LATENT BRUCELLOSIS IN FARMERS

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The incidence of undulant fever in Great Britain is not known. Wilson (1932) estimated it to be between 400 and 500 new cases per annum. Dalrymple-Champneys (1960) regards this as an underestimate, and puts the figure at about 1,300 per annum. In a recent survey of brucellosis in Oxfordshire, Bothwell (1960) found three hospital admissions in one year from a population of one million. The number of cases diagnosed but not admitted was not known, but, assuming the admission rate of 33% suggested by Smith (1951), Bothwell arrived at an annual incidence of 9 cases per annum per million people. If the incidence is uniform over the country as a whole this would suggest that the annual incidence for Great Britain is about 450 cases. As Dalrymple-Champneys has pointed out, undulant fever is often a mild illness which can run its course or be terminated by antibiotics without being diagnosed. It seems likely, therefore, that the actual incidence is considerably in excess of the number of cases diagnosed.

In the United States undulant fever is now regarded as almost entirely an occupational disease of those who handle infected animals or meat. Spink (1956) concluded that not more than 10% of cases were due to consumption of unpasteurized milk. The picture in Great Britain appears to be quite different. Only 236 of the 1,500 patients studied by Dalrymple-Champneys were in exposed occupations. In the Oxfordshire survey only 22% of the adults acquired their infection by direct contact.

Epidemiological studies of people in exposed occupations have revealed that a certain proportion of them have brucella agglutinins in their serum, although they have never had an attack of undulant fever. Since, with few exceptions, the presence of brucella agglutinins is due to invasion of the tissue at some time by brucella organisms, it is concluded that these people have had a latent brucella infection (Spink, 1956). Similarly, a proportion of people in these occupations give a positive reaction with the brucellin skin test. This reaction is due to a specific hypersensitivity to the brucella antigen—a state which can be produced only by invasion of the tissues by brucella organisms (Spink, 1956). It has therefore the same significance as the presence of agglutinins in the serum.

Arblaster and Prior (1956) performed brucellin skin tests and agglutination reactions on 18 Warwickshire veterinarians. All except two of these gave positive skin reactions, some of them strongly positive and incapacitating. Only 2 of the 18 had agglutinins present before the skin test. Two weeks after the skin test four had agglutinins to a titre of 1 in 20, one to a titre of 1 in 40, and two to a titre of 1 in 320.

Taking as their criterion a brucella agglutinin titre of 1 in 80, Damon *et al.* (1950) found a latent infection rate

of 3.7% in 190 male farm-workers from Indiana. So far as we know there have been no similar studies of the farming population in this country.

Present Investigation

The subjects of this study were 20 volunteers from one general practice. Of 22 men who were approached only two declined to take part. The 20 comprised 13 self-employed farmers, three farm managers, one pupil, and three farmers' sons working on their fathers' farms. Their ages ranged from 19 to 73. No man known to have had undulant fever was included. Fifteen different farms were represented in the survey.

At the first visit a medical history was taken, a detailed inquiry being made into all febrile illnesses. Blood was taken for the first agglutination test and a brucellin skin test was performed. This was read 48 hours later and the result placed in one of four categories. (1) Very strongly positive (+++): induration of 1 cm. diameter or more; erythema of 3 cm. diameter or more; general symptoms such as malaise, headache, or/and limb pains. (2) Strongly positive (++) : a reaction of the same dimensions as (1), but with no general symptoms. (3) Positive (+) : induration of 0.5–1 cm.; erythema of 2 cm. (4) Negative (–) : erythema only, or no reaction at all.

At the third visit, between two and four weeks after the first, the second blood sample was taken. Two men failed to attend for the second test, and in one other the second specimen was mislaid.

The agglutination tests were performed by the technique described by Spink (1956). A fixed dose of antigen mixed with appropriate serum dilutions is read at 48 hours after incubation at 37° C. This gives easily readable results and clear end-points.

Results

The results are summarized in the accompanying Table. The brucellin test was very strongly positive in five, strongly positive in five, positive in one, and negative in nine. Antibodies to a titre of 1 in 40 or more were present at the first test in eight (three brucellin +++, two ++, and three –) and at the second test in 10. Two others had antibodies to a titre of 1 in 20 at the first test. Eight showed a rise in titre at the second test. In three of these the increase was threefold or greater (all brucellin +++); in one it was twofold (brucellin ++); and in four the titre was doubled (one +++, one ++, one +, and one –). In the one negative reactor the rise was only from nil to 1 in 20.

Summary of Results

Sub- ject	Age	Brucellin Test	1st Agglutination Test	2nd Agglutination Test
1	47	+++	Nil	1/640
2	50	+++	1/320	1/640
3	27	+++	1/320	1/320
4	73	+	1/20	1/40
5	39	++	1/40	1/40
6	36	+++	1/40	1/640
7	42	–	Nil	Nil
8	39	+++	–	1/80
9	35	++	1/20	1/20
10	32	+	Nil	Nil
11	19	–	1/40	1/40
12	60	++	Nil	Nil
13	19	–	1/80	–
14	21	++	1/40	1/80
15	38	–	Nil	1/20
16	50	++	1/40	1/160
17	29	–	Nil	Nil
18	24	–	–	–
19	32	–	–	–
20	37	–	–	–

Evidence of Undiagnosed Undulant Fever

None of the participants showed any evidence of undulant fever at the time of investigation. From our inquiries into their past histories, however, we believe that two of them had undiagnosed attacks in the past.

Case 6.—This man at first denied any history of febrile illness. The symptoms produced by his brucellin test (malaise, headache, limb pains, sweating) recalled to his memory an illness with exactly similar symptoms which he had suffered 10 years previously. It lasted three months, but was not serious enough to cause more than a few days' loss of work. His doctor found no abnormality, and sent him to hospital for pathological tests. It seems that these were of little help, because no satisfactory diagnosis was made and the symptoms disappeared spontaneously.

It was not possible to obtain further clinical details or the results of the pathological tests. Nevertheless, we believe that the patient's description of his illness is fully consistent with a diagnosis in retrospect of the ambulant form of undulant fever.

Case 12.—Between 1936 and 1940 this farmer had experienced several bouts of fever with profuse sweating, each one lasting several days. At the time he was having much trouble with contagious abortion in his milking herd. His doctor was unable to find the cause of the pyrexia, but commented that the clinical picture resembled malaria. The patient had not, however, been abroad. About the year 1950 he had a prolonged pyrexial illness which kept him off work for three months, including convalescence. The pyrexia was swinging and accompanied by profuse sweating, malaise, and limb pains. There was no response to penicillin or sulphonamides, but the fever subsided promptly with chloramphenicol and there was no recurrence.

Discussion

If either a positive brucellin test or brucella agglutinations to a titre of at least 1 in 40 are taken as evidence of past or present latent infection, then the latent infection rate in this series is 14 out of 20, or 70%. The area is one of mixed arable and stock farming, with no preponderance of dairy herds, and there is no reason to think that these results could not be reproduced in other parts of the country with a similar agriculture. Vaccination of cattle with strain 19 has led to a decreased incidence of abortion (Stableforth, 1960). The proportion of positive milk samples has also decreased, but not to the same extent. In the veterinary section of the Oxfordshire brucellosis survey, between 4.4 and 8% of farms were found to be producing infected milk at the time of the test (McDiarmid, 1960). In spite of recent improvements in the abortion rate in cattle, it appears from the present survey that brucella infection is still widespread among farmers. Although the majority of those who contract the infection suffer no ill-health, it is interesting to find that 2 out of 20 (10%) in this series have almost certainly had undiagnosed undulant fever. This supports Dalrymple-Champney's contention that the real incidence of the disease is higher than its reported incidence. It also emphasizes the importance of considering undulant fever whenever a farmer or farm worker presents with a pyrexia of unknown origin or with vague symptoms such as malaise, limb pains, and sweating.

From the results of the agglutination reactions shown here it is evident that a titre of up to 1 in 320 is of no diagnostic value in a farmer, nor is a rise in titre after a positive brucellin test.

Summary

A survey of 20 farmers for latent brucellosis is described. Brucellin skin tests were performed, and serum agglutination tests both before and after the skin test.

Taking a positive brucellin test or the presence of agglutinins to a titre of 1 in 40 as the criterion of latent infection, we found a latent infection rate of 70%. As a result of inquiries into their past medical histories it is concluded that two of the farmers have almost certainly suffered from undiagnosed undulant fever.

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INCIDENCE OF NON-CENTRAL FIXATION IN CHILDREN WITH SQUINT

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Amblyopia, or diminution of vision in one eye, has long been recognized as a major factor to be reckoned with in the treatment of children with squint. A monocular visual deficiency or a recognizable squint is frequent in the child population of pre-school (under 5) and school (5–15) years in the urban areas in this country, and may reach a figure of 5%. Those children who have monocular convergent squint may develop amblyopia in the deviating eye. It is generally accepted that an eye may be regarded as amblyopic when the visual acuity is less than 6/12 or when the affected eye sees two or more lines fewer than its fellow on the Snellen chart, in the absence of pathological change.

Considerable interest has been taken in this subject recently, and it has been shown by Cole (1959) that 7.7% of children up to the age of 10 are amblyopic in one eye, compared with a figure of 5.27% for all age-groups in the adult population. The greater proportion of the amblyopia of childhood is due to squint, and the classical treatment—occlusion of the fixing eye (when performed up to the age of 7)—results in cure or improvement in visual acuity in those patients who persevere in the treatment. There remains, however, a number of patients in whom the amblyopia is intractable; in a recent series at the Manchester Royal Eye Hospital this intractability was found in 17% of patients under 10 with convergent strabismus (Naylor and Wright, 1959). A large proportion of these amblyopes