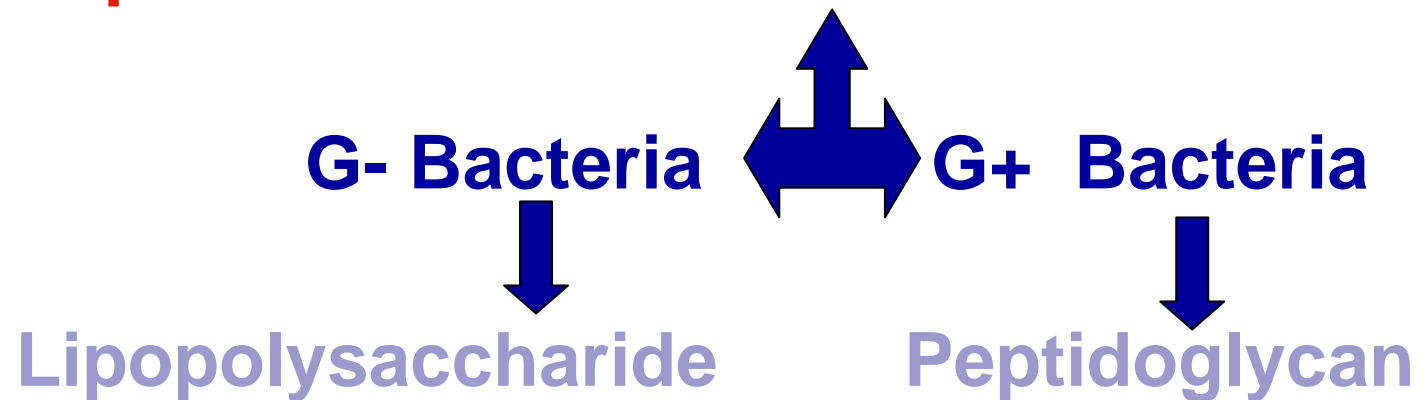
- Multifactorial
- Contaminants introduced under the flap
↓
Induction of immunologic response

No single agent responsible for all cases of DLK

Exogenous Etiologies

- Contaminants from instruments or sterilizers

Bacterial proliferation → **killed bacteria**



- Non-steroidal anti-inflammatory drops
- Lubricants or rust from microkeratome
- Particulate matter from the drapes, gown, or gloves





Exogenous Etiologies

- **Balanced salt solution (BSS)**
- Benzalkonium chloride
- **Povidone- iodine**
- **Excimer laser energy**



cell disruption ➔ **cell particles release**

Endogenous (Host) Factors

- Atopic disease (atopic dermatitis, eczema) -



- Chronic sinusitis, Allergic rhinitis, Reactive Airway disease (Immune system disease) -
- Overlying Epithelial Defects
- Prior tight soft contact syndrome
- Transected corneal epithelial cells

Endogenous Factors

- Meibomian gland secretions
- **Bacterial components from eyelid margin**

- **Additional tear film
Debris**

- **Red blood cells in interface**



Pathophysiology

Etiologic factor (endo- or exogenous)



Antigenic stimulus at interface



Activation of immune reaction



Recruitment of PMN's to stromal interface



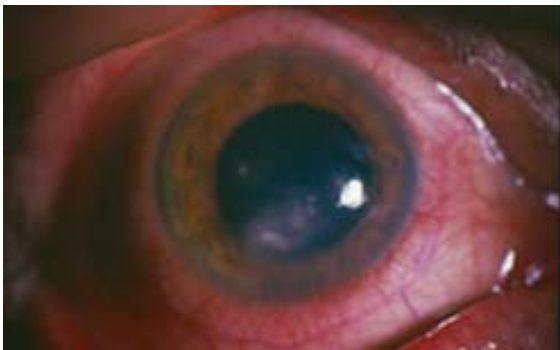
DLK



Differential Diagnosis

Microbial keratitis

- **Associated pain, photophobia**
- **Conj. inflammation, Ciliary Flush**
- **Purulent discharge**
- **Focal infiltration, stromal extension**



F.K





Differential Diagnosis ... cont

Particles deposition at interface:

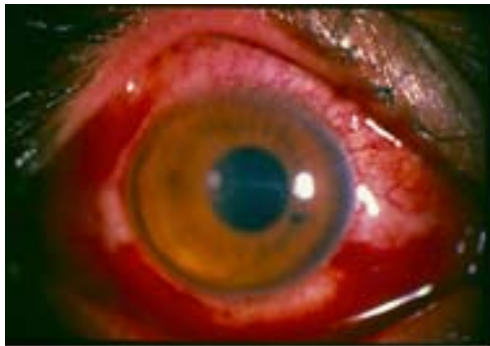
- Epithelial cells, RBC**
- Secretions,**
- Debris from sponges, Talc**
- lubricant, rust**

Diagnosis of DLK

- Location: - Sectorial or diffuse, **NOT** a single focus
- Confined to the interface
 - Fine, rippled, powdery appearance

Symptoms:

- Similar to any form of keratitis
- Early stage: asymptomatic, good vision
- Later: - Redness, pain, irritation, photophobia, decreased vision
- **Absent** eyelid and periorbital edema and erythema





Diagnosis... cont.

Signs:

First postop day: **barely perceptible peripheral interface haze**

3 to 4th day:

- **Faint white to tan colored powdery substance**
- **Mixed granular and rippled appearance**
- **Pattern of cells:**
 - **Circular resembling laser ablation profile**
 - **Linear: chatter marks of microkeratome**



Signs ... cont

Improving Condition:

- **Gradual resolution of haziness**
- **Fading within 1-2 wks**

Worsening condition:

- **Central aggregation of cells**
- **Stromal melting**
- **Fluid accumulation at interface**
- **Stromal loss, Scarring**



Grading / Staging of DLK

Machat Classification

**Grade 1: (Mildest) Vision and Refraction
unaffected, asymptomatic
- Interface haze: trace PRK haze**

**Grade 2: (Moderate): BCVA reduced 1-2 lines,
Central moderate PRK haze**

**Grade 3: (Severe) : BCVA reduced several lines,
Induced Hyperopia and irregular
astigmatism,
dense central infiltrate similar to grade 4 PRK haze**





Grading ... Cont

Hatsis Classification

**Grade I and II: -Appear on day 1 up to 3, fine,
diffuse interface, asymptomatic**

**Grade III and IV:- More severe form of
infiltrate, dense, loss of vision
- Symptoms: photophobia,
ocular discomfort**

Linebarger- Hardten- Lindstrom Classification

Stage I

Clinical findings:

- Fine, white cell distributed in a wave- like fashion at the periphery of the flap**
- No decrease in BCVA**

Present on day 1

Frequency: one in 25-50 cases



Linebarger- Hardten- Lindstrom Classification ... cont

Stage II

Clinical findings:

- **Granular or wave- like appearance of the cells in the visual axis \pm periphery**
- **No decrease in BCVA**

Present on day 1 or as progression of stage 1 on days 2 or 3

Photophobia, ocular irritation



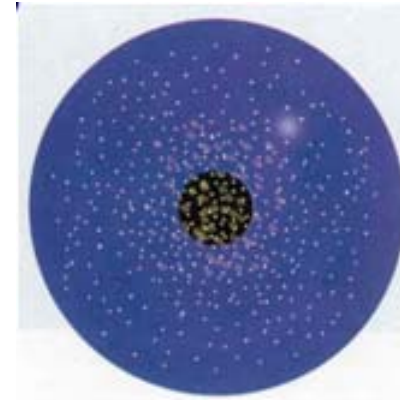
Linebarger- Hardten- Lindstrom Classification ... cont

Stage III

Aggregation of white, clumped cells in the flap center, clearing in the periphery

**Decreased 1-2 lines of BCVA,
subjective haze**

Frequency: one in 500 cases



Linebarger- Hardten- Lindstrom Classification ... cont

Stage IV

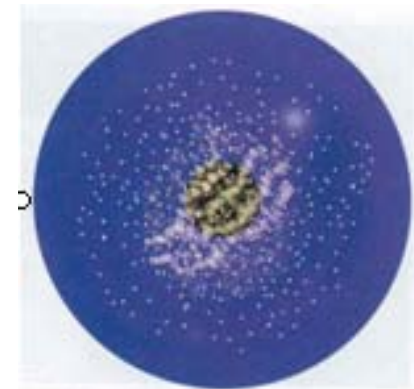
Most severe form, scarring and folds in visual axis, fluid collection in central lamella

Bullae formation, stromal melt

More significant decrease in BCVA

Hyperopia, irregular astigmatism

Incidence: one in 5000 cases





Azar Classification for DLK

Type I: peripheral:

- often associated with epithelial defects**
- Rapid functional recovery**

Type II: Central involvement:

possible loss of 1 or 2 lines of BCVA

A- Sporadic

**B- Cluster (diagnosed in other patients
operated on the same day)**



Classification ... Cont

- **Variable time of onset, severity at presentation, location and progression of DLK**
- **Many of mild cases resolve over a week without any sequel**
- **No predictive factor exists**
- **Close follow- up is essential**
- **Staging is helpful in regimen of treatment**



Laboratory Findings

Diagnosis of DLK: based on history and clinical presentation

Gram stain and culture only indicated in suspicious cases of microbial keratitis

Confocal microscopy

Focal pockets of debris with associated clusters of inflammatory cells

Cells are polymorphonuclear leukocytes



Treatment of DLK

Mild cases: Topical Corticosteroids

Stages I and II DLK:

- **Prednisolone Acet. or phosphate 1%,
Betamethasone 0.1%**
- **Frequency: every one hour**
- **Duration: 24- 48 hours**
- **Follow up, Daily, if improved tapering**

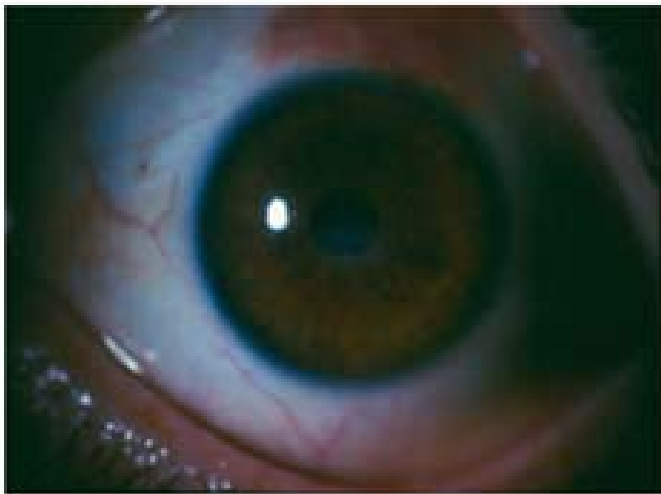
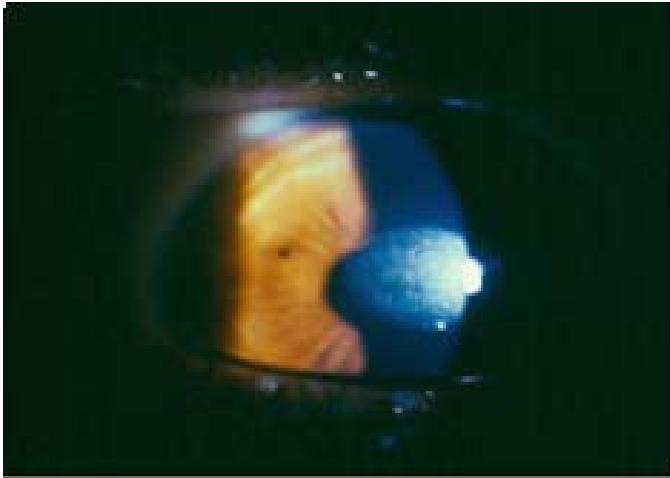
**Stage \geq II: Oral Prednisolone 60-80 mg P.O /day
(30 mg female/ 40 mg male bid)**





Stage III

- **Manual lifting the flap and thorough irrigation with BSS**
- **Irrigation dilutes the inciting agent, chemical mediators**
- **Vigorous debridement results in extensive stromal volume loss**
- **Hyperopic shift and scarring slowly improve over 3 to 6 mo**
- **Return to preoperative BCVA over next 6 to 12 mo**
- **Wait at least 12 mo for further intervention**



F.K





Prevention of DLK

Instrumentation

- **Clean and scrub instruments with mild detergent and rinse- soak in distilled water**
- **Flush cannulated instruments with distilled water followed by forced air from a syringe**
- **Sterilize instruments according to manufacturer recommendations**

Prevention of DLK ... cont (1)

Mikrokeratome

- Swab motor hand piece with ethanol
- Advance and reverse motor tip while dipped in ethanol or acetone to avoid debris
- **Avoid blade reuse**

Sterilizer

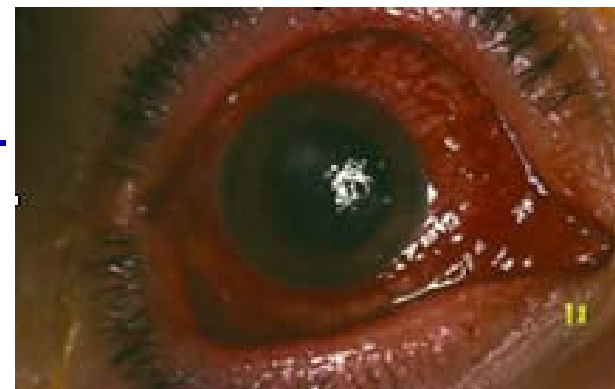
- Evacuate sterilizer water reservoir and dry thoroughly one to two times per week
- Use pyrogen-free sterile water for the sterilizer



Prevention ... cont (2)

Host factors

- **Treat Blepharitis preoperatively**
- **Treat atopic patients, and patients with a prior history of DLK with Antihistamine**
- **+/- prednisolone PO starting 1 day prior to surgery**



Prevention ... cont (3)

Intraoperative precautions

- **Clean Betadine over lids after prep and draping**
- **Prevent fluid reflux from cul-de-sacs into interface:**
 - **aspirating lid speculum**
 - **drying with sponge**
- **Complete a thorough washout of the interface if any debris noted**
- **Avoid epithelial defects by using viscous ocular lubricants, decreased Tetracaine use**





***Thank you for your
Kind Attention !!***