UNDULANT FEVER IN CHILDREN

BY


(From the Hospital for Sick Children, Great Ormond Street)

Since the discovery of the part played by the brucella abortus organisms in the production of undulant fever in man, increasing numbers of cases have been reported. In this country a series of three hundred cases has been recorded by Dalrymple Champneys (1936). This series agrees with all others published in that, first, it shows a great preponderance of cases amongst males—out of two hundred and fifty-five cases whose sex was known, one hundred and seventy were males and eighty-five females; secondly, it emphasizes the comparative rarity of the condition amongst children, there being only twelve cases under ten years of age (Champneys, 1935). From Scotland, Beattie and his co-workers (1935) have reported ninety-seven cases collected between 1929 and 1934; five of these cases were below ten years and five between the ages of ten and twenty years.

This present paper is a study of eight cases seen, either in private or at the Hospital for Sick Children, Great Ormond Street, between the ages of six and fourteen-and-a-half years. Children comprise the largest milk-consuming section of the community, but the rarity of the disease among them has not yet been satisfactorily explained. It is probable that many cases are never recognized.

Clinical features

Of the eight cases the youngest was six years old, and only one was a girl. In every case the beginning of the illness was abrupt, with signs of an infection of the nasopharynx, and the diagnosis was either that of a common cold or of influenza; it was only the persistence of the temperature which attracted attention. Sweating was a prominent feature in only two of the cases; fatigue was marked in one case. None complained of headaches or joint-pains; the appetite was not impaired. No case had a rigor. The temperature reached 104°F in one case; more usually it ran an irregular course between 99° and 100·5°F. In four instances the bouts of fever recurred over a period of four months; in one case they persisted for a year. One boy attended the outpatient department for a year with recurrent coughs and colds, and was only diagnosed as a case of undulant fever after his sister had been admitted to the
wards with the same disease. An enlarged spleen was found in one case otherwise the physical examination was negative.

Diagnosis

Agglutinations.—These were positive in every case to a titre of 1 in 500 or higher. Case 4 emphasizes the importance of carrying the agglutinations sufficiently far to detect a positive result in the presence of a pro-zone.

Skin tests.—Using 0·2 c.c. of a vaccine containing both abortus and melitensis organisms, skin tests were done on the patients, and gave in each case a strongly positive reaction. An attempt was made to use the test to discover possible latent cases of undulant fever among patients in the wards at Great Ormond Street. A preparation of brucellin containing both abortus and melitensis organisms was used: 0·1 c.c. of a 1 in 100 dilution was injected intracutaneously. A positive reaction, as given by a patient with the disease, was taken as an erythematous reaction about 1½ inch in diameter occurring around the site of the injection within twenty-four hours. Out of sixty cases investigated in this way, two gave such a reaction; agglutination reactions were, however, entirely negative in both cases. It would appear therefore that the skin test by itself does not give reliable evidence of the disease.

Blood picture.—An anaemia with an absolute or relative lymphocytosis is mentioned by Dalrymple Champneys (1935) as the most usual finding. The blood count in two cases in this series gave such a picture, but one case had an increased number of both red and white cells.

Blood culture.—This examination was not performed upon any of the cases in this series.

Case Histories

Case 1. Male, aged six years, was taken ill on August 1, 1934. Agglutinations against the brucella organisms on August 11 were negative. His temperature continued to keep up, and on October 22 his blood agglutinated b. abortus to a titre of 1 in 500 and b. melitensis to 1 in 200. Both skin tests were positive. A differential white cell count showed 30 per cent. polymorphs, 61 per cent. lymphocytes and 1 per cent. monocytes.

Case 2. Male, aged fourteen-and-a-half years, was seen in March, 1934. He had been running a temperature up to 100°F. since the beginning of the year. His illness had appeared to start with a mild otitis. He had not vomited, but he had a marked anorexia. Physical examination showed nothing abnormal except for a furred tongue. An x-ray of his chest showed enlarged hilar glands. His temperature continued, but, apart from night-sweats, he appeared to be in excellent health. In December 1934, almost a year after the onset of the disease, his blood gave a strongly positive agglutination with b. melitensis.

Case 3. Male, aged six-and-a-half years, came from Yorkshire. He began with a feverish cold in November 1934, and from then on his temperature continued between 99°F. and 100°F. On January 16, 1935, physical examination showed nothing abnormal. An x-ray of his chest showed enlarged hilar shadows. The undulant fever skin test was strongly positive. His blood agglutinated b. abortus to a titre of 1 in 500. His father kept a model dairy where nothing but Grade A milk was sold; the cattle were all prize cattle.
His nurse had a sister suffering from the same condition in Scotland and she was a contact of the child.

**CASE 4.** Male, aged eight years, came from Guildford. He was taken ill in October 1934 after catching cold. His temperature ranged from 99° to 100°F, and he lost 7 lb. in weight. Some teeth were extracted, as they were thought to be the cause of the trouble. Physical examination showed nothing abnormal. The Mantoux test was negative. A blood count showed: 5,000,000 R.B.C.; 4,700 W.B.C. with 48 per cent. of polymorphs. The undulant fever skin test was strongly positive. The agglutinations against b. abortus and b. melitensis were negative to a titre of 1 in 500. Later the test was positive to a titre of 1 in 1,500 at another laboratory.

**CASE 5.** Female, aged eight years nine months, was seen at Great Ormond Street on November 1, 1934. She had been ill with a temperature up to 100°F. for the previous two weeks. Physical examination showed nothing abnormal. X-rays of the chest and antra were normal. The Mantoux test was negative; the undulant fever skin test was strongly positive. A blood count showed: 6,000,000 R.B.C.; 8,100 W.B.C. with 56 per cent. polymorphs; haemoglobin 100 per cent. Examination of the stools and urine was negative. Her blood agglutinated b. abortus and b. melitensis up to a titre of 1 in 500. In hospital the temperature was 100°F. on admission, but by the fifth day was normal. She was discharged at the end of three weeks well.

**CASE 6.** Male, aged five years, was admitted to Great Ormond Street on February 5, 1937, with a history of the sudden onset of pyrexia at the beginning of January; the fever lasted fourteen days. The temperature was normal every morning, but rose in the evenings to 102°F. The child appeared to be quite well, but towards evening was noticeably tired and flushed. Appetite was good; the bowels acted regularly; there was no sickness, undue sweating, or complaint of pain. On examination he was a healthy, well-covered child with no abnormal physical signs in chest. The cardiovascular system was normal. The tonsils were small; there was no glandular enlargement. The spleen was enlarged to about two fingerbreadths below left costal margin. The temperature was normal while in hospital. The sedimentation rate (micro-method) was 9 mm. in first hour. Mantoux and Wassermann reactions were negative. Blood count: 3,720,000 R.B.C.; Hb. 70 per cent.; C.I. 0·9; 5,200 W.B.C.; polymorphs, 48 per cent.; lymphocytes, 46 per cent.; monocytes, 6 per cent. Agglutination with b. abortus was positive up to a titre of 1 in 1,000; there was slight agglutination with b. melitensis. [This case has been recorded elsewhere (Hardwick, 1937).]

**CASE 7.** Male, aged eight-and-a-half years, was seen in January 1935 with a history of a continuous temperature ranging from 99° to 101°F. for the previous few weeks. Apart from this the child appeared quite well. There was a history of contact with a case of tuberculosis, but an x-ray of the chest was quite normal. There were no abnormal physical signs; the spleen was not enlarged. The agglutination against b. abortus was positive to a titre of 1 in 5,000.

**CASE 8.** Male, aged five-and-a-half years, attended the hospital in July 1934 with a history of frequent colds accompanied by a high temperature during the previous eight months. There were no abnormal physical signs, the spleen was not enlarged. An X-ray of the chest showed enlarged hilar shadows, the sinuses were clear. The Mantoux tuberculin test 1:1,000 was negative. In November 1934 his sister was admitted to the wards suffering from undulant fever and the agglutinations of this boy against b. abortus gave a weak positive reaction.
Undulant fever in man is a relatively benign disease; Dalrymple Champneys (1935) gives the mortality as 3.1 per cent. in nearly three hundred cases. No fatal cases have been reported in children in this country. The disease would appear to start in children with the signs of a catarrhal infection of the upper respiratory tract. Such infections are so common at this age that it can well be understood that many cases of this disease never reach the care of a medical practitioner, let alone that of the serologist who can make the diagnosis.

Most authorities draw attention to the insidious onset of the disease. It would seem possible that in children an abrupt onset is more usual. This was so in five of our cases, and Robertson (1934) has reported a case of a child who became acutely ill within twenty-four hours of the beginning of her symptoms.

The brucella organisms are susceptible to heat and it is probable that pasteurization is usually successful in killing the organisms. Evidence in favour of this is given by Simpson (1933), who reported one hundred and forty-two cases from Dayton, Ohio. Three years after the introduction of compulsory pasteurization in the district no case had been reported (Beattie et al., 1935). Of Dalrymple Champneys' (1934) series of cases only nine came from London. In addition, there is very little risk of the bacteria being re-introduced into the milk by those who handle it after pasteurization, as may happen in tuberculous and streptococcal infections. Cases have been reported (Jewesbury, 1937) occurring in children whose milk supply has been pasteurized, but it is difficult to exclude the possibility of the consumption of milk from another source.

The small number of cases occurring in children may be accounted for by a threefold explanation. First, many cases are not recognized; secondly, pasteurization is successful in killing any organisms that are in the milk supply; thirdly, the b. abortus and b. melitensis are but mildly pathogenic.

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A comprehensive bibliography appears in the Ministry of Health Special Report, No. 56, prepared by Sir W. Dalrymple Champneys in 1929.
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