Efficacy of Antibiotic Treatment in Cows Affected with Cystitis and Those Affected with Pyelonephritis Due to Corynebacterium renale

Takashi HIRAMUNE* and Nobuo MURASE**
Hokkaido Branch Laboratory, National Institute of Animal Health, Hitsujigaoka, ToyoHIRA, Sapporo-shi, Hokkaido 061-01

Ryo YANAGAWA
Department of Hygiene and Microbiology, Faculty of Veterinary Medicine, Hokkaido University, Sapporo-shi, Hokkaido 060

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Abstract. The efficacy of antibiotic treatment in Corynebacterium renale infection was examined employing 26 cows whose serum antibody to C. renale was negative and thus diagnosed as to be suffered from cystitis alone and 19 cows whose serum antibody was positive and diagnosed as to be affected with pyelonephritis.

The therapy was more successful in cows affected with cystitis alone than those affected with pyelonephritis. With regard to cows affected with cystitis alone the treatment was successful in the case of infection with C. renale of types I and II, but was unsuccessful in the case of infection with type III organisms.

It was demonstrated in the preceding paper [5] that cystitis and pyelonephritis in cows infected with Corynebacterium renale could be differentially diagnosed by serum antibody response to the organisms; antibody response was positive in cows affected with pyelonephritis but negative in those with cystitis alone. Thus, a cow infected with C. renale and showing hematuria is diagnosed as being suffered from pyelonephritis when antibody response is positive, but as being suffered from cystitis alone when antibody response is negative.

The disease has been considered to progress from cystitis to pyelonephritis; C. renale infection in cows is an ascending one [3]. Therefore, it would be anticipated that the antibiotic treatment would be more successful in cows affected with cystitis alone than in those affected with pyelonephritis.

The present study was made to confirm that therapeutic efficacy would be different between cows affected with cystitis and those affected with pyelonephritis. For this purpose cows infected with C. renale which had already taken medication with antibiotics were divided into 2 groups, namely one group suffering from cystitis and the other from pyelonephritis, on the basis of serum antibody response. The data obtained are described in this paper.
Materials and Methods

Cows: Forty-five Holstein-Friesian cows, 2 to 12 years old, were employed. All the cows excreted hematuria, from which C. renale was isolated, and body temperature was elevated in some cases.

Treatment: Penicillin, 3,000,000 to 6,000,000 units per day was usually given intramuscularly for 3 to 5 consecutive days and streptomycin and other antibiotics were additionally given to some of them. Thus, the antibiotics and dosage given per individual was not always the same. Table 1 shows the mean total dosage of antibiotics given per head. There was only a slight difference in the dosage of antibiotics given between cows affected with cystitis alone and those affected with pyelonephritis.

Collection of samples: Serum and urine were collected from all the cases before treatment and about 30 days after the completion of treatment.

Detection of C. renale: The method was described previously [4].

Antibiotic susceptibility test on isolates: Sensitivity disk (Eiken Co., Ltd.), was used.

Diagnosis of cystitis and pyelonephritis: Cystitis and pyelonephritis were differentially diagnosed by demonstration of antibody response in serum to C. renale. For examination of antibody response, immunodiffusion test was used in the same way as reported by Yanagawa et al. [6].

Determination of therapeutic efficacy: The effect of therapy was evaluated as follows: Successful; the isolation of C. renale from urine was negative about 30 days after treatment and clinical signs completely disappeared, unsuccessful; elimination of C. renale from urine failed or clinical signs unchanged.

Results

Therapeutic efficacy of antibiotics given to cows infected with C. renale is shown in Table 2. Antibiotic therapy was successful in 19 of 26 cows suffering from cystitis alone. On the contrary, unsuccessful result was obtained in 12 of 19 cows suffering from pyelonephritis. There was statistical difference (p=0.05) in the therapeutic efficacy of antibiotics between these two groups of cows.

With regard to cows suffering from cystitis alone, there was a close relationship

Table 1. Mean total dosage of antibiotics given per head infected with C. renale

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Cows suffering from cystitis alone</th>
<th>Cows suffering from pyelonephritis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I* (18)</td>
<td>II (2)</td>
</tr>
<tr>
<td>Penicillin (million U)</td>
<td>23.8</td>
<td>30.0</td>
</tr>
<tr>
<td>Oxytetracycline (g)</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Streptomycin (g)</td>
<td>6.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Chloramphenicol (g)</td>
<td>0.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Spiramycin (g)</td>
<td></td>
<td>1.6</td>
</tr>
<tr>
<td>Erythromycin (g)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remarks.

*: Type of C. renale infected.
**: Number of cows infected with indicated type.

Table 2. Therapeutic efficacy of antibiotics in cows infected with C. renale

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of C. renale infected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>Cows suffering from cystitis alone</td>
<td>16/18</td>
<td>2/2</td>
</tr>
<tr>
<td>Cows suffering from pyelonephritis</td>
<td>4/10</td>
<td>0/1</td>
</tr>
</tbody>
</table>

Remarks.

Numerator: Number of cows proved to be successfully treated.
Denominator: Number of cows treated with antibiotics.
between therapeutic efficacy and type of *C. renale* infected (Table 2). In the case of infection with *C. renale* of types I and II, good efficacy was obtained in 18 of 20 cows. On the other hand, no efficiency was observed in all cows, except 1, infected with type III organisms. Thus, in cases of cystitis the difference of therapeutic efficacy caused between by types I and II organisms, and by those of type III was statistically significant (*p*<0.01). However, such a relationship was not evident in cows with pyelonephritis.

Antibiotic susceptibility test was performed on 28 isolates of *C. renale*. Seventeen of them were obtained from cows treated successfully and 11 from cows received unsuccessful treatment. All 28 strains examined were found to be sensitive to penicillin, oxytetacycline, streptomycin, chloramphenicol, spiramycin and erythromycin.

The changes in the detection of serum antibody were examined in cows affected with pyelonephritis. Serum samples were collected from 4 cases several times after treatment. In one case serum antibody was detected on the 14th day, but not on the 43th day after treatment. In other 3 cases, the changes from positive to negative were observed individually during 109 to 143, 210 to 235 and 215 to 257 days after treatment.

**Discussion**

The therapeutic efficacy of antibiotic treatment in *C. renale* infection was examined employing cows suffering from cystitis alone and from pyelonephritis. As stated above in cows suffering from cystitis alone, the therapy was rather successful when infected with organisms belonged to types I and II, but failed when infected with organisms belonged to type III. On the other hand in cows suffering from pyelonephritis, unsuccessful results were always obtained irrespective of types of organisms infected.

The similar findings were obtained from the therapy of urinary tract infection usually due to *Escherichia coli* in human beings, namely in the case of cystitis more successful results were obtained compared with the case of pyelonephritis [2].

In this experiment all 28 strains isolated from diseased cows were sensitive to penicillin and other antibiotics employed, and the dosage per head of antibiotics administered to cows suffering from cystitis alone or pyelonephritis respectively were nearly equal. Accordingly it would be considered that such pathological conditions of host as pyelonephritis and the severity of lesion, rather than the acquisition by parasite of drug resistance, would be primarily decisive for the efficacy of antibiotic treatment. The fact that the antibiotic treatment of cystitis due to the infection of *C. renale* type III often failed would be correlated with our previous observation that the lesions of urinary bladder due to the infection with type III were evidently severe compared with those due to the infection with types I and II organisms [4].

Andersen et al. [1] reported that the *E. coli* antibody titer of serum in patients decreased to the normal level in 2 to 4 months after treatment with sulfoisoxazole. In this study the detection of serum antibody employing immunodiffusion test failed within 2 to 9 months, reflecting evidently the wide individual difference, after the termination of therapy. In the future it will be necessary to trace the sequential change of serum antibody titer in many treated cases to obtain more detailed informations.

From the above mentioned results, it
seems promising, even if limited, to make prognosis concerning the efficacy of medication from the examination of types of causative \textit{C. renale} and the differentiation of cystitis from pyelonephritis in cows infected with the organisms.

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References


