A SEROLOGICAL TEST IN THE DIAGNOSIS OF STAPHYLOCOCCAL INFECTION


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The diagnosis of occult staphylococcal infection of bone is often difficult. Two cases are presented that illustrate the use of the anti-alpha haemolysin titration. In the second case this test appears to have been of value as a guide to effective chemotherapy. Such cases are now infrequent and we publish these results in the hope that further knowledge of the efficiency of this test may be sought elsewhere.

CASE REPORTS

Case 1—A man aged forty-seven was admitted to hospital in 1945 having been sent home from Italy with a diagnosis of typhoid fever and pleurisy. He had complained of backache, and radiographs showed a supposedly tuberculous lesion involving the seventh, eighth and ninth thoracic vertebrae (Fig. 1).

He was treated in a plaster bed for ten months, and since the disease then appeared quiescent he was discharged wearing a spinal support. Six months later he developed an occipital abscess, which was incised, and culture of the pus produced a profuse growth of staphylococcus aureus but no tubercle bacilli.

Two years later he was readmitted with pain and swelling in the left knee. This was caused by an abscess, and culture of the pus again grew staphylococci but no tubercle bacilli.

Four years after the onset of the spinal lesion he suffered girdle pain in the eighth and ninth

Fig. 1
Case 1. Figure 1—Early radiograph showing destructive changes at the T.8-9 interspace and similar changes, less clearly shown, between T.7-8. Figure 2—Final radiograph, showing fusion of the affected vertebral bodies.
thoracic dermatomes. He was admitted to hospital. A gradually increasing paraplegia was discovered. Radiographs of the spine showed a sclerosing lesion of the sixth, seventh, eighth and ninth thoracic vertebrae. It was now thought that the whole thoracic disease might be staphylococcal osteomyelitis of the spine and that the paraplegia was secondary to this. The anti-alpha haemolysin titre was estimated for the first time and proved to be 25 units per millilitre (normal—less than 2 units per millilitre) and the leucocyte count rose from 15,000 to 17,000 cells per cubic millimetre (70 per cent polymorphonuclear leucocytes). Penicillin (100,000 units eight-hourly) was given for eighteen days, and the paraplegia rapidly receded. Power in the legs became normal and control of the sphincters returned. One month after the onset of paraplegia the anti-alpha haemolysin level had fallen to 20 units and a month later to 16 units (Fig. 3).

The patient was discharged from hospital twenty-one weeks after the onset of the paraplegia and was walking with slight ataxia. He is now perfectly well and works as a plumber and decorator. Radiographs show healing of the diseased area with bony fusion (Fig. 2).

Case 2—A man aged fifty, who had had sciatica at intervals for seven years, was admitted to hospital in 1953 for exploration of the intervertebral discs. A large prolapse of the disc between the fourth and fifth lumbar vertebrae was removed completely. Operation was followed by fever and malaise, with a white cell count of 8,800 (72 per cent polymorphonuclear leucocytes). The temperature rapidly subsided with a short course of penicillin, but nine days after operation the wound was inflamed and there was a discharge of thin, serous fluid yielding a growth of staphylococcus pyogenes sensitive to aureomycin, chloromycetin and streptomycin. With a course of aureomycin, the inflammation subsided and the discharge ceased. The patient was discharged from hospital one month after the operation.

Three months after operation he developed a pyrexia of 103·6 degrees Fahrenheit, with tachycardia and a generalised aching pain in back, legs and left shoulder. There was no evidence of local infection at this time. The anti-alpha haemolysin titre was 2 units and the white cell count was 7,000 with 84 per cent polymorphonuclear leucocytes. Blood culture was sterile and the sedimentation rate was 7 millimetres/hour (Wintrobe). Radiographs of the lumbar spine showed no abnormality.

Three weeks after the onset of the pyrexia sciatica recurred, but there was still no sign of local infection in the wound. The anti-alpha haemolysin level had risen to 4–8 units per millilitre, and one week later was 16–32 units per millilitre (Fig. 4). Radiographs now showed erosion of the upper surface of the body of the fifth lumbar vertebra—an appearance suggestive of acute osteomyelitis (Fig. 5). The white cell count had risen to 10,750 cells per cubic millimetre and the sedimentation rate was 42 millimetres/hour. A course of aureomycin was given for three weeks and then changed to erythromycin. Further radiographs showed erosion of the lower surface of the body of the fourth lumbar vertebra with an abscess alongside the vertebral body (Fig. 6). But the patient felt less pain and his general condition had improved. The white cell count had fallen to 7,050 and the sedimentation rate was

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**Fig. 3**

Case 1—Graphs showing alterations of anti-alpha haemolysin titre, leucocyte count and erythrocyte sedimentation rate.

**Fig. 4**

Case 2—Graphs showing alterations of anti-alpha haemolysin titre, leucocyte count and erythrocyte sedimentation rate.
30 millimetres/hour. Gradually the back pain and sciatica decreased and he was able to move about in a plastic jacket. Later radiographs showed satisfactory healing of the spinal lesion, and the anti-alpha haemolysin titre had fallen to 8-10 units per millilitre, the sedimentation rate to 29 millimetres/hour and the white cell count to 5,500 per cubic millimetre.

The patient is now free from pain and engaged in his normal employment as a greengrocer.

Comment—The first point of interest is that in spite of the absence of any clear physical signs or of a significant leucocytosis, the cause of this patient's symptoms was indicated by a steadily rising anti-alpha haemolysin titre (Fig. 4). This rose to a level, unprecedented in our experience, of 32 units in spite of a course of aureomycin and chloromycetin. It was decided that the maintenance of this high level of persistence of clinical symptoms indicated that the infection was still active; so the patient was given erythromycin. After this the patient's general condition rapidly improved and his antibody level fell to 8 units, at which it has been maintained.

It will be noted on the chart that though the rise in sedimentation rate bears some relation to the rise of antibody, only a very mild rise was observed in the polymorph count and, had this alone been considered, the diagnosis would have been obscure. The second feature of interest is the fall in antibody titre after treatment by erythromycin when it had remained high after other antibiotics.

DISCUSSION

Sero logical tests in the diagnosis of staphylococcal infection have been of limited use. The reasons for this are too numerous to discuss in this communication and are dealt with in a publication in the press. The test which is most satisfactory from a laboratory point of view is probably the one used here, but all that can be said about it is that it seldom gives so
clear-cut an answer as in these cases. In Table I we set out the anti-alpha haemolysin titres of 259 hospital patients, and it will be seen that in more than half of those with staphylococcal osteomyelitis the titre was not raised. In our experience about 20 per cent of the staphylococci examined do not produce alpha haemolysin; so the infection they cause would not be accompanied by a rise in the specific antibody. On the other hand, it is rare to find a patient with a titre of over 8 units who has not recently had a severe staphylococcal infection.

### Table I

**Anti-alpha Haemolysin Titres of 259 Hospital Patients**

<table>
<thead>
<tr>
<th>Titre Range</th>
<th>Osteomyelitis</th>
<th>Secondary Staphylococcal Infection</th>
<th>No Staphylococcal Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2 units per millilitre</td>
<td>30</td>
<td>20</td>
<td>140</td>
</tr>
<tr>
<td>2-4 units per millilitre</td>
<td>9</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>4-8 units per millilitre</td>
<td>5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>8-16 units per millilitre</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>16-32 units per millilitre</td>
<td>1</td>
<td>1</td>
<td>1</td>
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</tbody>
</table>

Dolman (1935) reported that the normal value for healthy individuals is from 0·3–1 international unit and Murray's (1935) figures were 0·4–2 international units. Both obtained universally high titres in osteomyelitis. Blair and Hallman (1935) in their study of staphylococcal haemolysin in osteomyelitis and other staphylococcal infections found that two-thirds of the sera from the cases of osteomyelitis had a titre of one international unit or less, and only one-fifth of the sera had definitely higher titre averaging 5·1 units, the highest being 17·7 units. They concluded that a high anti-alpha haemolysin titre was not characteristic of staphylococcal osteomyelitis.

We believe that this test is worth doing when the staphylococcal etiology of a bone and joint lesion is under consideration and we would give considerable weight to a rising titre or a titre of over 10 units as favouring a staphylococcal origin.

**References**


