ANERGY TO TUBERCULIN IN BEEF CATTLE

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SUMMARY: Various aspects associated with anergy to tuberculin were investigated in a total of 78 tuberculous cattle. Forty-six (59%) had single lesions and 32 (41%) had multiple lesions. Forty-three (55.1%) had lesions in the lungs or associated lymph nodes and 23 (29.5%) showed multiple involvement of these tissues. Nine anergic cattle had generalised tuberculosis. Histological examination of lesions from 38 animals showed that the majority were of the progressive type.

When bovine PPD tuberculin was used more cattle were anergic to the 0.1 mg than to the 0.2 mg dose and fewer tuberculous cattle were detected with either dose if tests were read at 96 h rather than 72 h. Other factors thought to contribute to anergy are discussed with special reference to its relative importance in cattle with pulmonary infection.

Introduction

Anergy to tuberculin is defined as the failure of an animal with visible evidence of tuberculosis to show a palpable cutaneous delayed hypersensitivity response to a tuberculin, at the time when the test is read. Such tests in cattle are normally read at 72 or 96 h after injection of tuberculin.

Anergy is presumed to occur at 3 stages in the development of the disease. It is said to be associated with very early infection (Legg and Maunder 1941), the healing of lesions or immunopathological changes in advanced disease (Legg and Maunder 1940a, b; Maunder 1948). In addition, various factors are thought to contribute to anergy in range cattle. Stress associated with parturition (Kerr et al 1949), malnutrition, exhaustion and transport (Kleeberg 1960) may reduce the degree of reactivity to tuberculin. It is also known that certain unavoidable errors are inherent in the test procedure. These are associated with the operator, the dose used and the time at which the test is read. The anergic animal is thought to be important as a potential source of tuberculous infection, as its failure to respond to a tuberculin test, will result in its return to the herd.

In this study of a total of 78 anergic cattle from northern Australian beef herds, we examined the distribution and nature of tuberculous lesions in all animals. Histopathological characteristics of lesions have also been studied in 38. The cattle were all individually identified and originated from various properties in northern Queensland and the Northern Territory and formed part of studies concerned with the diagnosis of tuberculosis.

Forty-six (59%) cattle had single lesions and 32 (41%) were found to have multiple lesions of tuberculosis. It will be seen from Table 1 that 55.1% had lesions in the lung tissue or associated lymph nodes and that 29.5% showed multiple involvement of these tissues.

A further distinction not shown in Table 1 was made of those cattle with a more advanced form of the disease, so-called generalised tuberculosis. For the purpose of this study generalised tuberculosis is defined as the presence of lesions in 2 or more of the following sites: head, thoracic cavity, abdominal cavity or body lymph nodes, but excluding the combination of head and body lymph nodes. A total of 9 cattle (11.6%) had generalised tuberculosis of which six (7.7%) had lung tissue involvement.

Representative lesions in 38 anergic cattle were classified according to histopathological characteristics as either recent and active, progressive, quiescent or inactive (Lepper et al 1973). The results are shown in Table 2.

TABLE 1

<table>
<thead>
<tr>
<th>Distribution of Lesions in Anergic Tuberculous Cattle</th>
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<tr>
<td>Site of Infection</td>
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<tr>
<td>Single lesions in lung or associated lymph nodes</td>
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<tr>
<td>Multiple lesions including sites in the lung and associated lymph nodes</td>
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<tr>
<td>Single lesions in areas other than the lung and associated lymph nodes</td>
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<tr>
<td>Multiple lesions in areas other than the lung and associated lymph nodes</td>
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<tr>
<td><strong>Total</strong></td>
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* 6 generalised
† 3 generalised

The proportion of single to multiple lesions in this group was similar to that found for all anergic cattle. It will be seen that lesions were predominantly of the progressive category indicating that infection was well established.

In a particular trial to compare the ability of 2 different doses of bovine PPD tuberculin* to detect tuberculous cattle, animals were selected on the basis of a positive test with HCSM tuberculin 6 weeks previously. Sixteen of these animals were anergic to 0.1 mg and 9 were anergic to 0.2 mg at one or other of the 3 reading times, 48, 72, and 96 h.

Eight cattle were anergic to the 0.1 mg dose of PPD tuberculin at all reading times, but only 1 animal was anergic to the 0.2 mg dose at these times. The 9 animals were between 4 and 7 years of age and were in poor to store condition. Five cattle were anergic at 2 of the 3 reading times. Two of these (0.1 mg) were anergic at 48 and 96 h, and 2 animals (0.1 mg) and 1 (0.2 mg) were anergic at 72 and 96 h. The age of the animals ranged between 2 and 7 years and all were in store condition. Eleven cattle were anergic at only 1 reading time. Two cattle (0.2 mg) anergic at 48 h, were aged 2 and 2.5 years respectively and were in store and forward store condition. One at each dose rate was anergic at 72 h. The ages were 3 and 7 years and their condition was poor and store respectively. Four animals at the 0.2 mg dose rate and 3 at 0.1 mg were anergic at 96 h, their age ranged from 1 to 9 years and they were in store to forward store condition. None of these 25 animals was in an advanced state of pregnancy or had recently calved.

The distribution of lesions in the total of 25 anergic cattle in this trial included 20 animals with single lesions, 3 with multiple lesions and 2 with generalised lesions. Of the 2 latter, each animal was anergic at only one reading time. With a dose rate of 0.2 mg bovine PPD tuberculin and the readings taken at 48 and 72 h, 3 cattle were anergic to the test at each reading.

*Commonwealth Serum Laboratories, Melbourne


In the above-mentioned trial, 5% of all cattle with lesions when tested with 0.2 mg bovine PPD tuberculin were anergic at 48 or 72 h. However, when the 0.1 mg dose was used in a similar group and readings taken at the same times, 20% of the cattle were anergic. It would appear that if the dose of bovine PPD tuberculin is increased to 0.2 mg for caudal fold tests of range cattle, a more discernible reaction is produced in animals with a low level of sensitivity. Apparently the most favourable time for reading the test with this tuberculin is between 48 and 72 h. Readings at 96 h increased the number of anergic cattle to 28% and 10% for the 0.1 mg and 0.2 mg doses respectively.

It has been noted in our study that the majority of the 38 anergic cattle whose lesions were studied histologically had progressive lesions of tuberculosis. It would have been expected that such cattle would have reacted to tuberculin. It is possible that the presence of progressive lesions provide sufficient repeated antigenic stimulation in some cattle leading to temporary depression of skin reactivity (Corner et al 1976). There is insufficient data to determine the influence of age, sex, nutrition or parturient status of the cattle in this study in regard to anergy to tuberculin.

It is apparent from the variability in individual test results at different times that factors connected with the operator and the test itself may influence the result. These factors are likely to be associated with the intradermal deposition of tuberculin in the caudal fold, the age and condition of the tuberculin, the accuracy and consistency of subjective assessment and unavoidable variation in the time of reading.

Legg and Maunder (1940a and 1941) found that 50% of anergic, culled Australian dairy cattle had generalised lesions of tuberculosis. Our data, concerning anergic animals, compiled from northern range cattle which had not been recently tuberculin tested with HCSM, showed that only 15% had generalised tuberculosis. It is possible that the marked disparity of these two sets of data may be due to the different levels of morbidity and mortality in range and dairy cattle with tuberculosis.

Cattle with lung lesions have the greatest potential to spread infection in the northern environment (Francis 1972; Lepper and Pearson 1973; Tammemagi et al 1973). In the northern environment of Australia, it has been shown that...
the tuberculin test using 10,000 International Units of HCSM will detect 90% of tuberculous cattle at any one test (Lepper and Newton-Tabrett 1973; Lepper et al 1973). Thus approximately 10% of cattle may be anergic to tuberculin of this potency. From Table 1 it is apparent that 55% of anergic cattle can be expected to have lung lesions. Thus it could be assumed in any group of 100 tuberculous cattle, approximately 10 animals would be anergic if tuberculin tested, 5 of which could be expected to have progressive lung lesions. Therefore in herds where a prevalence of 5% bovine tuberculosis occurs, among every 400 head of cattle tested, it is anticipated there would be one anergic animal with lung lesions.

However, the mean prevalence of bovine tuberculosis in Queensland and the Northern Territory in 1975 was estimated to be 0.5% (Anon 1974-75; M. J. Carpenter, personal communication). Thus, from the data presented so far it is likely that only one animal with lung lesions would be anergic to tuberculin in every 4000 head subjected to the test. Except for certain properties where the prevalence is high, anergy to tuberculin is therefore not likely to be as important as formerly thought, provided that a sufficiently high dose of tuberculin is used, the test read at the optimum time for the tuberculin and testing is carried out on a regular basis.

References

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BOOK REVIEW

CLASSIFICATION OF TUMOURS

A special issue* completes the classification of the tumours of domestic animals, the first part of which, comprising classification of the tumours of 10 body sites, appeared in the Australian Veterinary Journal 50 (1-2) (1974). This project arose from a meeting of investigators on comparative oncology, convened by the World Health Organisation (WHO) in 1966 with the aim of developing an international classification of tumours of domestic animals corresponding to that of human tumours being developed by WHO. The main purpose was to reveal similarities and differences between tumours in man and in domestic animals and thus provide a basis for research in comparative oncology and to help advance veterinary pathology.

Classifications of primary tumours of 11 body sites are included: the upper and lower alimentary tract, liver and biliary system, pancreas, ovary, female genital tract, adrenal gland and paraganglia, kidney, prostrate and penis, nasal cavity, and bones and joints. Translations into French of the tabular classifications of all 21 body sites are included. References have been kept to a minimum, but each classification is well illustrated with photomicrographs. The species covered are: horse, ox, sheep, pig, dog, and cat. Generally the classifications are based on personal study by the author and his collaborators.

Although all pathologists may not agree entirely with the classifications, it is hoped that they will adopt them as standards for the sake of facilitating communication between cancer workers with different backgrounds, and especially between medical and veterinary pathologists.

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