Action of Lincomycin on Staphylococci

M. BALS AND MARIA BRATU

The II Clinic of Contagious Diseases of the Medico-Pharmaceutical Institute, Bucharest, Rumania

Received for publication 21 February 1966

Abstract

BALS, M. (Medico-Pharmaceutical Institute, Bucharest, Rumania), AND MARIA BRATU. Action of lincomycin on staphylococci. Appl. Microbiol. 14:582–583. 1966.—On a solid medium, 0.1 to 1 μg/ml of lincomycin hydrochloride had a bacteriostatic effect upon 95 of 100 strains of staphylococci. Using cellophane transfers, we observed a bactericidal effect upon 54 of these strains after 3 to 14 hr of contact with 1 μg/ml. Five staphylococcal strains resistant to 100 μg/ml of lincomycin were also resistant to penicillin G, streptomycin, erythromycin, tetracycline, chloramphenicol (three strains), and rovamycin (three strains). Other staphylococcal strains resistant to methicillin, ampicillin, tetracycline, streptomycin, chloramphenicol, and erythromycin were sensitive to lincomycin.

Lincomycin hydrochloride (Lincocin) is a new antibiotic (3) acting upon gram-positive organisms, especially upon staphylococci (2). The present paper deals with the in vitro relationship between the concentration of this antibiotic and its bacteriostatic and bactericidal action on 100 coagulase-positive staphylococcal strains isolated in our clinic.

Furthermore, investigations were carried out on the relationship between the concentration of lincomycin and the contact time necessary to obtain a bactericidal effect upon certain staphylococci in either the lag or the logarithmic phase. The possibility of obtaining staphylococcal mutants resistant to lincomycin was likewise studied, as was the relationship between the sensitivity of staphylococci to lincomycin and to other antibiotics.

Materials and Methods

One hundred strains of coagulase-positive, hemolytic staphylococci, isolated in the clinic, were used. These organisms were tested for sensitivity to common antibiotics.

The action of lincomycin was determined by dilutions in nutrient agar distributed in petri dishes. The following concentrations were used: 0.01, 0.1, 0.5, 1, 10, 25, 50, and 100 μg/ml. The inoculum for the study of the bacteriostatic and bactericidal action was, as a rule, of the order 10⁸ to 10⁹ organisms per milliliter. The inhibition was considered slight (or partial) when separate colonies were obtained, marked when fewer than 10 colonies grew, and total when no colonies developed.

To appraise the bactericidal effect upon staphylococci in the logarithmic phase (3-hr culture) and in the stationary phase (24-hr culture), inoculations were made on media containing increasing concentrations of lincomycin. In all cases, the inocula were approximately 10⁸ organisms per milliliter. At various intervals, transplants with cellophane (1) were made to fresh, antibiotic-free media. When fewer than 10 colonies per milliliter developed on the transplants, the bactericidal action was appraised as being marked; when the transplant remained sterile, the bactericidal action was considered to be total.

Results and Discussion

The bacteriostatic action of lincomycin upon some of the staphylococci tested was marked in 98 strains at 0.5 μg/ml, and total in 95 strains at 1 μg/ml. Five strains were partly resistant, and one was totally resistant even to 100 μg/ml. Some strains were affected by as little as 0.01 μg/ml. Lincomycin had a bactericidal action on 60 strains at concentrations of 1 to 10 μg/ml. In 24 strains, no bactericidal effect was observed, not even at 100 μg/ml (Table 1).

The minimal contact time necessary to obtain a complete bactericidal effect on staphylococci in the logarithmic multiplication phase was about 9 hr with 1 μg/ml, 8 hr with 2 μg/ml, and about 7 hr with 4 μg/ml. A marked bactericidal action was obtained after 3.5- to 4-hr contact with concentrations of 1 to 2 μg/ml. In the stationary phase, however, the organisms were more resistant to lincomycin, and, to obtain a complete bactericidal effect, a contact of about 14 hr was necessary with a concentration of 1 μg/ml, 12 hr with a concentration of 2 μg/ml, and 9 hr with 4 μg/ml. A partial effect with the above lincomycin concentrations was obtained at 8, 7, and 5 hr, respectively.
ACTION OF LINCOMYCIN ON STAPHYLOCOCCI

Table 1. Action of lincomycin on 100 strains of staphylococci

<table>
<thead>
<tr>
<th>Effect</th>
<th>Lincomycin (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Partial bacteriostasis</td>
<td>56</td>
</tr>
<tr>
<td>Marked bacteriostasis</td>
<td>14</td>
</tr>
<tr>
<td>Total bacteriostasis</td>
<td>7</td>
</tr>
<tr>
<td>Partial bactericidal action</td>
<td>60</td>
</tr>
<tr>
<td>Total bactericidal action</td>
<td>54</td>
</tr>
</tbody>
</table>

* Results are expressed as the number of strains affected at various concentrations.

Of 20 strains of staphylococci subjected to successive passages on solid media containing increasing concentrations of lincomycin, rapid (after four to five passages) and marked (up to 100 µg/ml) adaptation was obtained with only two strains (resistant to penicillin G, erythromycin, and tetracycline; sensitive to other antibiotics). After adaptation, the sensitivity or resistance of these two strains to other antibiotics remained unchanged. The other strains could not be adapted even after 45 transfers.

Of the 100 strains tested, 59 were resistant to penicillin G, 6 to methicillin, 6 to oxacillin, 33 to ampicillin, 42 to streptomycin, 22 to chloramphenicol, 43 to tetracycline, 22 to erythromycin, 5 to novobiocin, 2 to neomycin, and 12 to rovamycin. The resistance or sensitivity to lincomycin was not dependent upon the sensitivity or resistance of the strain to other antibiotics.

Of the five strains resistant to lincomycin, three were also resistant to penicillin G, erythromycin, novobiocin, streptomycin, and rovamycin, and three strains were resistant to the preceding antibiotics plus tetracycline and chloramphenicol; they were, however, all sensitive to novobiocin, neomycin, nitrofuran, methicillin and oxacillin.

A number of strains resistant to penicillin G, methicillin, oxacillin, ampicillin, streptomycin, tetracycline, chloramphenicol, erythromycin, neomycin, kanamycin, novobiocin, rovamycin, and nitrofuran were extremely sensitive to lincomycin.

Literature Cited