GIANT BONE CYSTS IN RHEUMATOID ARTHRITIS

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Subarticular cystic lesions often develop during the course of rheumatoid arthritis. They are considered to be one of the typical manifestations of the disease (Cruickshank, Macleod and Shearer 1954). Generally several small lesions are observed, showing a typical radiological and pathological picture (Steven 1947; Kersley, Ross, Fowles and Johnson 1964; Gardner 1965). Single giant bone cysts, or geodes, are relatively rare in rheumatoid arthritis, and they may cause diagnostic difficulties. They may simulate malignancy (Hunder, Ward and Ivins 1965), or they may cause spontaneous pathological fractures (Colton and Darby 1970). Recently Jayson, Dixon and Yeoman (1972) described a case of rheumatoid arthritis with unusually large bone cysts.

We report here seven examples of this condition. The main findings are summarised in Table I.

![Figures 1 and 2](image)

**Fig. 1**—Radiographic and histological appearances. Figure 1—Radiograph of the knee joint showing the giant rheumatoid cystic lesion in the metaphysis of the left tibia. Figure 2—Tomograph showing a thin cortical shell and localised fragmentation of the subchondral bone.

**CASE REPORTS**

**Case 1**—A woman aged fifty-six years was known to have suffered from rheumatoid arthritis for eleven years, with affection of the knees for six years. She had been treated with salicylates, indomethacin and phenylbutazone. Both knees had been injected repeatedly with hydrocortisone. On admission she complained of stiffness and pain in both knees. Both knees were slightly painful at rest, and she could only walk for half an hour. On examination the knees showed slight limitation of flexion, and some

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### TABLE 1  
**Summary of Findings**

<table>
<thead>
<tr>
<th>Case number</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Duration of disease (years)</th>
<th>Rose-Waaler titre</th>
<th>Subcutaneous nodules</th>
<th>Stage (Steinbrocker)</th>
<th>Sedimentation rate (millimetres in first hour)</th>
<th>Location of the cyst</th>
<th>Histological appearances of the material removed from the cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>56</td>
<td>11</td>
<td>1/32</td>
<td></td>
<td>III</td>
<td>40</td>
<td>Tibial metaphysis</td>
<td>Granulation tissue with appearances resembling synovium affected by rheumatoid arthritis</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>55</td>
<td>19</td>
<td>1/512</td>
<td>+</td>
<td>III</td>
<td>40</td>
<td>Tibial plateau</td>
<td>Fibrous tissue</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>50</td>
<td>9</td>
<td>1/256</td>
<td></td>
<td>III</td>
<td>35</td>
<td>Femoral head</td>
<td>Granulation tissue with appearances resembling synovium affected by rheumatoid arthritis</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>60</td>
<td>11</td>
<td>1/256</td>
<td></td>
<td>III</td>
<td>55</td>
<td>Distal part of the ulna</td>
<td>Rheumatoid nodule</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>54</td>
<td>24</td>
<td>1/256</td>
<td>+</td>
<td>III</td>
<td>10</td>
<td>First metatarsal bone</td>
<td>Rheumatoid nodule</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>53</td>
<td>13</td>
<td>1/512</td>
<td></td>
<td>III</td>
<td>15</td>
<td>Third metacarpal bone</td>
<td>Granulation tissue with appearances resembling synovium affected by rheumatoid arthritis</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>30</td>
<td>18</td>
<td>1/256</td>
<td>+</td>
<td>III</td>
<td>40</td>
<td>Heads of both humeri</td>
<td>Biopsy not performed</td>
</tr>
</tbody>
</table>
lateral instability. The erythrocyte sedimentation rate (Westergren) was 46 millimetres in the first hour, haemoglobin level 10.9 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/32.

Radiographs of the left knee showed slight narrowing of the tibio-femoral joint space. A large cyst was seen in the lateral part of the head of the tibia (Fig. 1). This finding was confirmed by tomography, which also showed that the upper wall of the cyst had an irregular outline (Fig. 2). On arthrography, the contrast fluid failed to penetrate into the cyst.
Operation—Synovectomy was followed by opening of the cyst, emptying it of its contents and packing with bone chips.

Pathological findings—The cyst contents consisted of soft, pale yellow fragments of tissue. Microscopically the material was composed of fragments of homogeneous necrotic tissue, and of loose connective tissue containing collections of lymphocytes and plasma cells (Fig. 3). Evidence of fibrosis, hyalinisation, calcification and ossification was seen in the necrotic material. Many small inclusions composed of degenerating cartilage and bone were observed in the fibrotic or necrotic connective tissue (Fig. 4). There was some evidence of osteoclastic activity around the bone fragments.

Case 2—A woman aged fifty-five years was known to have suffered from rheumatoid arthritis for nineteen years and from swollen, painful knees for four years. She had been treated with gold, salicylates and phenylbutazone for seventeen years. Before admission she received injections of hydrocortisone into the knee joints. On examination, rheumatoid nodules were present on both elbows. Both knees were swollen and painful and slight restriction of movement was noted. The erythrocyte sedimentation rate (Westergren) was 36 millimetres in the first hour, haemoglobin was 11·4 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/512.

Radiographs of the right knee showed a trabeculated cyst in the postero-medial part of the tibial plateau (Fig. 5). This was confirmed by tomography.

Synovectomy was done and the bone cyst, which was found to be empty, was packed with bone chips. A specimen was taken from the wall of the cyst.

Pathological findings—The biopsy specimen was composed of minute fragments of bone trabeculae containing fatty and fibrous bone marrow, surrounded by dense fibrous connective tissue. There was evidence of calcification and new bone formation in the fibrous connective tissue bordering some of the bone trabeculae.

Case 3—A woman aged fifty years had suffered for nine years from rheumatoid arthritis, which in the beginning affected the small joints, and later both knees and elbows. The right hip had been painful for six months. The patient had been treated with gold, salicylates, indomethacin and Glifanan. Movements of the hip were only slightly restricted, but were extremely painful.

The erythrocyte sedimentation rate (Westergren) was 35 millimetres in the first hour; haemoglobin was 12·5 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/256.

Radiographs of the right hip showed severe narrowing of the joint space, with supero-lateral displacement of the femoral head, and with a cystic lesion in the acetabulum. The femoral head and
neck had a mottled structure. The apical region was sclerotic and contained cysts, one of which had extended into the femoral neck (Fig. 6). Treatment consisted of total replacement of the hip joint. **Pathological findings**—Macroscopically the surface of the cartilage was yellow and showed many large, deep erosions. On the cut surface three round subchondral cyst-formations were seen, containing greyish-white, somewhat gelatinous tissue. The diameter of these cysts varied from 1 to 2 centimetres. The connection between these formations and the joint cavity was apparent. Histologically the cysts were composed of loose connective tissue, which contained many blood vessels. There was marked perivascular cuffing by lymphocytes. There were many large collections of lymphocytes and plasma cells and some lymphoid follicles were present (Fig. 7). Small foci of necrosis were also observed.

**Case 4**—A woman aged sixty years had an eleven-year history of rheumatoid arthritis, which affected the wrist and finger joints. She was treated with gold, indomethacin and prednisolone. Both wrists were painful and swollen, and there was an ulnar head syndrome, and extensor tenosynovitis.

The erythrocyte sedimentation rate (Westergren) was 55 millimetres in the first hour, haemoglobin was 13 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1:256.

Radiographs of the wrists showed osteoporosis with narrowing of the radiocarpal and the intercarpal joint spaces. There was widening of the right distal radio-ulnar joint with slight dorsal displacement of the distal end of the ulna, which showed slight signs of erosion without obvious cystic changes. Bilateral dorsal tenosynovectomy with resection of the distal end of the right ulna and synovectomy of the wrist joints were done. **Pathological findings**—The resected distal part of the right ulna showed a round subchondral cyst-like...
defect, 1·5 centimetres in diameter, containing a greyish-yellow, homogenous tissue (Fig. 8). Microscopically the central part of the cyst-like lesion showed the typical appearances of a rheumatoid nodule. There was no evidence of any connection between the cystic lesion and the joint cavity.

Case 5—A woman aged fifty-four years had a twenty-four-year history of rheumatoid arthritis. During the six months before admission she had been suffering from pain in both feet on weight-bearing. Treatment was by salicylates, indomethacin and Plaquenil. Rheumatoid nodules were present on both elbows.

The erythrocyte sedimentation rate (Westergren) was 15 millimetres in the first hour, haemoglobin was 13·1 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/256.

Radiographs showed a large trabeculated cyst in the epiphysis and metaphysis of the first metatarsal bone (Fig. 9). All the metatarso-phalangeal joints were resected.

Pathological findings—The head of the first metatarsal bone contained a round cyst 2·2 centimetres in diameter, filled with gelatinous substance. Microscopically the lesion showed the typical appearances of a rheumatoid nodule. No connection between the cyst and the joint surface was observed.

Case 6—A male porter aged fifty-three years had a thirteen-year history of rheumatoid arthritis with painful hands and wrists. Both wrists were swollen and movement was restricted. The patient had been treated with salicylates.

The erythrocyte sedimentation rate (Westergren) was 15 millimetres in the first hour, haemoglobin was 15·2 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/512.

Radiographs of the right hand showed a large cyst occupying the distal half of the third metacarpal bone. The cyst was enucleated and the cavity was filled with bone chips.

Pathological findings—The specimen was composed of minute fragments of calcified material, bone
fragments of necrotic tissue in which acute and chronic inflammatory cells as well as histiocytic cells were still discernible. Some of the fragments of necrotic tissue appeared to be fibrosing and calcifying. There were also marked changes affecting the blood vessels, which consisted of thickening of the vessel wall, narrowing of the lumen and perivascular cuffing by lymphocytes (Fig. 10).

**FIG. 10**

Case 6—Contents of the cyst showing thick-walled blood vessels with perivascular cuffing by lymphocytes surrounded by loose granulation tissue. (Haematoxylin and eosin, ×140.)

**FIG. 11**  
**FIG. 12**

Case 7—Radiographs showing the cystic lesions in the head of the right humerus and glenoid (Fig. 11) and a cystic lesion in the severely damaged head of the left humerus (Fig. 12).

Case 7—A thirty-year-old lorry driver had an eighteen-year history of rheumatoid arthritis. In the last eighteen months he suffered from pain in his left shoulder. He was treated with indomethacin, phenylbutazone and gold. There was bilateral enlargement of axillary and cervical lymph nodes. Rheumatoid nodules were present on both elbows.
The erythrocyte sedimentation rate (Westergren) was 40 millimetres in the first hour, haemoglobin was 13.6 grams per 100 millilitres, and the Rose-Waaler test was positive at a titre of 1/256.

Radiographs of the right shoulder revealed a small subchondral cystic lesion in the glenoid fossa and a large cystic lesion in the head of the humerus extending into the neck. The left shoulder showed severe cystic changes in the head of the humerus and in the glenoid fossa (Fig. 11). The patient was treated without operation, with some improvement of the shoulder pain.

DISCUSSION

All the seven patients described had long-standing classical rheumatoid arthritis and were found clinically and radiologically to be in stage III of the disease according to the classification proposed by Steinbrocker, Traeger and Batterman (1949). In each case the Rose-Waaler test was strongly positive and the erythrocyte sedimentation rate was only slightly elevated. In six patients there was a marked tendency to generalised cyst formation in the affected bones and there was little evidence of effusion. The cystic lesions were symptomless and were incidental findings in patients leading an active life, except in Case 3. The pathological findings in this case differed from those in the other cases in that the lesion was composed of cellular, vascular and severely inflamed granulation tissue. It is probable that in this case the rheumatoid disease was of a more exudative nature than in the other six cases.

In Cases 1, 2, 3 and 6 the large cysts were composed partly of necrotic granulation tissue, resembling the appearances of synovium in chronic rheumatoid arthritis. In Cases 4 and 5 the bone cysts consisted of subchondral, intraosseous rheumatoid nodules.

In rheumatoid arthritis small cyst-like lesions in subchondral bone are often found in radiological examination. Although these lesions have been studied extensively both clinically and experimentally their pathogenesis remains obscure. These subchondral cyst-like lesions can be divided into two groups: 1) pseudo-cysts which communicate with the joint cavity; the majority belong to this type; and 2) true cysts which do not communicate with the joint surface.

There are different opinions concerning the pathogenesis of the pseudocysts. Fletcher and Rowley (1952), Cruickshank et al. (1954) and Bywaters (1964) suggested that the subchondral lesions are enclosed erosions, as they contain granulation tissue, pieces of detached cartilage and bone and occasionally fluid which originates from the joint cavity. They have stated that extrusion, or even penetration of synovial tissue into the subchondral cavity can be observed in each case. In the two cases of Colton and Darby (1970) the histological appearances of the giant rheumatoid bone cysts were similar to the appearances of the typical small subchondral pseudocysts of rheumatoid arthritis.

In three of our seven cases (Cases 1, 3 and 6) the histological appearance of the cysts also suggests a massive invasion of the subchondral bone by rheumatoid granulation tissue. In Case 3, in which the femoral head was removed and the whole specimen could be examined, the connection between the subchondral cysts and the joint cavity was obvious and extrusion of the pathological synovial tissue (pannus) into the bone could be seen. Unfortunately the biopsy specimen obtained in Case 2 was not diagnostic, but the similarity of the clinical and radiological findings suggests that the lesion was of the same type. Some authors mention the importance of increased intra-articular pressure in the pathogenesis of bone cysts in rheumatoid arthritis. Castillo, El Sallab and Scott (1965), Freund (1940) and Jayson, Rubenstein and Dixon (1970) suggested that there was a close relationship between the degree of physical activity and the development and size of the bone cysts.

Kersley, Ross, Fowles and Johnson (1964) suggested that the closed cysts could be due to the formation of true intraosseous rheumatoid nodules. Baggenstoss, Bickel and Ward (1952) and Kanefield, Mullins, Freehafer, Furey, Horenstein and Chamberlin (1969) described cases of rheumatoid arthritis with rheumatoid nodules in the spongy bone of the vertebrae. Soila (1963) found large cysts enclosed within an intact bone cortex and concluded that these
lesions are the result of nutritional, vascular or metabolic changes caused by rheumatoid arthritis. Recently Jayson et al. (1972) discussed the possibility of the obliteration of a previous connection between a cyst and the joint cavity.

The results of our study suggest that cystic bone lesions in rheumatoid arthritis can arise in two ways, either by replacement of subchondral bone by the rheumatoid process or by formation of rheumatoid nodules within the bone.

SUMMARY

1. Clinical, radiological and pathological findings in seven cases of rheumatoid arthritis with giant bone cysts are presented.
2. In three cases the large cysts represented massive involvement of subchondral bone by rheumatoid granulation tissue; in two cases the cysts were due to rheumatoid nodules, and in two other cases the diagnosis was made only on the radiological findings.
3. The pathogenesis of this condition is discussed. It is suggested that cystic bone lesions in rheumatoid arthritis can arise either by replacement of subchondral bone by the rheumatoid process, or by the formation of rheumatoid nodules within the bone.

Addendum

Since the submission of this article another case of rheumatoid arthritis with giant bone cysts has been published by Cabanel, G., Philip, X., Gras, J. P., Mories, D., and Couderc, P. (1973): Lésions osseuses macro-géodiques au cours de la polyarthrite rhumatoïde. Revue du Rhumatisme, 40, 259. The authors reviewed the literature and discussed the histogenesis.

REFERENCES