# 馬由来Klebsiella pneumoniaeの薬剤感受性

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# Drug-sensitivity of *Klebsiella pneumoniae* Derived from Horses

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The importance of the pathogenic strains of *Klebsiella* species as causal agents of venereal disease of mares has been stressed in a number of reports [2, 3, 10, 14]. Sensitivity to antimicrobial agents of the isolates of *Klebsiella* species derived from mares with genital infections has been determined using the disc method [8, 13] and the agar dilution method [6]. The aim of this study is to determine the drug-sensitivity of the isolates of *K. pneumoniae* derived from horses, of which the biotypes were determined previously [4], and to examine whether the drug-sensitivity patterns vary with biotypes.

Minimum inhibitory concentrations (MICs) of 38 antimicrobial agents for the 34 isolates of *K. pneumoniae* were determined by the agar dilution method [5]. Of the 34 isolates, 20 originated from cervical and clitoral swabs of mares with clinical metritis, 11 from preputial swabs of stallions, 2 from the intestines of foals and 1 from a lung of a foal [4]. The capsular types of the isolates were represented previously [4].

Stock solutions of antimicrobial agents were prepared with proper solvents and diluted with sterile distilled water by twofold dilutions. One milliliter of each dilution of the agents was added to 9 m*l* of heart infusion agar (Difco). To determine the MICs of sulfadimethoxine and trimethoprim, Fildes digested in blood was added to the agar at 5% concentration. Bacterial culture grown in the trypticase soy broth (Becton, Dickson and Company) for 18 hours was diluted with sterile saline to obtain a final concentration of about $1.0\times10^6$ colony forming units per m*l*. A five microliter of the suspension was spotted on each plate containing an antimicrobial agent with a device similar to the Steers replicator [12], and the plates were incubated at 37°C for 20 hours. The lowest concentration of the antimicrobial agent that inhibited the growth of bacteria completely was considered to be the MIC.

The MICs of 26 of 38 antimicrobial agents for all of the isolates are shown in Table 1. All of the isolates showed a high degree of sensitivity to gentamicin, cephalexin, colistin, polymyxin B and furazolidone, while they showed a low sensitivity or resistance to other antimicrobial agents.

For the isolates, the MICs of the remaining 12 antimicrobial agents, namely, 5 aminoglycosides (AGs), 4 tetracyclines (TCs), chloramphenicol (CP), nalidixic acid and trimethoprim were distributed in a wide range. The distribution of the MICs of these antimicrobial agents for the isolates of each biotype are shown in Table 2. The isolates of biotype 1 showed various drug-sensitivity patterns but the patterns were roughly divided into three types; (1) sensitive to AGs, TCs and CP, (2) resistant to all these antibiotics, and (3) sensitive to TCs and CP, but showing various sensitivities to AGs by isolates. Most isolates, 19 of 22, belonged to the third type. The number of the isolates of biotype 2 appeared to be so few that whether the drug-sensitivity patterns of which were peculiar to the biotype could not be determined. All isolates of biotype 3 showed one type of drug-sensitivity pattern and this type was very similar to the first type of biotype 1. All isolates of biotype 4 showed another type of drug-sensitivity pattern and this type was different from the types of the other biotypes. These findings suggest that the drug-sensitivity patterns of the isolates of *K. pneumoniae* are not always peculiar to each biotype. It is interesting, however, that each of the biotypes 3 and 4 showed one type of drug-sensitivity pattern.

Epidemics of metritis have usually been associated with *K. pneumoniae* of the capsular type 1 [1, 7, 9, 11]. All isolates of biotype 1 used in this study were identified as capsular type 1 and were isolated in Hidaka district during a period from 1983 to 1984 [4]. The data on the distribution of the MICs of the antimicrobial agents for these

Table 1. Sensitivity of 34 isolates of *Klebsiella pneumoniae* derived from horses to 26 antimicrobial agents

| Antimicrobial agents | Minimum inhibitory concentration ($\mu$g/ml) | | |
|---|---|---|---|
| | Range | For 50% of isolates | For 90% of isolates |
| Aminoglycosides | | | |
| Gentamicin | 0.39–0.78 | 0.39 | 0.78 |
| Cephem antibiotics | | | |
| Cephalexin | 3.13–12.5 | 6.25 | 6.25 |
| Lincomycins | | | |
| Clindamycin | 200–400< | 400 | 400< |
| Lincomycin | 100< | 100< | 100< |
| Macrolide antibiotics | | | |
| Erythromycin | 25–50 | 50 | 50 |
| Kitasamycin | 100< | 100< | 100< |
| Oleandomycin | 100< | 100< | 100< |
| Spiramycin | 100< | 100< | 100< |
| Tylosin | 100< | 100< | 100< |
| Penicillins | | | |
| Ampicillin | 25–100< | 50 | 50 |
| Cloxacillin | 100< | 100< | 100< |
| Dicloxacillin | 100< | 100< | 100< |
| Nafcillin | 100< | 100< | 100< |
| Penicillin G[a)] | 100≦ | 100< | 100< |
| Polyether antibiotics | | | |
| Monensin | 50< | 50< | 50< |
| Salinomycin | 50< | 50< | 50< |
| Polypeptide antibiotics | | | |
| Colistin | 0.2–0.78 | 0.39 | 0.78 |
| Enramycin | 100< | 100< | 100< |
| Flavophospholipol | 100≦ | 100< | 100< |
| Polymyxin B[a)] | 3.13–12.5 | 6.25 | 6.25 |
| Others | | | |
| Bicozamycin | 50–100< | 100 | 100 |
| Furazolidone | 0.39–6.25 | 0.78 | 3.13 |
| Novobiocin | 25–100< | 50 | 50 |
| Rifampicin | 25– 50 | 25 | 50 |
| Sulfadimethoxine | 800–1600< | 1600< | 1600< |
| Tiamulin | 50≦ | 50< | 50< |

a) unit/ml.

isolates were essentially similar to those of Kamada *et al.* [6], who tested the capsular type 1 isolates from mares with metritis occurring in the same district during a period from 1980 to 1983. The present results, however, revealed that these isolates were divided into 3 groups from their drug-sensitivity patterns. Therefore, determination of drug-sensitivity patterns of the isolates may be potentially useful for epidemiological studies of metritis associated with *K. pneumoniae* of capsular type 1 in mares.

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Table 2. Distribution of the MICs of 12 antimicrobial agents for 34 isolates of *K. pneumoniae*

| Biotype[a] (Number of isolates) | 1 (2[b]) | 1 (19[c]) | 1 (1[b]) | 2 (2[d]) | 3 (5[e]) | 4 (5[e]) |
|---|---|---|---|---|---|---|
| MICs ($\mu$g/ml) of: | | | | | | |
| Aminoglycosides | | | | | | |
| Dihydrostreptomycin | 1.56 | 12.5–100< | 100< | 100< | 1.56 | 100< |
| Fradiomycin | 1.56 | 1.56– 50 | 25 | 1.56 | 1.56 | 25 |
| Kanamycin | 1.56–3.13 | 1.56–100< | 100< | 3.13 | 3.13 | 100≦ |
| Spectinomycin | 6.25 | 50–100 | 100< | 6.25 | 6.25 | 6.25 |
| Streptomycin | 3.13 | 12.5–100< | 100< | 100< | 3.13 | 100< |
| Tetracyclines | | | | | | |
| Chlortetracycline | 3.13–6.25 | 3.13–12.5 | 100< | 100< | 3.13 | 100< |
| Doxycycline | 1.56–3.13 | 1.56–3.13 | 25 | 25–100 | 1.56 | 25 |
| Oxytetracycline | 0.78–1.56 | 1.56 | 100< | 100< | 0.78–1.56 | 100< |
| Tetracycline | 1.56–3.13 | 3.13–6.25 | 100< | 100< | 1.56 | 100< |
| Others | | | | | | |
| Chloramphenicol | 3.13–12.5 | 6.25–12.5 | 100< | 3.13–100 | 3.13 | 3.13–6.25 |
| Nalidixic acid | 3.13–6.25 | 6.25 | 6.25 | 6.25–100 | 3.13–6.25 | 6.25 |
| Trimethoprim | 400≦ | 400≦ | 400< | 400< | 400< | 50 |

a) Biotype was represented in the previous report [3].
b) These isolates originated from mares with metritis.
c) Seventeen of 19 isolates originated from mares with metritis, one from a stallion and one from a foal.
d) These isolates originated from foals.
e) These isolates originated from stallions.

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要　約

馬由来 *Klebsiella pneumoniae* の薬剤感受性（短報）：江口正志・國安主税[1]・大前憲一[2]・柏崎　守[1]（家畜衛生試験場北海道支場，[1]家畜衛生試験場，[2]動物医薬品検査所）——馬由来 *K. pneumoniae* 34株の38薬剤に対する感受性を調べた．GM, CEX, CL, PL, FZ には全株が感受性を示した．菌株が多様な感受性を示した12薬剤（DSM, FRM, KM, SPCM, SM, CTC, DOXY, OTC, TC, CP, NA, TMP）の最小阻止濃度をもとに薬剤感受性型を区別し，生物型と比較した．薬剤感受性型は必ずしも生物型に特異的ではなかったが，生物型3及び4の菌株はそれぞれ1種類の薬剤感受性型しか示さなかった．