Subconjunctival gentamicin

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Gentamicin sulphate is a new broad spectrum antibiotic produced by *Micromonospora purpurea*, and is active against both Gram-positive and Gram-negative bacteria.

The antibiotics which have hitherto been used subconjunctivally all have some disadvantages. Penicillin, which is only mildly irritant, has a range of activity which does not cover the Gram-negative bacilli, *Pseudomonas*, *Proteus*, or *E. coli*. In addition, most strains of staphylococci may become resistant. Streptomycin is useful but resistant strains develop quickly. Polymyxin and Neomycin are rarely used because the injections are painful and irritant to the tissues.

Soframycin is a useful antibiotic, being active against both Gram-positive cocci and Gram-negative bacilli, but repeated injections are slightly irritant to the tissues and systemic absorption may have nephrotoxic and ototoxic effects.

ADMINISTRATION

The use of gentamicin in the form of local ocular drops is now established. It has also been given intrathecally, and to rabbits subconjunctivally (Furgiele, Kiesel, and Martyn, 1965). We have now administered this antibiotic subconjunctivally in man to assess its usefulness in ophthalmology.

Gentamicin sulphate is highly stable and water soluble, and when given in a dilution of 20 mg./ml. subconjunctivally, it produces an osmotic pressure in solution which is less than that of the other antibiotics; better diffusion and local tolerance can therefore be anticipated.

The osmolarities of different antibiotics are tabulated below according to a theoretical assumption based on molecular weight and drug concentration.

Antibiotic	Concentration	Percentage ionic tonicity (g./ml.)
Gentamicin	20 mg./ml.	50
Penicillin	0.5 mega units/ml.	55
Streptomycin	0.25 g./ml.	180
Soframycin	250 mg./ml.	300
Neomycin	500 mg./ml.	600

The activity of gentamicin sulphate is enhanced when it is used synergistically with ampicillin, chloramphenicol, colistin and tetracycline.

ASSESSMENT

The trial was conducted in three parts:

(1) Tolerance

To determine the response to a single subconjunctival injection of 20 mg. gentamicin (1 ml.) as regards local reaction and pain, ten patients received a subconjunctival injection of gentamicin

sulphate infero-temporally at the conclusion of a routine cataract extraction. After 3 hours the patients were asked whether they had any pain in the area of the injection. At the first dressing (24 hrs after the injection) the area was examined for any reaction.

One patient complained of pain, localized to the area of the injection, and six showed minimal conjunctival injection and chemosis which disappeared after a further 24 hrs.

(2) *Prevention of infection*

Five patients were given subconjunctival injections of 20 mg. gentamicin sulphate at the conclusion of an operation for a perforating injury; there was no case of postoperative infection.

(3) *Treatment of established infection*

In eight patients the conjunctival sac was anaesthetized with 4 per cent. cocaine drops locally, and gentamicin was injected subconjunctivally as shown in the Table.

Table *Results of subconjunctival injection of gentamicin in eight cases of ocular infection*

Case no.	Diagnosis	Bacteriology	Subconjunctival gentamicin	Result
1	Stitch abscess in aphakic subject with 2 mm. hypopyon and early vitreous abscess	No growth	20 mg. + mydracaine 2 gutt. gentamicin four times daily Repeat 20 mg. after 24 hrs + systemic chlor-ampenicol	Hypopyon cleared in 6 hrs Healed in 9 days
2	Corneal ulcer (spontaneous) with 3 mm. hypopyon	No growth	20 mg. + mydracaine 2 + systemic ampicillin Gentamicin repeated twice	Hypopyon cleared in 3 days Healed in 5 days
3	Corneal ulcer with 3 mm. hypopyon in aphakic Had been treated with local steroids for 1 week before admission	<i>Strept. viridans</i>	20 mg. gutt. gentamicin 1 per cent. 1-hrly + systemic chloramphenicol	Hypopyon cleared in 36 hrs Healed in 10 days
4	Corneal abscess (traumatic) 2 mm. diameter	No growth	20 mg. repeated in 3 days gutt. gentamicin 1 per cent. 1-hrly + systemic ampicillin 6-hrly	Healed in 6 days
5	Infected corneal wound after cataract extraction	No growth	20 mg. repeated in 2 days gutt. gentamicin 1 per cent. 1-hrly	Exudate on anterior vitreous face cleared in 48 hrs Healed in 4 days
6	Corneal ulcer (spontaneous) with 3 mm. hypopyon	No growth	20 mg. gutt. gentamicin 1 per cent. 1-hrly	Healed in 3 days
7	Infected wound after cataract extraction	No growth	20 mg. gutt. gentamicin 1 per cent. 1-hrly	Healed in 24 hrs.
8	Corneal abscess (post-dendritic) with 2 mm. hypopyon	No growth	20 mg. gutt. gentamicin 1 per cent. 1-hrly + systemic ampicillin	Healed in 4 days

Results

Subconjunctival gentamicin was found to be well tolerated locally. There were no cases of postoperative infection when the gentamicin was used prophylactically in five cases of perforating injury, and eight cases of corneal infection treated with subconjunctival gentamicin all responded satisfactorily.

Mydracaine 2 (6 mg. procaine hydrochloride, 1 mg. atropine sulphate, 5 mg. acid boric 0.12 ml. solution of adrenaline 1/1000) was added to the gentamicin with no adverse effect. Incubation of gentamicin with Mydracaine 2 at 37°C. for 48 hrs showed that the solution was stable and there was no reduction of the adrenaline.

Discussion

Subconjunctival gentamicin is well tolerated locally and produces very little chemosis. This lack of irritation to the conjunctiva is important in assessing the degree of inflammation of the eye.

The value of subconjunctival gentamicin as a prophylactic measure for perforating injuries is doubtful, since induced allergic reactions and acquired bacterial resistance may become significant problems (Gordon, 1970), but if wounds are contaminated with *Pseudomonas* or other pyogenic organisms, subconjunctival gentamicin is useful.

Summary

The purpose of this communication is to establish that treatment with gentamicin may be effective in infective conditions, and the rapidity of the response leads us to believe that it is more effective than the antibiotics in use at present. A double-blind trial would be necessary to confirm this.

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References

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