

**TREATMENT OF INFECTED CORNEAL ULCER BY
SUBCONJUNCTIVAL INJECTION OF PENICILLIN IN
DOSES OF 1,000,000 UNITS***

BY

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In earlier communications it has been shown that adequate concentrations of penicillin can be obtained in the cornea and aqueous of the rabbit by subconjunctival injections. It was also shown that by increasing the dose not only is the level of concentration increased but it also persists longer. The addition of vasoconstrictors like adrenalin still further increases both levels and persistence. In the rabbit high aqueous levels persisting for as long as 48 hours could be obtained with a subconjunctival injection of 1,000,000 units crystalline penicillin in 1 ml. of adrenalin (Sorsby and Ungar, 1946, 1948a).

The value of subconjunctival injections of penicillin clinically has been recorded in two previous studies. Originally a dose of 50,000 units was used, and to maintain adequate levels these injections had to be given at 6-hourly intervals (Sorsby and Reed, 1947). Subsequently the dose was increased progressively to 500,000 units in one injection at 24-hourly intervals (Sorsby and Ungar, 1948b). These large doses were tolerated if white crystalline penicillin was used.

The present study covers 30 consecutive cases of infected corneal ulcer, generally complicated by hypopyon, and treated with doses of 1,000,000 units at either 24-hourly or 48-hourly intervals. Cases of hypopyon iritis were excluded. The series fell into two groups, those in which the eye was previously healthy and those in which it was not. In all cases the diagnosis of infected corneal ulcer was established on the clinical evidence of the ulcer showing either a sloughy base, or sloughy infiltrated margins with or without interstitial infiltration. In 25 cases hypopyon was present, and in all cases bacteriological examination was carried out, generally with positive results.

CASE REPORTS**PREVIOUSLY HEALTHY EYES**

(Table A)

Of the 17 cases in this group, 14 responded promptly to penicillin and did well. The 3 patients who did not respond to penicillin

* Received for publication, September 1, 1949.

within 24 hours all showed Gram negative bacilli, and penicillin treatment was replaced by streptomycin.

Penicillin Sensitive Cases

The patients, 11 men and 2 women (Nos. 1-13 in Table A), were of ages ranging from 23 to 66 years. In only one patient was there no history of trauma. In 4 cases corneal foreign bodies had been removed, and in 3 there was a history of a blow on the eye. In the remaining 5 cases the infected ulcer followed respectively on grit, sand, coal dust, tobacco ash and a scratch from a child's nail. One patient had two ulcers, the second being a relapse of the first, 14 days after he took his own, unauthorised, discharge from hospital. He figures twice in the table as 13a and 13b.

Hypopyon was absent in one case, in one it was represented by cells in the anterior chamber, in 8 it was present, though minimal, and in the remaining 4 it filled $\frac{1}{4}$ of the anterior chamber. Pneumococci were found on smear or culture in 5 cases. In 3 cases no organisms were obtained, and the remainder yielded only staphylococcus albus or *B. xerosis*.

Number and interval of injections

The initial severity of the condition determined the number of injections the patient received and the intervals at which they were given. The following summary table extracted from Table A brings out the salient features.

It will be seen that only one case required more than 2 injections, and that in most cases the second injection was given after 48 hours.

Response to treatment

All patients showed a clear response to treatment within 24 hours except one patient in whom the infection was not controlled until 72 hours. In the 8 patients who had a minimal hypopyon at the start of treatment, this had become absorbed within 24 hours. Of the 4 patients with hypopyon filling a quarter of the anterior chamber, two took two days and two five days for the hypopyon to disappear. One case was treated as an out-patient; of the others 7 required in-patient treatment for 5 to 9 days, 3 for 10 to 14 days, 1 for 16 days and one discharged himself after two stays of 5 days and 8 days respectively.

End-results

One month after discharge, the visual acuity was 6/5, 6/6 or 6/6 pt. in 5 cases, 6/9 or 6/9 pt. in six cases, and 6/18 in two cases. The cornea was clear in 4 cases, there was a superficial

SUMMARY TABLE I

*Showing number of injections in relation to severity of the lesion ;
previously healthy eyes, penicillin sensitive cases.*

State.	No. of cases.	Number of injections.
Infected cornea only without hypopyon.	1	Two injections at 48-hourly intervals.
Infected cornea with cells in anterior chamber.	1	One injection as out-patient.
Infected cornea with minimal hypopyon.	8	Two injections at 48-hourly intervals in 7 patients. One subconjunctival injection on admission followed by a retrobulbar injection 72 hours later in one case.
Infected cornea with hypopyon filling a quarter of the anterior chamber.	4	Two injections at 24-hourly intervals in two patients. Two injections at 48-hourly intervals in one patient (who discharged himself before treatment was complete.) Four injections, two at 24-hourly intervals, followed by two at 48-hourly intervals in one patient.

nebula in 8 cases, and a dense nebula in the remaining case. The results were considered good in all cases. The four most severely affected patients, those who showed hypopyon filling a quarter of the anterior chamber, finally showed vision of 6/9, 6/9, 6/18 and 6/9 respectively. Of the two cases with 6/18 vision, one was an elderly patient of poor intelligence, and the other had a central nebula partially obstructing the pupil. The one case left with a dense corneal scar was the only patient in this series who had had carbolic treatment before penicillin treatment was undertaken.

Penicillin Insensitive Cases

These three ulcers (Nos. 14-16, in Table A) all followed removal of foreign bodies, and in all three Gram negative bacilli were found in the conjunctival sac. In one case, pneumococci were grown as well. Twenty-four hours after the first injection of penicillin, not only was there no response but the ulcers were markedly worse. In all three patients the clinical picture was similar and rather characteristic: a sloughing dirty white, and somewhat heaped up lesion with rapidly spreading and extensive interstitial infiltration. In these cases no attempt was made to persist with penicillin.

Treatment was changed to streptomycin and the results will be recorded in a subsequent study.

SUMMARY TABLE II

End result as to vision a month after discharge of the cases shown in Summary Table I.

State.	No. of cases.	End result	
		Vision with correction where necessary.	No. of cases.
Infected cornea only without hypopyon.	1	6/18 (? better)	1
Infected cornea with cells in anterior chamber.	1	6/9	1
Infected cornea with minimal hypopyon.	8*	6/5 6/6 or 6/6 pt. 6/9 or 6/9 pt.	1 4 2
Infected cornea with hypopyon filling a quarter of the anterior chamber.	4	6/9 6/18	3 1

*In case 13a final vision could not be recorded. The patient figures in the next group with vision of 6/9.

SUMMARY TABLE III

Showing the final condition of the cornea in the cases shown in Summary Table I.

State.	No. of cases.	End-result	
		State of cornea.	No. of cases.
Infected cornea only without hypopyon.	1	Superficial nebula.	1
Infected cornea with cells in anterior chamber.	1	Clear.	1
Infected cornea with minimal hypopyon.	8*	Clear. Superficial nebula. Dense scar (peripheral).†	3 3 1
Infected cornea with hypopyon filling a quarter of the anterior chamber.	4	Superficial nebula.	4

*Case No. 13a omitted as no end-result could be recorded. The patient figures in the next group as a case with superficial nebula.

†Carbolized before penicillin treatment was undertaken.

TABLE
Previously

No.	Sex	Age	Clinical Condition	History of trauma	Organisms	Hypopyon	Response to penicillin noted within	Treatment other than subconjunctival penicillin and mydriatics
1	M	47	Superficial infiltration of corneal ulcer.	Blow from plant	Staphylococcus Pneumococcus B. Morax-Axenfeld	Minimal	24 hours	Nil
2	M	66	Corneal ulcer with superficial infiltration	Tobacco ash in eye	Staphylococcus Pneumococcus	Nil	72 hours	Nil
3	M	35	Corneal ulcer with superficial infiltration	Foreign body removed	B. Xerosis Staphylococcus albus	Minimal	24 hours	Carbolized prior to penicillin treatment
4	M	45	Corneal ulcer with superficial infiltration	Foreign body removed	B. Xerosis	Cells in anterior chamber only $\frac{1}{4}$	24 hours	Nil
5	F	45	Corneal ulcer with much slough and superficial infiltration	Coal dust in eye	Pneumococcus Staphylococcus	$\frac{1}{4}$	24 hours	Nil
6	M	36	Corneal ulcer with superficial infiltration and mild iritis	Blow from piece of concrete	Staphylococcus albus B. Xerosis	Minimal	24 hours	Nil
7	M	45	Corneal abrasion became an ulcer	Piece of grit in eye	Staphylococcus albus Pneumococcus B. Xerosis	Minimal	24 hours	Nil
8	M	34	Corneal ulcer with superficial infiltration	Sand in eye	Nil in smear culture	Minimal	24 hours	Nil
9	F	43	Corneal ulcer with deep infiltration and advancing edge	No trauma	B. Xerosis	$\frac{1}{4}$	24 hours	Nil
10	M	41	Corneal ulcer, deep infiltration	Scratch by child's nail	Nil in smear or culture	Minimal	24 hours	Subconjunctival penicillin 200,000 units 7 injections before seen
11	M	50	Corneal ulcer with superficial infiltration	Foreign body removed (piece of tile)	Staphylococcus albus B. Xerosis	$\frac{1}{4}$	24 hours	Nil
12	M	33	Corneal ulcer with superficial infiltration and striate keratitis	Foreign body removed Rust ring scraped	Nil in smear or culture	Minimal	24 hours	Nil
13	M	23	(a) Corneal ulcer, sloughing	Struck by piece of clinker	Pneumococcus Gram negative diplobacilli	$\frac{1}{4}$	24 hours	Nil
			(b) Corneal ulcer, sloughing	No trauma	Staphylococcus albus	Minimal	24 hours	Nil
14	M	26	Corneal ulcer with interstitial infiltration	Foreign body removed	B. proteus B. subtilis	Nil	} Nil within 24 hours	—
15	M	59	Corneal ulcer with interstitial infiltration	Foreign body removed	B. pyocyaneus	Nil		—
16	M	55	Corneal ulcer with localized interstitial infiltration	Foreign body removed	Pneumococcus Gram negative bacilli	Nil		—

TABLE
Previously injured

No.	Sex	Age	Clinical Condition	History of trauma	Organisms	Hypopyon	Response to penicillin noted within	Treatment other than subconjunctival penicillin and mydriatics
1	M	65	Corneal ulcer 1 month ago. Never settled. Absolute glaucoma.	No trauma	B. Xerosis	$\frac{1}{4}$	24 hours	Not known
2	M	63	? Old mustard gas keratitis. 3 previous attacks. Perforating ulcer treated—returned with hypopyon.	'Knocked eye'	B. Morax-Axenfeld	$\frac{1}{8}$	24 hours	Gutt. zinc sulph. $\frac{1}{4}\%$ twohourly
3	M	35	Intraocular foreign body with traumatic cataract two years ago.	Corneal foreign body removed	Staphylococcus	Minimal	24 hours	Nil
4	M	59	Eye red and painful six months. ? previous attack. Corneal ulcer.	No trauma	Staphylococcus albus Pneumococcus	Minimal	72 hours	Carbolized before seen
5	M	50	Dendritic ulcer three years ago—vascularized scar. Corneal ulcer with superficial infiltration.	No trauma	Staphylococcus Pneumococcus	Minimal	24 hours	Tarsorrhaphy
6	M	55	Ciliary staphyloma—band shaped opacity—staining area.	No corneal sensation	Staphylococcus aureus	Present	48 hours	Lid silvered Carbolization before seen
7	F	67	Lysol burn 18 years ago. Corneal ulcer one year ago. Corneal ulcer with superficial infiltration.	No recent trauma	Staphylococcus albus	$\frac{1}{2}$	—	Sulphonamide by mouth
8	M	28	Old interstitial keratitis active. Corneal ulcer.	Injury with wire	Staphylococcus Pneumococcus	Present	72 hours	Penicillin intramuscularly 2,000,000 dly.
9	F	55	Central vascular scar from old injury. Corneal ulcer with deep infiltration of old scar like corneal abscess.	—	Nil in smear and culture	$\frac{1}{8}$	24 hours	Gutt. penicillin
10	F	39	Previous attack ten weeks ago—incompletely cured—relapse Corneal ulcer—interstitial infiltration.	No trauma	B. Xerosis	$\frac{1}{2}$	24 hours	Nil
11	F	54	Corneal ulcer. Old phlyctenular scars.	No trauma	Staphylococcus albus Pneumococcus B. Xerosis	Nil	24 hours	Nil
12	F	47	Dendritic ulcer with secondary infection.	—	Staphylococcus Xerosis	$\frac{1}{4}$	Nil	—
13	M	67	Previous 'eye trouble', nature unknown, Raised tension, congested eye, corneal abscess.	No trauma	Gram negative bacilli Staphylococcus aureus	Minimal	Nil	—

B

or diseased eyes

Routine subconjunctival penicillin	Duration of in-patient treatment in days	Duration of hypopyon in days	Visual acuity			Final condition of cornea	Result	Remarks
			On admission	On discharge	After 1 month			
2 injections 48 hour interval	5	5	No perception of light	No perception of light	No perception of light	Well healed Nebula	Good	—
3 injections 24 hour interval	12	3-5	—	Counts fingers	Counts fingers	Healed Old scar	Good	—
2 injections 48 hour interval	7	1	Hand movements	Hand movements	Hand movements	Cornea clear	Good	—
3 injections intervals of 3 days and 48 hours	24	8-11	2/60	6/60	6/9	Nebula	Good	—
2 injections 43 hour interval	27	1	Counts fingers	6/24	6/24	Old vascularized scar	Good	—
2 injections 48 hour interval	54	4	No perception of light	No perception of light	No perception of light	Settled	Fair	—
6 injections at intervals of 72, 24 and 48 hours	9	—	Perception of light	—	—	Enucleation Hypopyon responded but relapsed	Bad	—
6 injections 48 hour interval	7	7	Counts fingers	6/18	6/18	Dense circumscribed scar. Intersitial keratitis inactive	Good	—
2 injections 48 hour interval	7	3	Hand movements	—	Hand movements	Healed Vascular scar as before	Good	—
4 injections 48 hour interval	15	8	6/12	6/12	6/12	Faint nebula	Good	—
2 injections 4 day interval	9	—	6/60	—	6/12	Nebula with faint pigmentation	Good	—
1 injection	—	—	—	—	—	—	—	No response to penicillin Treatment changed to streptomycin. ? A case of hypopyon iritis.
1 injection	—	—	—	—	—	—	—	No response to penicillin Treated with streptomycin.

PREVIOUSLY INJURED OR DISEASED EYES
(Table B)

Of the 13 cases in this group, 11 responded satisfactorily to penicillin and 2 did not. Of the 11 who responded to treatment, one patient none the less lost his eye owing to a relapse in a grossly damaged eye (No. 7 in Table B). In one of the two cases without response to penicillin Gram negative bacilli were present in the conjunctival sac, and in the other—a case of dendritic ulcer—staphylococci and *B. xerosis* were isolated.

Penicillin Sensitive Cases

These 11 patients (Nos. 1-11 in Table B), seven of whom were men, were between the ages of 28 and 67 years. The condition of the eye prior to the onset of the corneal infection was: old corneal ulcer or abscess in 3 cases; chronic or absolute glaucoma in 2 cases, and in 1 case each the following lesions respectively were present: old interstitial keratitis, old lysol burn, phlyctenular scars, dendritic ulcer, old intraocular foreign body, and ? mustard gas keratitis.

Hypopyon was absent in one case only. It was minimal in 3; in 2 cases one-half of the anterior chamber was occupied by the hypopyon; in 1 case each $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{8}$ of the anterior chamber was filled; in two cases hypopyon was recorded as present without further specification. There was a history of recent trauma in 3 cases only. Pneumococci were found in 4 cases, staphylococcus aureus in 1 case, Morax-Axenfeld bacillus in 1 case, and the rest gave only staphylococcus albus or xerosis. In one case, no organisms were seen in the smear or grown in culture, due probably to previous treatment.

Number and interval of injections

As in the uncomplicated cases the initial severity of the condition determined the number of injections the patient received, and the intervals at which they were given. Summary Table IV extracted from Table B brings out the salient features.

It will be noted that in 6 of the 11 cases only 2 injections at intervals of 48 hours or more were given, and in 2 more only 3 injections.

Response to treatment

Most patients showed a clear response to treatment within 24 hours except one in which the hypopyon responded only after 5 days and later relapsed, leading to loss of the eye (No. 7 in Table B). Four patients were in hospital a week or less, 4 more between 1 and 2 weeks, and 3 patients for 3 weeks or more.

SUMMARY TABLE IV

Showing number of injections in relation to severity; initially diseased eyes, penicillin sensitive cases.

State.	No. of cases.	Number of injections with intervals.
Infected cornea with— No hypopyon.	1	Two injections at four day intervals.
Minimal hypopyon.	3	Two injections at 48-hourly intervals in two cases. Three injections at intervals of three days, and two days respectively in one case.
Hypopyon filling. $\frac{1}{8}$ of anterior chamber.	1	Two injections at 48-hourly intervals.
$\frac{1}{4}$ of anterior chamber.	1	Two injections at 48-hourly intervals.
$\frac{1}{3}$ of anterior chamber.	1	Three injections at 24-hourly intervals.
$\frac{1}{2}$ of anterior chamber.	2	Six injections at 72-, 24- and 48-hourly intervals in one case. Four injections at 48-hourly intervals in one case.
Hypopyon "present."	2	Two injections at 48 hourly intervals in one case. Six injections at 24-hourly intervals in one case.

End-results

As already noted one patient, after an initial response, relapsed and the eye was enucleated. This was an old lysol burn of 18 years standing with perception of light only and a hypopyon occupying half the anterior chamber at the start of treatment. Two patients had no perception of light before the attack. In the remaining 8 patients, the end result (one month after discharge) was vision of 6/24, 6/18 and 6/12 in one case each; 6/9 in two cases; and C.F. or H.M. in 3 cases, but in these 3 patients visual acuity was the same as before the cornea became infected.

Apart from the eye which came to enucleation, the final condition of the cornea was in no case markedly worse than it originally had been. Having regard to the condition of the eye at the start of treatment, the results were considered to be good in 9 cases, fair in one, and bad in one case.

Penicillin Insensitive Cases

In two cases (Nos. 12 and 13 in Table B) there was no response to penicillin within 24 hours, and the treatment was changed. One case was a dendritic ulcer with secondary infection; staphylococcus and bacillus xerosis were present. It is possible that the hypopyon was of the iritis hypopyon type. In the second case Gram negative bacilli in addition to staphylococcus aureus were present. Both these cases were treated with streptomycin.

Discussion

THE VALUE OF PENICILLIN IN INFECTED CORNEAL ULCERS

The value of penicillin in the treatment of infected corneal ulcers due to penicillin-sensitive organisms is no longer in dispute. It is such that the older methods of treatment, including oral sulphonamide therapy, have now no place in the management of infected corneal ulcers. Heat cauterisation in particular must now be regarded as a superseded barbaric procedure, and carbolization as little better.

What is still at issue is the mode of applying penicillin. Little is to be expected from the instillation of drops—which are rapidly washed out—or from dusting solid crystalline penicillin on to the infected surface—for such penicillin is rapidly dissolved and readily eliminated. Penicillin ointments, however concentrated, do not give such high levels as are obtained by subconjunctival injection. Ionization of penicillin applied by means of a corneal bath presents some technical as well as theoretical difficulties, and there is nothing to suggest that it gives as persistently high levels as are obtained by subconjunctival injections. Subconjunctival injection is therefore the method of choice. The high tolerance of the eye to crystalline penicillin allows the use of massive doses and the present series of cases shows that the subconjunctival injection of doses of 1,000,000 units is possible, clinically as well as experimentally. The advantage of these massive doses lies in the fact that they render unnecessary many injections at frequent intervals. In fact, the milder cases respond to one injection, and a second injection in many of the cases recorded here has been in the nature of a consolidating dose rather than an essential measure in treatment. It is clear that in most cases the second injection need not be given until after 48 hours, though with the present limited experience it is safer to give a second injection after 24 hours in severe cases. It will be seen from Table A, and the corresponding summary table I that of the 14 cases of uncomplicated infected corneal ulcers treated with massive doses of penicillin subconjunctivally, only one patient required more than two

injections. It is likely that in nine patients one injection would have been adequate instead of the two they actually received.

There is nothing to be gained by persisting with the method of treatment by six-hourly injections of 50,000 units as advocated previously. The results in the present series are certainly not inferior to those recorded in the previous study.

There is likewise nothing to be gained by an unnecessary poly-pharmacy which combines oral sulphonamide with local penicillin therapy. Such measures may be justified in exceptional cases; they are unnecessary as a routine.

TECHNICAL CONSIDERATIONS

A dose of 1,000,000 units crystalline penicillin dissolves without difficulty in 1 ml. of water. It dissolves as readily in an equal quantity of 0.5 ml. water and 0.5 ml. adrenalin 1 : 1,000. If it is desired to replace the water by procaine, it is essential that the penicillin should first be dissolved in the adrenalin and an additional 0.25 ml. of water, for penicillin in procaine solution forms a cloudy suspension from which the penicillin tends to crystallise out. Saline should not be used as such solutions of penicillin are markedly hypertonic. If severe iritis is present rapid mydriasis may be obtained by incorporating mydricine in the solvent. In this case the solvent used should be mydricine min. v, adrenalin 1 : 1,000 min. v, aq. dist. ad. 1 ml. Alternatively the penicillin can be dissolved in 5 minims of adrenalin 1 : 1,000 to which is added 10 minims of a stock solution of water containing atropine sulphate 1/40 grain and cocaine hydrochlor. $\frac{1}{8}$ grain.

It is advisable to test the sensitivity of the patient to adrenalin before using it in a subconjunctival injection. If a subcutaneous injection of 2 minims of adrenalin 1 : 1,000 gives no unpleasant reaction within 15 minutes, it may be assumed that no harm will result from the full injection. No general reactions were observed in the present series.

No sign of corneal reaction was observed after any of these injections. Chemosis is inevitable and is occasionally accompanied by some subconjunctival haemorrhage, especially in a congested eye. It clears up completely, though occasionally not for a few weeks.

Pain after the injection is usually slight, lasting only for a few minutes, or half an hour at the most. Occasionally patients complain of more severe discomfort. If care is taken to inject beneath the laxest part of the conjunctiva, this can be reduced to a minimum and is usually easily controlled with analgesics. It is doubtful whether the use of procaine as the solvent does anything to

reduce the discomfort, which is probably caused by the hypertonicity of the injection.

No general reaction from the massive dose of penicillin was observed.

SUGGESTED SCHEME OF TREATMENT

Once the diagnosis of infected corneal ulcer has been made the object must be to obtain immediate control of the penicillin-sensitive organisms and the earliest possible knowledge of the insensitive ones. To this end the following scheme is suggested.

Immediately on admission

A smear and culture from the conjunctival sac should be taken and an adrenalin sensitivity test carried out. If the use of adrenalin is not contra-indicated, the patient should be given a subconjunctival injection of 1,000,000 units of crystalline penicillin in mydrine, m.v, adrenalin 1 : 1,000 m.v, and aq. dist. ad. 1 ml. (or alternatively 1,000,000 units dissolved in 5 minims of adrenalin 1 : 1,000 and 10 minims of a stock solution of water containing atropine 1/40 grain and cocaine 1/8 grain). On no account must any but white crystalline penicillin be used.

During the first 24 hours

No treatment is needed beyond keeping the eye bandaged and instilling atropine to maintain mydriasis.

Twenty-four hours after admission

If the condition shows marked improvement a further injection should not be needed until 48 hours after the first, but in severe infections it may be wise to give the second injection at 24 hours. For the present it is perhaps best to maintain 24-hourly injections as long as any hypopyon is present. If, after 3 or 4 injections, it proves difficult to continue with subconjunctival injections, the retrobulbar route may be used. If there is no substantial improvement the possibility of an insensitive organism must be considered, whilst deterioration indicates that the infection is almost certainly due to a penicillin-insensitive organism, and some other form of treatment such as streptomycin therapy should be instituted.

Forty-eight hours after admission

If, after a second injection at 24 hours, the condition is inadequately controlled, the infection should be regarded as due to a penicillin-insensitive or relatively resistant organism and treatment changed.

The bacteriological findings may confirm the clinical diagnosis at any stage. More weight, however, should be attached to clinical course than to bacteriological findings.

Summary

(1) A series of thirty consecutive cases of infected corneal ulcer treated by subconjunctival injections of 1,000,000 units penicillin is recorded. In 17 cases the eye had been healthy previous to the onset of the infected corneal ulcer. In 13 cases a corneal infection occurred in eyes previously diseased.

(2) Of the 17 cases in the first group, 14 responded promptly to penicillin treatment. The three patients who did not respond to penicillin were cases of infected corneal ulcer due to Gram negative bacilli, insensitive to penicillin. The 14 cases (13 patients) with good response showed a varying amount of hypopyon reaction. All but one of these cases required not more than two subconjunctival injections of penicillin. It is likely that in most cases one injection would have been adequate. The end-result as to vision was 6/9 to 6/5 in 11 patients.

(3) The 13 cases of infected corneal ulcer in previously diseased eyes contained two that failed to respond. Of the remaining 11 cases, one eye—an old-standing chemical burn—ended in enucleation; the result of treatment could be considered as satisfactory in 9 cases, and only fair in one.

(4) Treatment of infected corneal ulcer by subconjunctival injections of 1,000,000 units of penicillin has the advantage of bringing the condition under control within 24 hours in most cases. Frequent injections are unnecessary, recovery is rapid, corneal scarring minimal and the visual results gratifying.

We are indebted to Sister Thorogood and Charge Nurses Moore and Beadle of the Eye Unit at Lambeth Hospital, and to Sisters Chubb, Ball and Bryant at the Royal Eye Hospital as also to the house surgeons, Drs. C. W. Searle, H. B. Jacobs, G. Romanes and C. M. Shafto for their help in this work.

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