SUPPURATIVE KERATITIS

A guide to the management of microbial keratitis

Edith Ackuaku

Maria Hagan

Mercy J. Newman

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Authors:

Dr. Edith Ackuaku, MB ChB, DO, MRCOphth, FWACS
Senior Lecturer, Eye Unit, Department of Surgery
University of Ghana Medical School, Korle Bu Teaching Hospital

Dr. Maria Hagan, MB ChB, DOMS, DCEH, MRCOphth
Head, Eye Care Unit, Ghana Health Service
Former Head, Eye Unit, Korle Bu Teaching Hospital

Professor Mercy Newman, MB ChB, MSc, FWACP
Professor and Head, Department of Microbiology
University of Ghana Medical School, Korle Bu Teaching Hospital

TABLE OF CONTENTS

	Page
1. Acknowledgment	3
2. Foreword	4
3. Introduction	5
4. Aetiology	6
5. Epidemiology	7
6. Predisposing Factors	8
7. History Taking	9
8. Clinical Presentation	10
9. Examination	14
10. Microbiology Investigation	21
11. Treatment Guideline	24
12. Appendices	
Flow chart – Treatment Guidelines	26
Sample treatment Form	28
Preparation of fortified antibiotics	29
13. References	30

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The following Ophthalmologists actively participated in the study:

Dr. Vera Essuman	Korle Bu Teaching Hospital, Accra
Dr. Oscar Debrah	Bawku Presbyterian Hospital Eye Clinic
Dr. Ababio Danso	Agogo Presbyterian Hospital Eye Clinic

The study was initiated by Professor Gordon Johnson, and coordinated by Dr. Astrid Leck, both from ICEH, London.

Treatment flow-chart was designed by Mr. George Anthony Kofi Bentum Hagan

Correspondence address

Dr. Maria Hagan
EYE CARE UNIT
GHANA HEALTH SERVICE
PRIVATE MAILBAG, MINISTRIES,
ACCRA

E-mail
hagan_maria@yahoo.co.uk

Fax:
233-21-666850

FOREWORD

Suppurative Keratitis is an important cause of avoidable blindness in Ghana. The blindness results from corneal scarring. Corneal scarring may also represent the long term sequelae of trachoma or follow infections of eye injuries.

An earlier study in Ghana on the causes of suppurative keratitis showed that one or more organisms were cultured from 114 out of 199 patient. Fungi alone or in combination were isolated in 56% of patients who had positive cultures. While 122 out of 199 had their treatment either determined or altered on the results of microbiological diagnosis, only 87 out of these had their treatment solely on the basis of direct microscopic examination.

In Bangladesh a study by Williams and associates demonstrated that a simple miocrobiological laboratory made a substantial difference to accuracy of management of corneal suppuration. Of fifty-eight cases that were culture positive the results of forty-seven could have been anticipated on the basis of Gram stain alone.

The Ghana study showed that both training in technique and experience in interpretation are necessary for microscopy based diagnosis by staff in the eye clinic to be of greatest value.

This manual based on the results of a Multi-centre Corneal Ulcer Project in Accra and India and coordinated from the International Centre for Eye Health (ICEH), London, is to guide ophthalmologists in the management of suppurative keratitis. Early, accurate and effective management of this condition should help prevent blindness from suppurative keratitis.

The manual is arranged under the following headings:
1. Introduction
2. Aetiology
3. Epidemiology
4. Predisposing Factors
5. History Taking
6. Clinical Presentation
7. Microbiology Investigation
8. Treatment Guidelines

It is hoped that clinicians and medical technologists/technnicians will find the manual useful.

SIGNED

Professor Agyeman Badu Akosa
Director General,
Ghana Health Service.

INTRODUCTION

Suppurative keratitis (infective corneal ulcer) is an important cause of preventable blindness especially in the developing world. Often it follows corneal trauma caused by airborne particles entering the eye and causing damage to the surface of the eye (the Cornea). These foreign bodies may be, vegetable matter such as rice husk, soil, sand, or metallic.

These foreign bodies not only damage the corneal surface, but they also introduce infection. When left untreated or if inadequately treated, these ulcers progress and eventually lead to blindness. Prompt and adequate treatment may save the eye and salvage vision.

Suppurative corneal ulcers may be caused by bacteria, fungi, or protozoa. For effective treatment it is crucial to identify promptly the causative organisms. Management is usually by intensive use of topical antimicrobials.

AETIOLOGY

From studies done in Ghana, the common causes of corneal ulcers include:

1. **Bacteria (10.7%)** mainly:

Pseudomonas species
Streptoccoccus species
Staphyloccoccus aureus/epidermidis

2. **Fungus (35.7%)** commonly:

Fusarium species
Aspergillus species

3. **Mixed infections (both bacteria and fungi) = (1.7%)**

4. **Unknown (51.7%)**

Note: protozoa (e.g acanthoamoeba) and non-filamentous fungi
(e.g Candida) may also cause corneal ulcer but are rare. In a recent study in Ghana one acanthoamoeba was isolated.

EPIDEMIOLOGY

From studies done in Ghana

AGE

All age groups are affected, but average age is 35 years

SEX

Male : Female ratio is 1.4:1

SEASONALITY

There are seasonal differences in geographical regions in Ghana, with peak infection coinciding with the harvesting season: June/July in the southern belt and November / December in the northern belt.

PREDISPOSING FACTORS

The normal cornea is protected from infection by its surface epithelium. Most organisms cannot penetrate the intact corneal epithelium. The following may predispose to suppurative corneal ulcers.

Trauma:

-e.g. from twigs, thorns, husk or seeds, finger pricks from a baby, broomsticks (in children during play).

Abnormalities of eyelid:

-e.g. trichiasis, lagophthalmos

Malnutrition and Vitamin A deficiency and measles:

- Usually in children.

Harmful eye Practices

-e.g. use of herbal preparations or steroid eye drops for treatment of eye infections

HISTORY TAKING

The history may suggest the causative organism in some patients but is not always useful.

A history of injury on the farm or during gardening may suggest a fungal infection.

Fungal infections are the commonest cause of corneal ulcers and would usually follow a slow chronic course.

Bacterial infections are more acute and progress faster. Gram negative bacteria would usually progress very rapidly to involve the whole cornea in a few days.

Record the severity of pain, photophobia and watering, as changes in these parameters will help you determine the progress of the ulcer.

CLINICAL PRESENTATION

Common symptoms

- Sudden onset of pain
- Foreign body sensation
- Watering of eyes
- Photophobia
- Reduced vision
- Red eye

Signs

Important signs include:

- Visual Acuity Reduced
- Swollen Eye lids
- Conjunctival injection (mainly circumcorneal)
- Corneal defect (the ulcer crater) with slough
- Corneal infiltrates surrounding the ulcer

Other signs in severe cases include:

- Corneal endothelial plaque
- Corneal abscess
- Keratic precipitates
- Hypopyon
- Anterior chamber cells, flare, fibrin

Some patients may present with any of the following **Complications**

- Descemetocoele
- Corneal perforation
- Corneal melting
- Endophthalmitis/Panophthalmitis
- Corneal scarring
- Staphyloma

CLINICAL FEATURES

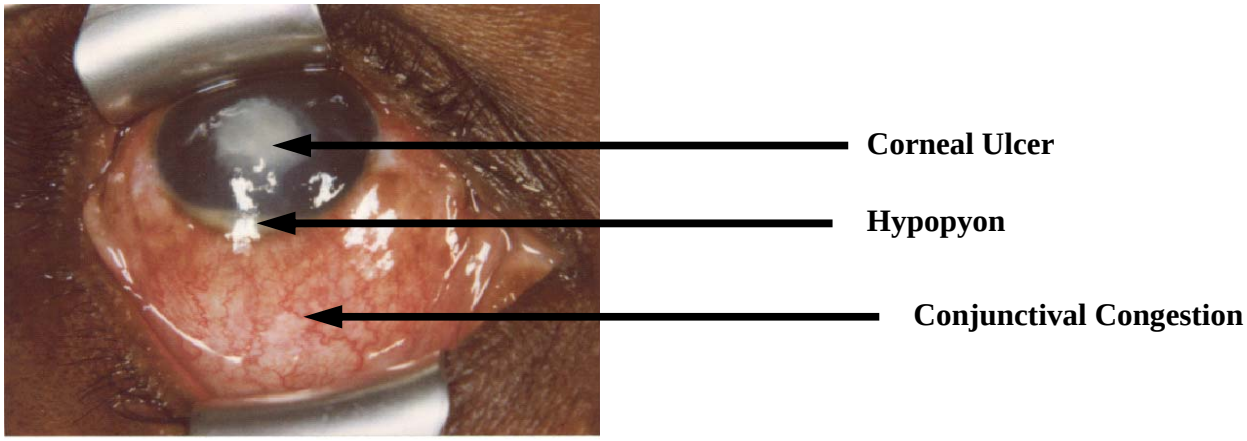


Fig. 1: Picture shows an eye with a severe corneal ulcer.

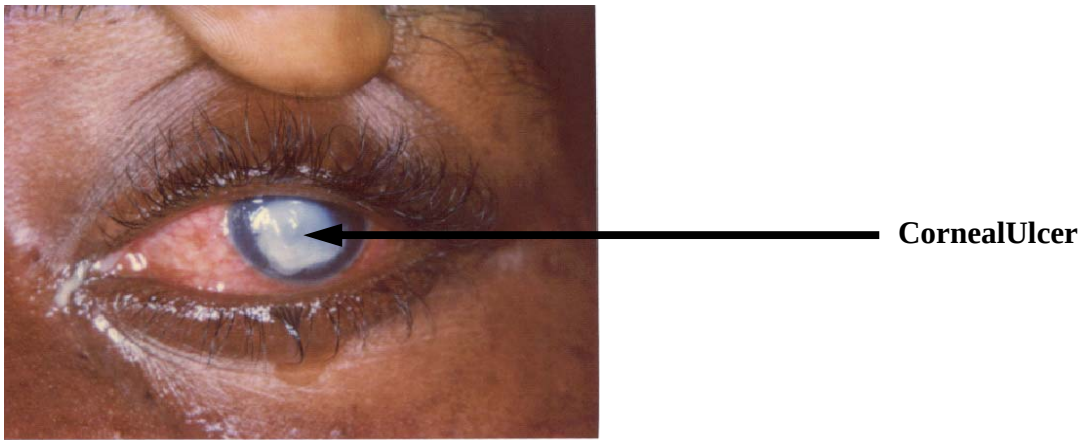


Fig. 2: Picture shows another eye with severe corneal ulcer.
Patient had presented Late because he was on some treatment
which did not improve the condition.

COMPLICATIONS

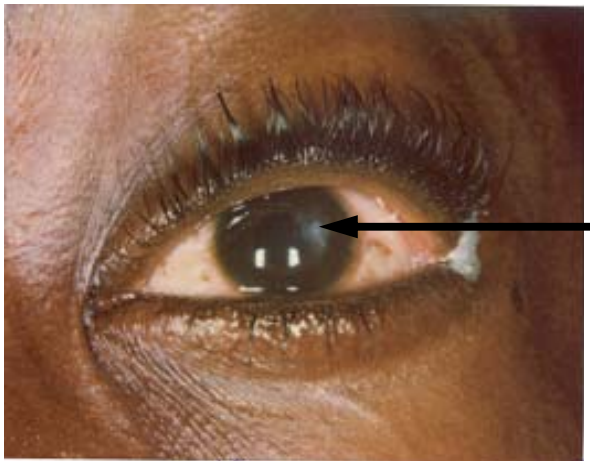


Fig. 3: Following appropriate treatment corneal ulcer has healed leaving a feint scar. Patient presented early and eyesight has been saved

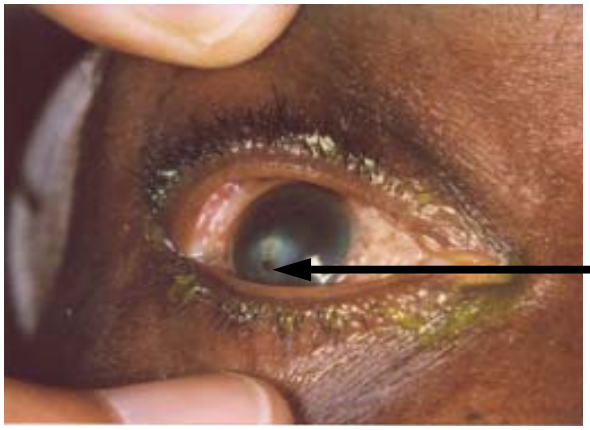


Fig. 4: This picture shows an eye that had a severe corneal ulcer. The cornea perforated and iris prolapsed through the perforation. Ulcer is healed. There is a corneal scar with a tag of iris seen as brown spot in the corneal scar

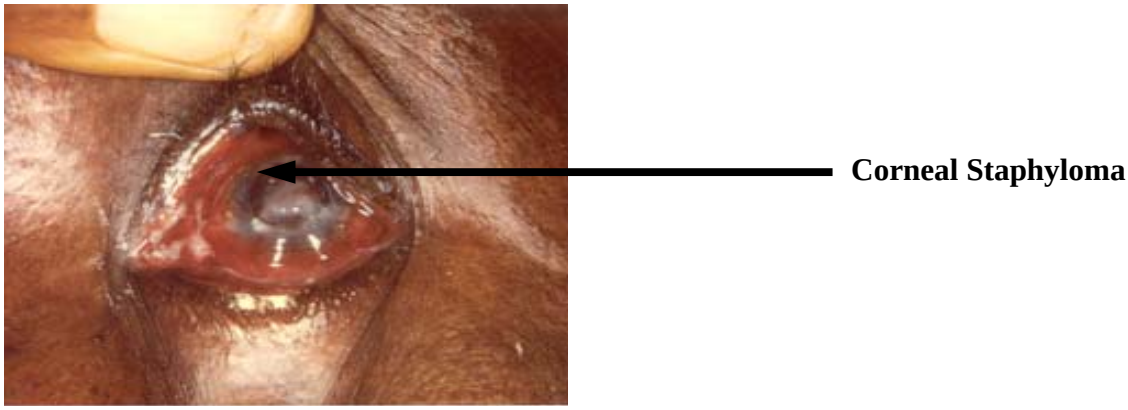


Fig. 5: This picture shows an eye with a severe corneal ulcer. The entire cornea has thinned and iris is bulging out – 'staphyloma'. The vision in this eye cannot be restored. The eye is blind.

EXAMINATION

The following examination scheme is suggested:

- Record the visual acuity in both eyes
- Measure the ulcer size in the greatest and smallest diameters
- Measure the surrounding infiltrate in the greatest and smallest diameters
- Determine the infiltrate depth and record (0-30%, >30- 60%, >60-100%)
- Note the presence or absence of hypopyon and measure the hypopyon height if any
- Note any anterior chamber cells and record as 0, 1, 2, 3 or 4
- Note any anterior chamber flare and record as : 1+, 2+, 3+ 4+
- Daily assessment of these parameters will help you determine the progress of the ulcer.
- Draw a diagram of the ulcer in the patient's case notes showing both the front view and the cross sectional view (see pages 17 & 18 for guide)
- Examine patient daily to determine healing progress.

GRADING OF ANTERIOR CHAMBER CELLS AND FLARE	
With maximum light intensity and magnification and slit-lamp beam 3 mm long and 1 mm wide	
Grading of cells:	**Grading of Flare:**
5 - 10 cells = 1	Faint – just detectable = +1
11 - 20 cells = 2	Moderate – iris details clear = +2
21 - 50 cells = 3	Marked – iris details hazy = +3
>50 cells = 4	Intense with severe fibrinous exudate = +4

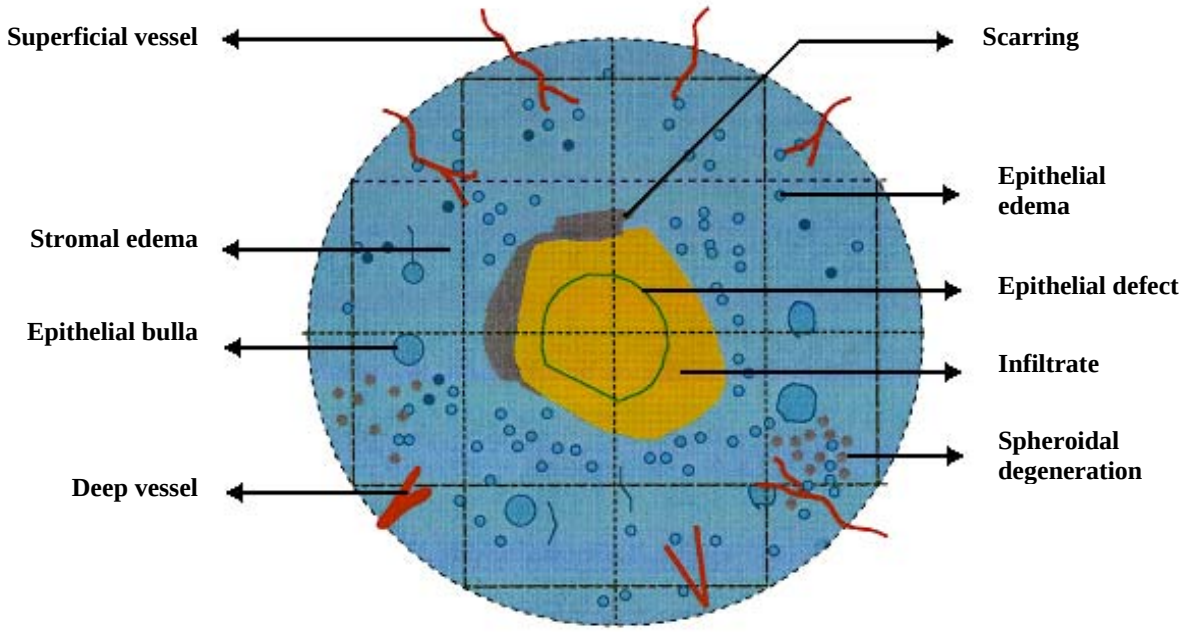
Examination of the eye

Patient presents at eye clinic with suppurative keratitis
Patient's history is taken by ophthalmologist and a clinical examination is performed

Laboratory personnel (or laboratory-trained ophthalmic nurse / technician) are requested to bring slides and media to outpatient clinic.

- Do not stain the cornea with fluorescein until the ulcer has been scraped
- Prior to scrape only apply anaesthetic drops which do not contain preservative (Recommend Amethocaine hydrochloride 0.5% minims)

Frontal View



Colour code used in corneal drawing

All outlines, e.g. corneal outlines in frontal and slit view, eye lids, lens and suture

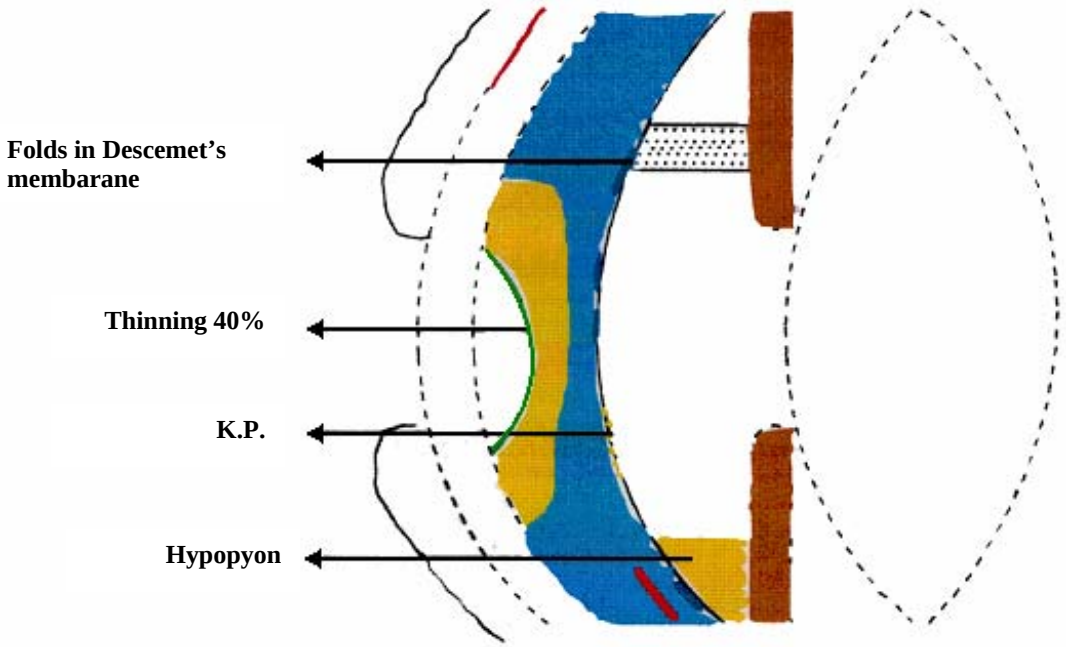
Scar, degeneration, corneal guttata, corneal nerves

Edema

Descemet's folds
Epithelial edema

Pigment, iris, pupil, peripheral, iridectomy or iridotomy

Slit View



Colour code used in corneal drawing

Blood, Rose, Bengal

Blood vessels (superficial and deep)

Ghosts vessels

Flourescein, Vitreous, corneal filaments, epithelial defects

Infiltrated, contactlens deposits, keratic precipitates, hypopyon, cataract

MICROBIOLOGY INVESTIGATION

To determine the causative organism, the ulcer is scraped for microscopy, culture and drug sensitivity. Scraping material should be inoculated directly onto culture media and slides.

Steps in scraping a corneal ulcer:

- Sit the patient behind the slit lamp microscope
- Anaesthesize the affected eye with a topical anaesthetic drug which does not contain a preservative (minims).
- Insert an eye speculum
- Using a gauge 21 needle (or a spatula if available), gently but firmly scrape the base and edges of the ulcer.

Take samples in the following order:

- Smears on 2 slides: 1 for Gram staining, 1 for lactophenol blue staining (for fungal hyphae)
- Blood agar plate
- Sabouraud glucose agar slope

Note:

- Use a new needle for each scrape or re-sterilize in a spirit lamp flame before each subsequent scrape.
- For details of microscopy refer: "**Suppurative Keratitis: A laboratory manual and guide of microbial ketatitis.** By A. K Leck, M. M. Matheson, J. Heritage"

Media and materials required for corneal scrape

2x clean microscope slides

21-gauge needles

1x Blood or chocolate agar plate

(1x Non-nutrient agar plate)

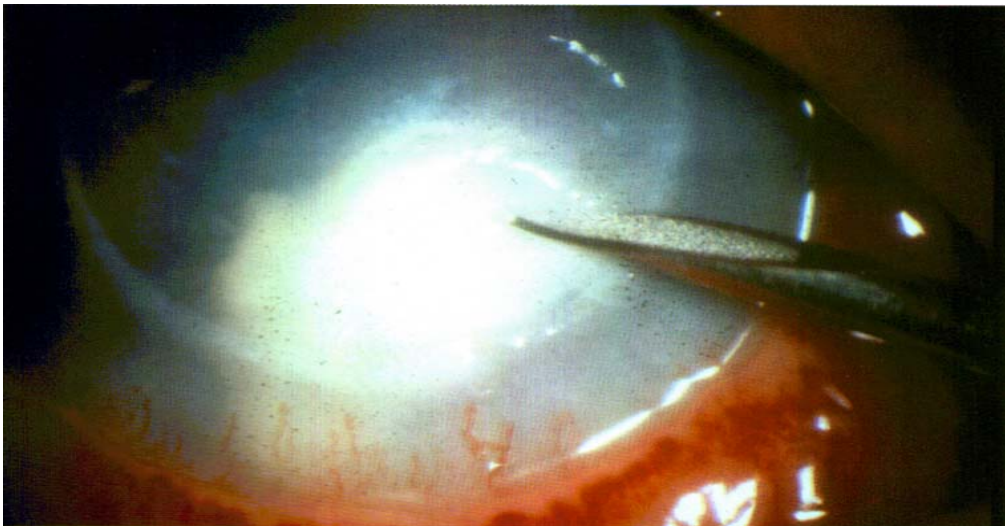
1x Sabouraud glucose agar slope

1x Cooked meat broth

1xThioglycollate broth

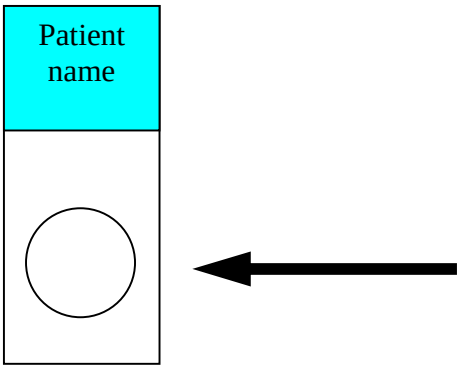
1x Nutrient broth (for anaerobic culture)

*** <u>Ophthalmologist performs scrape using 21 – gauge needle or Kimura scalpel</u>**



*** If patient is using antimicrobial eye drops at presentation, stop treatment for 24hours and then scrape.**

Label slides with name of patient and hospital identification number.
Inoculate media and label agar plates and broth cultures as for slides.



Draw a circle on each slide to indicate area of slide in which corneal material should be smeared

The results from microscopy are reported to the clinician and a decision is made on treatment.

TREATMENT GUIDELINE

- Admit patient for intensive topical antimicrobial treatment

Instillation of eye drops is frequent initially and gradually tailed down as the ulcer improves

Suggested treatment regime

1st one hour - every 15 mins

Next two hours - every 30 mins

Next 3-5 days - every 1 hour

Subsequently every two hours and then every 3 hours till ulcer heals.

Examine patient daily to determine progress and review treatment accordingly (see Appendix 1 for treatment flow chart guide)
Keep a treatment chart to monitor regular instillation of eye drops (see sample of treatment chart in Appendix 2)
Adjuvant treatment with a short acting mydriatic (1% cyclopentolate or homatropine) helps relieve pain and prevent posterior synechiae formation

TREATMENT GUIDELINE

Microscopy result must be ready within 1 hour from the hospital laboratory. Upon receiving results, proceed as follows:

Gram positive organisms
- Give Ciprofloxacin or Ofloxacin or Chloramphenicol eye drops

Gram negative organism
- Give Ciprofloxacin or Ofloxacin or fortified Gentamicin eye drops

Fungal hyphae
- Give Natamycin eye drops

Mixed bacterial (Gm positive and Gm negative)
- Give Ciprofloxaxin
- Or combine fortified Gentamicin and Chloramphenicol eye drops

Mixed bacteria and fungal
- Combine Ofloxacin with Natamycin eye drops
- Or Natamycin + fortified Gentamicin + Chlroamphenicol eye drops

If there is no improvement on above regime within 48-72 hours, modify treatment according to culture and sensitivity results if available.

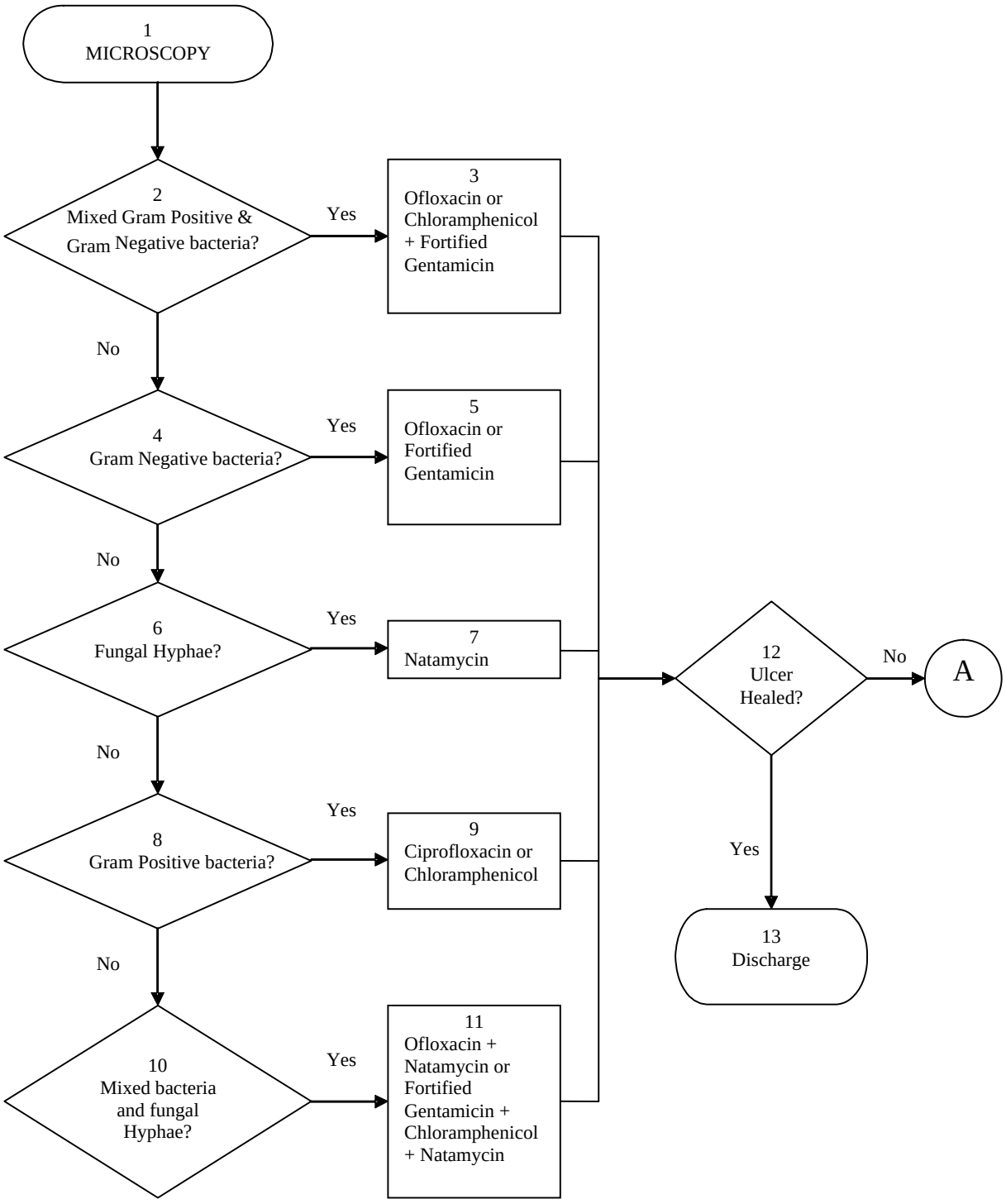
If sensitivity result is not available, or culture results show no growth, assume mixed infection and use broad-spectrum antibiotic and antifungal drugs as suggested above.

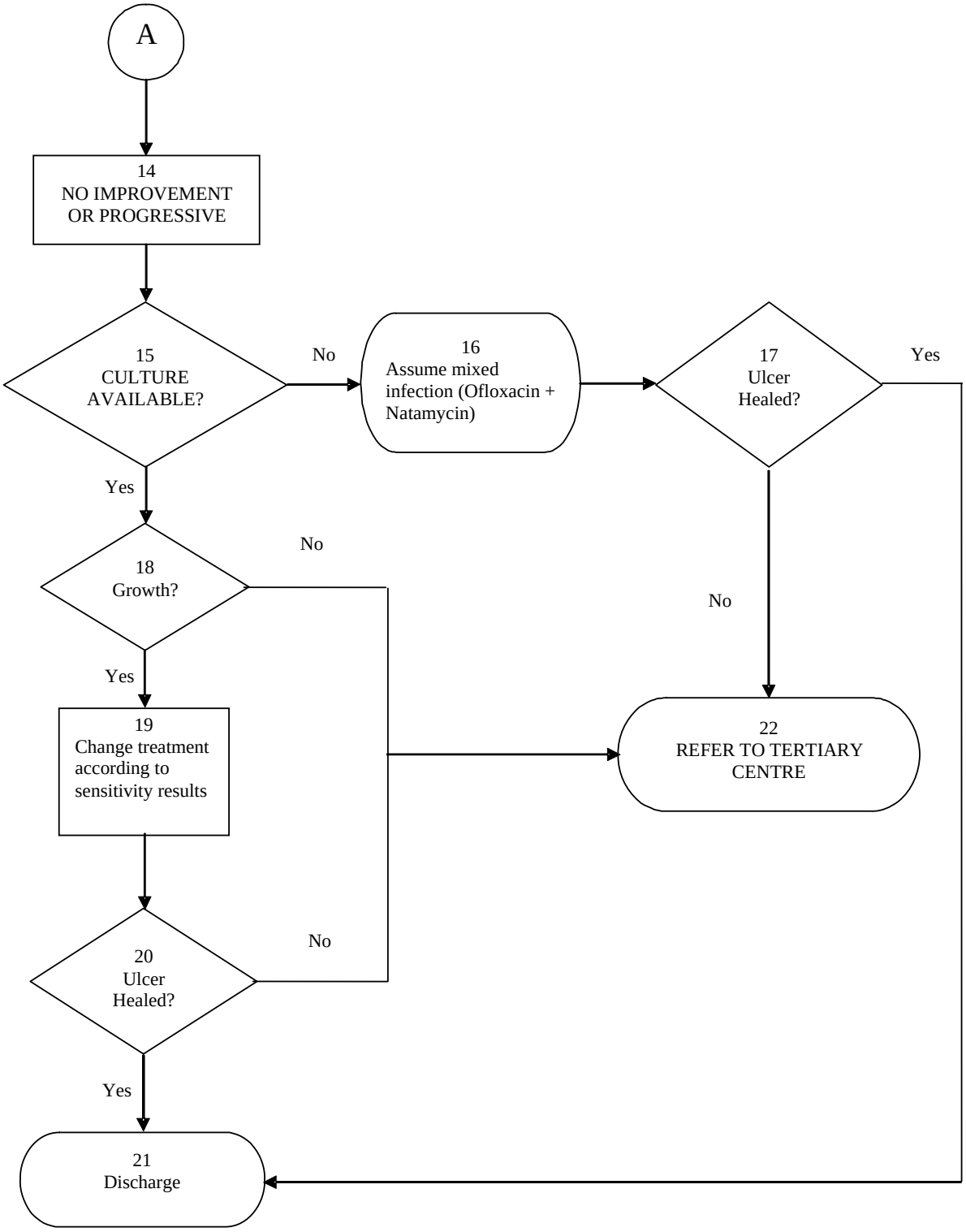
If ulcer still does not improve within 72 hours refer patient to tertiary centre.

(Refer Appendixes 1 and 4)

Appendix 1

TREATMENT GUIDELINES FOR SUPPURATIVE KERATITIS




A
14
NO IMPROVEMENT
OR PROGRESSIVE
15
CULTURE
AVAILABLE?
No
16
Assume mixed
infection (Ofloxacin +
Natamycin)
17
Ulcer
Healed?
Yes
Yes
18
Growth?
No
No
Yes
19
Change treatment
according to
sensitivity results
22
REFER TO TERTIARY
CENTRE
20
Ulcer
Healed?
No
Yes
21
Discharge

Appendix 2

SAMPLE TREATMENT FORM

Date	Time						
	12th Oct / 01	13th Oct / 01	14th Oct / 01	15th Oct / 01	16th Oct / 01	17th Oct / 01	18th Oct / 01
5am							
6am							
7am							
8am							
9am							
10am							
11am							
12noon							
1pm							
2pm							
3pm							
4pm							
5pm							
6pm							
7pm							
8pm							
9pm							
10pm							
11pm							
12midnight							
1am							
2am							
3am							
4am							

The nurse administering the drug signs against the time the drug is administered.

Appendix 3

PREPARATION OF FORTIFIED ANTIBIOTICS

DRUG	PREPARATION	CONCENTRATION
FORTIFIED GENTAMYCIN	2 mls parenteral Gentamicin (40mg/ml) is added to 5 mls commercially available ophthalmic Gentamicin eye drop (0.3%)	**14 mg/ml**
CEFUROXIME	Add 2.5 mls sterile water to 1000mg of Cefuroxime powder. Remove 2.5 mls from 15 mls bottle of artifical tears. Take 2.5 mls of Cefuroxime solution and add to rest of artificial tears.	**50 mg/ml**
AMIKACIN	Add 4 mls parenteral Amikacin (100 mg/2 mls) to 6 ml bottle of artificial tears.	**20 mg/ml**

NOTE: Keep all reconstituted drugs refrigerated for not more than 96 hours

Appendix 4

TREATMENT GUIDELINE

ORGANISM	**SUGGESTED TREATMENT**
Gram positive organisms	Ciprofloxacin, Ofloxacin, or Chloramphenicol eye drops
Gram negative organisms	Ciprofloxacin, Ofloxacin or fortified Gentamicin eye drops
Filamentous fungi	Natamycin or Econazole eye drops

NOTE:

- Combination of appropriate drugs may be used in mixed infection.
- Natamycin is the first choice of drug in the treatment of filamentous fungal infections. Econazole is an alternative drug of choice
- Systemic Ketoconazole or Itraconazole may be used in severe fungal infections especially those close to the limbus
- Fortified Cefuroxime may be used in resistant Gram positive cocci
- Pseudomonas infection may be resistant to Amikacin
- Subconjunctival injections are not necessary.

See Appendix 3 for preparation of topical drugs from parental preparations

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5. Suppurative Keratitis: A laboratory manual and guide of microbial ketatitis**.** By A. K Leck, M. M. Matheson, J. Heritage