joint takes place by absorption of the central part of the disk (Johnston and Whillis, 1949). The incidence of ossification of the disk was found to average 10% and was commoner in women than in men. There was no correlation between incidence of ossification and age (Trotter, 1934).

Discussion

The above cases are examples of the effect of rheumatoid arthritis on the manubrio-sternal joint. In the early stages there is pain, swelling, and tenderness at the joint site, and in more advanced cases radiological changes. It may be the first manifestation of rheumatoid arthritis (Case 2). The pain may be constant or may show periodicity. In all the above cases it was aggravated by respiratory movements, and in particular by coughing, sneezing, yawning, and deep inspiration, and hence may occur on exertion. It may be severe enough to inhibit full inspiration. The pain has to be distinguished from other causes of chest pain. In Case 5 its precipitation by exertion simulated angina of effort.

Soft-tissue swelling was prominent in two cases. Tenderness over the joint was present in all the cases; as an isolated finding, however, it was not considered sufficient to justify the diagnosis, because this area may be sensitive in normal people, particularly those with a prominent sternal angle.

Radiological changes present in three cases included soft-tissue swelling, irregularity and narrowing of the joint space, erosion of the articular surfaces, and irregular expansion of the articulating ends of the manubrium and sternum. Progression to bony ankylosis was not observed in any of the cases. When bony ankylosis occurs in normal people the radiographs show that the continuity of the bony surfaces is quite smooth (Fig. 4). The joint was best visualized in coned lateral views; routine lateral chest films were usually not satisfactory. The joint picture may be obscured by superimposition of calcification in the second costal cartilage or in the presence of a depressed sternum.

Rheumatoid arthritis commonly affects synovial joints, especially those at the periphery, where considerable mobility is a feature. In contrast, the manubrio-sternal joint is usually cartilaginous and the site of very limited movement.

Involvement of the manubrio-sternal joint is well recognized in ankylosing spondylitis, and was noted in 7 out of 65 cases (Hart, Bogdanovitch, and Nichol, 1950). Osteoarthritis of this joint has been described (Rolleston, 1892-3). There is reference to two cases of osteochondritis (Brailsford, 1934).

Summary

Rheumatoid arthritis of the manubrio-sternal joint is described, with particular reference to five illustrative cases.

The pain may be the first symptom of rheumatoid arthritis. It is mainly related to respiratory movements, and has to be differentiated from other causes of chest pain.

The radiological changes, when present, are best seen in coned lateral views of the joint. The chief features are irregular narrowing of the joint space, with irregular expansion of the articulating bone ends.

We should like to express our thanks to Dr. F. Dudley Hart for encouragement and permission to publish these cases from the Rheumatism Unit of Westminster Hospital. We are also indebted to Dr. W. D. Nichol for his help with the radiology; also the Department of Medical Photography. We are indebted to Miss F. E. Stevens for her invaluable secretarial assistance.

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ERYTHEMA NODOSUM AS INITIAL MANIFESTATION OF BOECK'S SARCOIDOSIS

BY

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[WITH SPECIAL PLATE]

In chest clinics there is increasing awareness of growing appreciation among the profession of the fact that erythema nodosum is often a manifestation of tuberculous infection, and the formerly widely held opinion that this disorder is of rheumatic origin is fast disappearing. It is less widely recognized that the determination of the cause often provides an intriguing exercise in diagnosis for the chest physician who is aware of the multiplicity of disorders with which erythema nodosum has associations, and which tend to be discussed in the more specialized journals to the loss of those whose reading is confined to the more widely circulating publications.

Consideration is primarily given to investigations of tuberculosis as the cause, for it is now commonly considered that the eruption occurs during primary infection at the time when the patient first develops hypersensitivity to tuberculin. In Scandinavia, Wallgren (1938) has shown that 95% of his series of 800 cases gave positive tuberculin skin reactions, though that high percentage is not generally found in this country, where 54% of the cases of Bruce Perry (1944) were tuberculin-positive. In Scandinavia, where primary infection occurs at a later average age than here, 30% of primary infections were associated with the eruption; but in Ireland, where the age of onset of primary infection is earlier, Dunlevy (1949) has shown an incidence of only 2.8%.

Causes other than tuberculosis appear, therefore, to be more frequent in this country than in many others. Collis (1932) revealed that some tuberculin-negative patients showed pronounced skin sensitivity to streptococcal nucleoprotein, and Rotnes (1936) recorded a case in which the eruption appeared on 14 occasions, mostly after attacks of tonsillitis.

Sulphonamide sensitivity is not infrequently a cause, and it may be difficult to decide whether a patient with streptococcal tonsillitis under treatment with sulphonamides has developed erythema nodosum as a result of the streptococcal infection or of the treatment. Similarly, in patients with pyrexia of unknown cause under treatment with sulphonamides, the eruption cannot be attributed to the drug without the exclusion of tuberculosis and other conditions. During the recent war it was commonly recognized that meningococcal septicaemia was a far from infrequent cause.

In California, infection with *Coccidioides immitis* has resulted in a considerable number of cases, but none seem to have been recognized in this country, and

other infrequent causes here and elsewhere are syphilis, gonococcal septicaemia, lymphogranuloma inguinale, leprosy, lymphadenoma, and iodides, bromides, and other drugs. It is difficult as yet to determine the importance of Boeck's sarcoidosis as a factor in the aetiology of the disorder, but, in this country, Kerley (1942, 1943) and, in Scandinavia, Löfgren (1946) and Bjerkelund (1947) have described cases in which sarcoidosis was considered to be responsible.

Below is given the history of three cases in which there are thought to be grounds for arriving at the diagnosis of sarcoidosis.

Case 1

A married woman aged 30 had an attack of erythema nodosum in June, 1949. There had been no preceding illness of any kind. Her chest was x-rayed at a general hospital when the erythema had subsided and again in mid-August, both films showing gross bilateral hilar glandular enlargement and a small shadow in the left subclavicular area. She had no cough and was breast-feeding her few-months-old baby, and, apart from some lassitude, had no symptoms.

In view of the radiological appearances she was referred to the chest clinic late in August. Her weight was 10 st. 7 lb. (66.7 kg.); there was no evidence of glandular or splenic enlargement, no history of uveitis or parotid swelling, and no skin eruption; the E.S.R. (Cutler) was 12 mm. in one hour, and the differential white cell count showed 48% neutrophils, 5% eosinophils, 1% monocytes, and 46% lymphocytes. Examination of the chest revealed a slightly impaired percussion note in the hilar region on both sides posteriorly and a marked *signe d'Espine*. The x-ray film (Plate, Fig. 1) showed gross bilateral lobulated hilar glandular enlargement, an irregular faint shadow in the first left interspace, and hard streaky shadowing in the right upper zone. A Mantoux test performed with 1 in 1,000 O.T. was negative.

On October 11 she weighed 10 st. 4 lb. (65.3 kg.) and felt well; her E.S.R. (Cutler) was 7 mm. in one hour, and Mantoux 1 in 1,000 was again negative. There was now a small cluster of papules on the left side of the forehead and one small gland palpable above the head of the right clavicle. A laryngeal swab contained no tubercle bacilli on culture. An x-ray film showed some diminution in the size of the glandular enlargement, but the striations were increased in the right lung and were now also evident on the left. A film of both hands revealed no abnormality in the bones.

On November 25 she felt as well as she had done for years, and weighed 10 st. 5 lb. (65.8 kg.); the papules and gland were unchanged; Mantoux 1 in 100 was negative; W.R., Kahn, and G.C.F.T. tests were negative; and serum proteins totalled 7.55 g. %. Rather copious fine rales were audible at the right base, but she denied having any cough. An x-ray film showed further diminution in size of the hilar glandular enlargement, but the left subclavicular shadow and the striations in both lungs were unchanged and a few pinhead faint shadows were evident in the right upper zone.

Case 2

A married woman aged 28 had an attack of erythema nodosum in July, 1949, and two weeks previously had had a slight sore throat but had not received any treatment. After four weeks in bed she was referred to the chest clinic on August 30. She then felt perfectly well and weighed 14 st. 1 lb. (89.4 kg.).

General examination and questioning showed no evidence of splenic or glandular enlargement, skin eruption, or history of eye trouble or parotid swelling. No abnormal signs were found on examination of the chest, but x-ray films (Fig. 2) of the lungs showed considerable bilateral lobulated glandular enlargement and faint irregular striations in both lower zones. A Mantoux test with 1 in 1,000 O.T. was negative.

The patient was asked to attend for further investigation a few days later, but went for a holiday to another county

and was not seen until November 1. She was then feeling perfectly well and weighed 14 st. 3 lb. (90.3 kg.), but whilst on holiday in early September she had a recurrence of erythema nodosum. Her E.S.R. (Cutler) was 10 mm. in one hour; the differential count was 66% neutrophils, 3% eosinophils, 4% monocytes, and 27% lymphocytes; the W.R., Kahn, and G.C.F.T. tests were negative; a laryngeal swab showed no tubercle bacilli on culture; radiographs of the hands revealed no abnormality; and chest films showed no alteration in the picture. Mantoux 1 in 1,000 was again negative, but on November 8 a Mantoux test with 1 in 100 O.T. produced a positive reaction of 1½ in. (3.75 cm.) diameter.

On November 29 she weighed 14 st. 1 lb., and felt perfectly well; the serum proteins amounted to 7.9%, and the E.S.R. (Wintrobe) was 12 mm. in one hour. Radiologically the bilateral hilar enlargement was much less, but a few fine faint floccular shadows were scattered in both lungs, especially in the right mid-zone.

Case 3

A youth aged 18 was seen on June 3, 1949, two weeks after the onset of erythema nodosum. There had been no preceding illness other than a slight cold in the head a week before the eruption appeared. He still had a slight cough and some nasal catarrh. His weight was 10 st. 4 lb. (65.3 kg.). No abnormal signs were found in his lungs, but an x-ray film (Fig. 3) showed marked enlargement of the left and slight enlargement of the right hilar shadow. A Mantoux test with 1 in 1,000 O.T. was negative.

He was persuaded to attend for further investigation on October 21. He had felt perfectly well and had been at work from the week after his previous visit. His weight was still 10 st. 4 lb. There was no enlargement of spleen or of glands other than a few in both axillae, but these were apparently secondary to many cuts and abrasions on the hands, sustained at work. There had been no previous trouble with his eyes and no history of parotid swelling. His E.S.R. (Cutler) was 3 mm. in one hour; the Mantoux test, 1 in 1,000, was again negative; the white cell count was 8,800 per c.mm., and the differential count 67% neutrophils, 2% eosinophils, 1% basophils, 2% metamyelocytes, 2% monocytes, and 26% lymphocytes. Serum proteins were 7.55 g. %; the W.R., Kahn, and G.C.F.T. tests were negative; a laryngeal swab showed no tubercle bacilli on culture and there were no abnormal signs in the lungs. X-ray films of the hands showed no abnormality, and lung radiographs revealed considerable diminution in size of the left hilar shadow.

When seen again on December 2 he remained well, and weighed 10 st. 7 lb. (66.7 kg.), Mantoux 1 in 100 was negative, and a film of the lungs showed an almost normal hilar shadow on the right but a moderately increased shadow on the left. At no time was there any evidence of infiltration in the lungs.

Discussion

The tuberculin sensitivity was not recorded in the cases described by Kerley (1942, 1943), who based his diagnosis on the radiological appearances of massive glandular enlargement in the lungs, with or without lung infection. In his earlier series of 12 cases, all adults, eight showed benign infiltration of the lungs, and the hilar glandular enlargement in 10 was bilateral and in two on the left only. He states that in lymphadenoma it is exceptional to see the bronchial glands involved in the early stages, that bilateral lymphatic obstruction has not been described in this disease, and that the large lobulated bronchial glands have not been described in lymphosarcoma or the leukaemias.

In the studies of 185 patients over 15 years of age with erythema nodosum, Löfgren (1946) considers that in adults a non-tuberculous cause is more common than in children. Two of his sarcoidosis cases were diagnosed with the supporting evidence of biopsy, and in one of

there was a positive tuberculin reaction to 1 in 100 O.T. He found that on testing with increasing strengths of tuberculin the skin sensitivity of erythema nodosum patients increases rapidly after the initial threshold had been passed. This may account for the marked reaction to 1 in 100 O.T. in Case 2. This effect does not appear to be due to sensitization produced by the serial testing, as others using stronger test dilutions in much greater number have not produced Mantoux conversion by this means. Löfgren classed all his six cases with bilateral hilar glandular swellings with miliary infiltrations as sarcoidosis, and a further nine with bilateral glandular enlargement and negative reactions or reaction to 1 in 1,000 or 1 in 100 O.T. as probable sarcoids. Most estimates of the incidence of negative reactors to tuberculin in sarcoidosis give figures of 60-70%, the remaining positives tending to be weak reactors. In the case described by Bjerkelund there were a negative reaction to 1 in 100 tuberculin, bilateral hilar glandular enlargement, and only two small pea-sized infiltrations near the hilum.

In sarcoidosis one-quarter to one-half of the cases show an eosinophilia, rarely over 10-15%, and the findings in Case 1 may be significant. In the active phase an increase in serum proteins is often noted and may exceed 9 g. %, the result in Case 3 being possibly a little further supporting evidence.

Whilst it may be regretted that histological proof of the diagnosis could not be obtained, it was not considered justifiable to ask the patients to submit to the inconvenience of the necessary investigations, but on the above criteria the three cases could be regarded as sarcoidosis.

Summary

The many different causes to be considered in the differential diagnosis of erythema nodosum are discussed and three cases are described in which the cause appears to be sarcoidosis.

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A new approach to Shakespeare's plays is being made in the United States. In an experimental course sponsored by the Institute of Arts and Sciences at Columbia University in New York modern psychiatric techniques are applied in studying the characters in nine Shakespearian plays: *Othello*, *Hamlet*, *Macbeth*, *Romeo and Juliet*, *A Midsummer Night's Dream*, *Antony and Cleopatra*, *Julius Caesar*, *King Lear*, and *The Tempest*. The aim of the course, according to Dr. Russell Potter, director of the institute, is to utilize applied science to gain a "more sympathetic comprehension" of some of Shakespeare's great character studies. Five psychiatrists, all of them Shakespearean scholars, will co-operate with Dr. Maurice Valency, professor of English at Columbia, in conducting the course. Dr. Daniel E. Schneider, one of the psychiatrists, emphasizes that the course does not seek to psycho-analyse any particular character in the play. "Rather," he says, "we will try to judge the relationship of one character to another to achieve an understanding of the entire outline of the play." It is his opinion that much of modern psycho-analysis derives some of its roots from the great poets and dramatists of the past. "Shakespeare was the greatest analyst of them all," he believes.

CARDIOLOGICAL CASE FINDING BY MEANS OF MASS MINIATURE RADIOGRAPHY

BY

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The main object of mass miniature radiography surveys is to identify patients with minimal asymptomatic pulmonary tuberculosis. In carrying out such a survey many non-tuberculous lesions are met with, and these include a fair number of cardiac examples. The following is a description of the methods used in such a survey, and a discussion of the results obtained.

Method

Survey 1 was carried out in an industrial town in the North of England, and Survey 2 in a hospital for mental defectives closely adjoining this town. In the former the material consisted of 11,929 subjects, of whom 3,931 were females and 7,998 were males, with ages varying between 14 and 75 years. The great bulk of the group consisted of 10,306 industrial workers in factories. In the same group there were 1,255 school-children, all 14-15 years old; they were particularly chosen for x-ray examination as they were at the age when their school careers terminated. The remaining small group of 368 subjects consisted of those other than factory workers who volunteered for mass miniature radiography. In the mental hospital group of 244 subjects all were women, their ages ranging from 18 to 66 years.

The apparatus used was the standard type as supplied by the Ministry of Health for mass radiography surveys. This has a camera attachment so that the x-ray picture is photographed on to a 35-mm. film; after development the miniatures are projected through a Pullin projector on to a specially prepared white screen, the distance of the projector from the screen being so arranged that an enlargement of the miniature to 6½ in. (16.7 cm.) square can be satisfactorily carried out. If the enlargement is increased to greater than these dimensions there is a larger area for the eyes to cover and the strain of reading numerous miniature films is thereby increased.

Any patients who showed evidence of cardiac abnormalities were recalled for a routine history and physical examination, followed by screening and a barium swallow if thought necessary. At the same time large films were taken in the standard postero-anterior and oblique positions.

In making the diagnosis of cardiac abnormality by means of a miniature film, the following criteria were adopted: enlargement of the cardiac shadow; undue prominence of the pulmonary artery; changes in the contour of the aortic arch and cardiac shadow; changes in the lung fields. There are certain difficulties in using miniature films which are not found in large films, quite apart from the reduced size of the negatives. In the taking of miniatures the x-ray tube is situated 36 in. (91.4 cm.) from the fluorescent screen, so that there is bound to be some distortion of the cardiac shadow, which will appear larger than normal. Adiposity also causes broadening of the cardiac shadow, by consequent elevation of the diaphragm. I have found that all subjects with a maximum postero-anterior diameter of the chest of over 10½ in. (26.7 cm.) have a diaphragm that is higher than one would normally expect, so that the heart

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FIG. 1.—Case 1.

FIG. 2.—Case 2.

FIG. 3.—Case 3.

FIG. 1.—Lateral radiograph of sternum, showing irregular destruction of the articular margins of the manubrio-sternal joint (Case 1).

FIG. 2.—Radiograph showing expansion of articulating bone ends with gross irregular narrowing of the joint space (Case 2).

FIG. 3.—Radiograph showing irregular bony expansion at the joint with erosion of joint margins and irregularity of the joint space (Case 3).

FIG. 4.—Radiograph in a normal woman aged 65 showing naturally occurring synostosis of the joint. Note the smooth continuity of the bony surfaces.