Radiological manifestations of Reiter's syndrome

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Reiter's syndrome (RS) presents with a broad spectrum of radiological manifestations. Although there is an overlap with other connective tissue diseases^{134, 214, 221, 248, 286} certain features appear to be characteristic, particularly when present in combination. This report concerns the radiological findings in 36 patients with RS. They are compared with the radiological manifestations of rheumatoid arthritis (RA), ankylosing spondylitis (AS), and psoriatic arthritis (PSA).

Patients and methods

Records of 36 patients were selected from the files of the department of radiology, University of Michigan Medical Center, on the basis of previously documented positive radiological findings. The records were then reviewed to confirm the clinical diagnosis of RS. For the purpose of this study the diagnostic criteria were (1) objective evidence of arthritis of the appendicular joints, and (2) two of the following: mucocutaneous lesions, conjunctivitis, and urethritis. These features had to have occurred within six weeks of one another. It was recognised that the arthritis in patients with RS may be limited to the spine, but because of the difficulty in evaluating such arthritis, particularly in the early stages, such cases were not included in the study.

Radiological joint surveys of the spine and appendicular joints were available in 20 cases. Six others had had fairly complete radiological evaluations, although not all joints were included. Films of the lumbosacral spine were available in all cases. Many patients had been followed-up clinically for several years, affording opportunities for extended periods of radiological observation.

Radiological features

Significant radiological features are summarised in Table 1.

DISTRIBUTION

Joints of the lower extremities were affected in 30 cases whereas joints of the upper extremities were

Table 1 *Distribution of arthritis and radiological features in 36 cases of Reiter's syndrome*

<i>Distribution</i>	<i>No. of cases</i>
Joints of upper extremities	11
Joints of lower extremities	30
Forefoot	18
Heel	18
Interphalangeal great toe	8
Feet more than hands	16
Sacroiliac arthritis	26
Symmetric	17
Asymmetric	6
Unilateral	3
Spondylitis	16
Atypical for ankylosing spondylitis	14
Typical for ankylosing spondylitis	2
Focal sacroiliitis	4
Periosteal bone apposition (appendicular joints)	26

affected in only 11. The most common site of involvement was the foot, particularly the metatarsophalangeal joints and heels. The posterosuperior and posteroinferior aspects of the calcaneus were affected (Figs 1, 2), particularly the latter, at the attachment of the plantar aponeurosis. The interphalangeal joint of the great toe was affected in eight instances and this appeared to be relatively selective in three (Fig. 3). Occasionally there was severe destruction of some metatarsophalangeal joints but adjacent ones seemed completely spared. The hips were affected in one case bilaterally. Arthritis was more extensive in the feet than the hands in 16 cases. The terminal interphalangeal joints of the hands were affected in two patients and only one such joint was affected in both. The sacroiliac joints were affected in 26 patients and the spinal column in 16. Focal sacroiliitis near a sacroiliac joint was noted in four cases.

REGIONAL OSTEOPOROSIS

This was a striking finding in the early stages of the disease in three patients. It was limited to the foot in two cases (Fig. 4) and to the hand in one. A frequent feature was relative absence of osteoporosis despite extensive joint destruction. This was particularly evident in the foot.

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Soft-tissue swelling, presumably non-specific due to joint effusion and synovitis, was common in the ankle, knee, and joints of the hand, wrist, and foot.

DESTRUCTION OF ARTICULAR CARTILAGE

This was common and manifested by uniform

narrowing of the interosseous space. Bone destruction occasionally appeared as discrete marginal erosions within the joint at the chondro-osseous junctions ('bare areas') (Fig. 5) or as loss of cortical definition within and adjacent to the joints. Sites of bone erosion were often blurred by coexistent

Fig. 1 Progressive calcaneal erosion. Early erosion in May 1971 (arrow) was more extensive in September 1971 with blurred margins presumably due to associated minimal reactive bone formation.

Fig. 2 Note erosion at posterosuperior aspect of calcaneus (arrow) and extensive periosteal bone apposition at inferior aspects of calcaneus, especially posteriorly, and cuboid. Calcaneocuboid joint relatively intact but cuboidmetatarsal joint affected.

Fig. 3 Relatively selective arthritis of interphalangeal joint of great toe with severe joint destruction and reactive bone formation. Note soft tissue swelling of 4th and 5th toes with erosion of distal interphalangeal joint of the 4th.

Fig. 4 Osteoporosis, right foot, associated with minimal generalised soft-tissue swelling.

Fig. 5 Arthritis limited to proximal interphalangeal joint. Note fusiform soft-tissue swelling, uniform loss of cartilage, and marginal erosions. Erosions partially obscured by periosteal bone apposition.

Fig. 6 Severe destructive arthritis and subluxation of multiple joints with sparing of 4th metatarsophalangeal joint. Note involvement of interphalangeal joint of great toe and relative lack of osteoporosis.

periosteal bone apposition. Large subchondral cyst-like lesions were not seen. Severe destructive arthritis with extensive bone resorption and subluxation ('arthritis mutilans' or Launois's deformity) was observed in three cases. All involved the metatarsophalangeal joints. One or more joints may be 'skipped'—that is, completely spared (Fig. 6).

PERIOSTEAL BONE APPPOSITION

This was seen in the appendicular skeleton in 24 cases, was often exuberant and fluffy during the active stage of inflammation, and was typically contiguous to affected joints (Fig. 7). Later in the disease such bone characteristically appeared linear and compact, giving the cortex a 'thickened'

appearance (Fig. 8). Focal bone apposition, adjacent to a previously affected joint, was at times the only indicator of prior inflammation. This feature was often subtle (Fig 9).

SACROILIAC ARTHRITIS

This occurred in 26 cases and was symmetrical in 17. In the latter it was indistinguishable from the radiological changes of ankylosing spondylitis (Fig. 10). The appearance depended on the stage of the disease, with the early lesion often appearing as an indistinctness of the subchondral cortices (Fig. 11). Reactive sclerosis in the adjacent bone varied in degree. Bony ankylosis was common. In six patients sacroiliac arthritis was clearly asymmetric and in three it was unilateral. In three cases the asymmetry or unilaterality persisted for several years (Fig. 12). In four patients there was a focal sclerosis and hyperostosis, involving both sacrum and contiguous

Fig. 7 Arthritis of first metatarsophalangeal joint associated with bone erosion and periosteal bone apposition of metacarpal and, to lesser extent, phalanx (arrows). Note minimal uniform narrowing of interosseous space of this joint.

Fig. 8 Destructive arthritis, right fourth metatarsophalangeal joint, with deformity and widening of bones due to periosteal bone apposition in a child. Note involvement of first tarsometatarsal joint with marginal bone erosions and lack of osteoporosis in right foot.

Fig. 9 Subtle periosteal bone apposition, right medial malleolus—a residuum of earlier arthritis of the ankle which at this time appeared normal. Compare with opposite normal side.

ilium, adjacent to the cranial margin of the joint (Fig. 13). This appeared to be analogous to the hyperostoses in the appendicular skeleton and vertebral bodies.

SPONDYLITIS

Two of the 16 cases with spinal involvement showed changes indistinguishable from those of ankylosing spondylitis. However, the others had a distinctive appearance characterised by asymmetric bony bridges between contiguous vertebral bodies, usually involving the lateral aspects (Fig. 14). These often resembled massive syndesmophytes, appearing to arise from the vertebral body proper, and often there were several such bone formations which were non-continuous. The vertebral body margins where these arose occasionally showed deformity and sclerosis, suggesting that the bone formation reflected vertebral periostitis rather than inflammation of the discovertebral joints. Furthermore, the intervertebral discs were often of normal height at the affected levels.

Although there was squaring of the vertebral bodies in some cases the anterior surfaces of the vertebrae tended to be spared, even at those levels where lateral bony bridging was present. In some patients segments of the spine appeared to be 'skipped'—for example, in one case the spondylitis in the cervical segment was fairly advanced whereas the dorsal spine and much of the lumbar segment

Fig. 10 A. Bilateral sacroiliac arthritis with reactive sclerosis. B. Asymmetric lateral bony bridge between L_1 and L_2 , having appearance of large syndesmophyte. C. Anterior vertebral surface relatively normal and height of disc not reduced at this level. No other lumbar spinal lesions present. Although the sacroiliac arthritis in this case was indistinguishable from that seen in ankylosing spondylitis the lumbar lesion is characteristic of RS and PSA.

Fig. 11 Early right sacroiliac arthritis in RS. The lesion consists of an indistinctness of the cortices, particularly on the iliac side.

appeared to be spared (Fig. 15). Two cases showed unilateral, vertically-oriented ossification adjacent to a discovertebral joint (Fig. 16). The adjacent vertebral body was unaffected and the appearance suggested that this lesion was related to the lateral spinal ligament. In no cases of spondylitis was there sparing of the sacroiliac joints, but 10 patients with sacroiliac arthritis did not exhibit spondylitis.

Differential diagnosis

RHEUMATOID ARTHRITIS (RA)

Although erosions occur at the chondro-osseous junctions ('bare areas') in RS this distribution is more conspicuous in RA and the erosions appear more discrete. The feet may occasionally be affected before the hands in the early stages of RA, but it is unusual to see significantly greater involvement in the feet than the hands as the disease progresses; predilection for the joints of the lower extremities is unusual in RA.

12A

12B

Fig. 12 A. 1958. B. 1964. *Persistent asymmetric sacroiliac arthritis: left side more severely involved than right.*

Periosteal bone apposition occurs in juvenile RA adjacent to affected joints, but it is almost always linear rather than fluffy and exuberant. Significant periosteal bone apposition of any type is unusual in adult RA. Subchondral cyst-like lucencies (pseudocysts) are not uncommon in rheumatoid arthritis and tend to be multiple, but they are apparently rare in RS. Asymmetric arthritis does occur in adult RA but it is uncommon and not associated with other features of RS. Selective involvement of the inter-

phalangeal joint of the great toe is not a feature of RA.

The sacroiliac joints are rarely affected in RA, but the cartilage space has been reported on occasion to have become completely obliterated. Sclerosing osteitis in the sacroiliac joints and bone proliferation at the vertebral body margins, however, are decidedly unusual. The spondylitis in RA is most evident radiologically in the cervical region and is characterised by bone destruction and subluxation.

Fig. 13 Focal sclerosing osteitis above right sacroiliac joint in 40-year-old man with RS. Lesion appears to involve contiguous sacroiliac margins. Left sacroiliac joint normal, right equivocal. There were no lesions in the lumbar spine.

14A

14B

Fig. 14 A. 1963. Large, asymmetric bony bridge L₃-L₄ and bilateral sacroiliac arthritis in man with RS. B. 1968. Sacroiliac joints now fused and previous bony bridge altered owing to remodelling. Other syndesmophytes now evident at L₂-3 and L₁-2, but generalised syndesmophyte formation as generally seen in ankylosing spondylitis has not developed. Note fairly well preserved disc heights.

15A 15B
Fig. 15 A. 1963. B. 1968. Same case as in Fig. 14, showing advanced involvement of cervical spine. Dorsal spine was not affected. This case illustrates the tendency towards skipped segments and non-uniform spondylitis. A similar distribution may be seen in PSA.

Fig. 16 Paravertebral ossification which is lateral, adjacent to disc, but separate from vertebrae. Such ossification has also been described in PSA.

The latter is particularly common in the atlantoaxial joints. Subluxation of the atlantoaxial joints has been described in RS¹⁹⁷ but it is rare. It is doubtful whether true syndesmophyte formation occurs in RA.

ANKYLOSING SPONDYLITIS (AS)

Although the spondylitis in RS is occasionally identical to that of AS most RS patients show distinctive features. These include *focal* syndesmophyte formation, often massive and associated with little change in the adjacent discovertebral joints; relative sparing of the anterior surfaces of the vertebral bodies; and a tendency towards non-uniform involvement of the spinal column (often with 'skipped' segments).

In most cases of RS the sacroiliac arthritis is in itself indistinguishable from that seen in AS. Nevertheless, asymmetric or unilateral involvement of the sacroiliac joints should prompt suspicion that one is not dealing with ankylosing spondylitis. Focal sclerosing osteitis adjacent to the sacroiliac joint proper may be a significant differential point which has not been emphasised. There is a predilection for the rhizomelic joints in AS, whereas in RS the hips and shoulders are not commonly affected.

Irreversible structural changes, including articular bone erosion, may develop in the hands and feet in AS, but usually this is a late manifestation. As in RS, there may be periosteal bone apposition near affected joints and marginal erosions at the chondro-osseous junctions, but mutilating destruction of the bones is unusual. Heel lesions may be identical in both conditions but extensive bone destruction and widespread periosteal bone apposition of the calcaneus is unusual in ankylosing spondylitis. Selective involvement of the interphalangeal joint of the great toe is not a feature of AS.

PSORIATIC ARTHRITIS (PSA)

There is a significant overlap between the radiological features of PA and RS. This is particularly true of the spondylitis. As in RS, some patients with PA show a pattern which is identical to that seen in AS. But in most cases it is more like that of RS, including asymmetrical involvement of the sacroiliac joints, large non-continuous syndesmophytes primarily involving the lateral aspects of the vertebral bodies with relative sparing of the anterior surfaces, and 'skipped' segments.

I have never seen focal sacroiliitis adjacent to the sacroiliac joint proper in PSA, but it is not clear whether this will prove to be a significant differential point. An important differential feature is the tendency for the terminal interphalangeal joints of the fingers to

be affected in PSA, and often many such joints are involved. Although patients with RS occasionally have arthritis of a terminal interphalangeal joint multiple involvement of such joints is rare. Resorption of the terminal tufts of the fingers occasionally occurs in PSA but this is not a feature of RS.

Periosteal bone apposition adjacent to affected joints is common in PSA and is often fluffy and exuberant, as in RS. Similarly, the calcaneal changes and the tendency to involve the interphalangeal joint of the great toe are common in both diseases. The feet may be more severely affected than the hands in PSA, but severe involvement of the feet with relatively little change in the hands seems to be more common in RS. Panarthritis of the hands and wrists is not uncommon in PSA but is distinctly rare in RS.

Discussion

Patients were included in this study because they had had abnormal radiological joint findings earlier. Therefore the features described here probably reflect a more severe form of the disease. The observations are significant, however, in that they indicate the spectrum of radiological findings that may be encountered in RS. Since the patient sample was small and the radiological joint survey incomplete in many conclusions about the precise incidence of specific features are probably not warranted.

Although none of the described features are in themselves pathognomonic of RS certain ones should strongly suggest this diagnosis, particularly when present in combination. These are listed in Table 2.

The significance of focal paravertebral ossification, seen in two cases, is uncertain. This appears to lie in relation to the lateral ligament and differs from syndesmophytes in that it does not seem to involve the vertebrae. Bywaters and Dixon⁴⁹ described similar lesions in four patients with PsA but in three of their cases the possibility of RS was raised.

Asymmetric spondylitis with a tendency to 'skipped' segments is characteristic though not diagnostic. A similar pattern has been observed in PSA.^{208, 221} In a

Table 2 Radiological features characteristic of Reiter's syndrome

- (1) Severe involvement of the feet with relative sparing of the hands
- (2) Predilection for the calcaneus, interphalangeal joint of the great toe, and metatarsophalangeal joints
- (3) Periosteal bone apposition near affected joints
- (4) Sacroiliac arthritis, especially when asymmetric
- (5) Asymmetric, often large, bridging syndesmophytes involving mainly the lateral aspects of the vertebral bodies with relative sparing of their anterior surfaces

recent survey of clinical and radiographic abnormalities in 87 patients with AS it was concluded that the pattern of spinal involvement differed in men and women.²⁵⁵

Focal sclerosing sacroiliitis, seen in four cases adjacent to the sacroiliac joint, is of interest. Increased density due to osteophytes may be noted in this location in osteoarthritis of the sacroiliac joints. However, our patients were relatively young and showed no other features of osteoarthritis in these joints. To my knowledge this has not been noted in PSA, RA, or AS but additional studies are needed before diagnostic significance is attached to this finding.

Conclusion

The radiological manifestations of RS overlap those of other rheumatic diseases, particularly AS and PSA. Nevertheless, certain features are characteristic and, depending on the combination of findings in a given case, the diagnosis may be suspected on radiographical grounds.

General Discussion

DR. J. T. SCOTT: What do you consider the best radiological projection for sacroiliac joint evaluation?

PROF. MARTEL: I don't advocate oblique views because they are often confusing and hide early lesions. I prefer to have an angled beam with the patient supine (some radiologists prefer the patient prone). The beam is angled 15°–20° towards the head. This effect distorts the sacroiliac joints but shows the inferior aspect of the sacroiliac area, which is the true joint.

DR. G. R. V. HUGHES: We and others have seen typical patients with both seropositive erosive RA and B27-positive sacroiliitis. Have you looked at the small but definite percentage of rheumatoids who are B27-positive to determine whether B27 confers a different pattern on coincidental RA?

PROF. C. M. PEARSON: We have seen cases of coinciding spondylitis and seropositive rheumatoid arthritis with nodules which were B27-positive. Cases reported so far have been tabulated in the April 1978 issue of *Arthritis and Rheumatism*. However, the pattern of RA seems to have been quite classical as well as that of AS, either beginning first.

DR. F. C. ARNETT: Within nearly 200 patients with either RS or AS we have three patients with coinciding seropositive nodular rheumatoid arthritis,

one with Felty's syndrome. This incidence is to be expected in view of the 1–2% population prevalence of RA.

DR. E. ALBERT: We have observed a family in which, within one generation, four siblings were homozygous for B27 with apparently classical RA. In the second generation all the children were heterozygous for B27, and four or five of them had developed AS. Has anyone information about the full genotyping or also the phenotyping of such patients that seem to have both AS (or RS) and RA?

DR. D. A. BREWERTON: In looking at families of patients with AS it is all too common to find previous generations that have been wrongly diagnosed as RA. When they are reinvestigated clearly they have a form of polyarthritis related to B27 and spondylitis.

PROF. T. BITTER: I know that Professors Vischer and Fallet from Geneva have systematically tissue-typed a large series of patients with RA for B27 and got a slightly higher percentage of B27 than expected in the general population. Would they want to comment on the clinical features of these B27 rheumatoids?

PROF. G. H. FALLET: The problem has presented itself slightly differently. Beyond three of Dr. Mason's patients in London and one in Oxford, we have observed in Geneva six patients who presented with both apparently seropositive RA and AS. Three of them had rheumatoid nodules identified by biopsy. Two patients had children, one child of each had AS. All but one of them had HLA-B27 and x-ray findings compatible with both diseases. Michael Mason's and our feeling is that unless these patients had a coincidental predisposition for both diseases we should revise our concept of RA and AS.

PROF. A. E. GOOD: From our small arthritis clinic we reported three patients in 1977 with classical findings for both diseases. In summing up the reports about patients with RA, nodules, and AS we found that neither disease seemed to interfere with the expression of the other. It seems to us that the association is purely accidental and not so rare after all.

PROF. R. F. WILLKENS: Dr. Martel would you comment on a non-marginal syndesmophyte and the distinction of AS from RS on the basis of these?

DR. MARTEL: I haven't used the terms 'marginal' and 'non-marginal' syndesmophyte. The syndesmophytes in RS and in PSA may be identical to those in AS—the so-called 'marginal' ones. However, the large asymmetric syndesmophytes characteristically seen in RS are indeed so large that they appear to be non-marginal. They seem to develop as a consequence of vertebral osteitis and bone formation

thereafter, not necessarily related to the disco-vertebral junctions. Whenever they are present they are useful in differentiating RS from AS. I have not seen such bone formation in classical AS. The sacroiliac joints are the least help unless the sacroiliac arthritis is asymmetrical. Such asymmetry can be seen early in the course of AS. It is unusual to find severe involvement on one side as the disease progresses with little or no change on the other. Most of the time patients with RS present with sacroiliac arthritis which is indistinguishable from that of AS.

PROF. B. AMOR: With the former we found more destructive lesions. Likewise bone proliferation on the great toes seems to be more common in psoriatic arthropathy than in RS.

DR. MARTEL: The appearance I have shown in the feet is identical to what we may see in PSA, including the heels and terminal interphalangeal joints of the great toes. In AS I am not sure. We have seen patients with AS with severe arthritis of the hands and feet as a late manifestation—a picture indistinguishable from that seen in RS. In the latter, however, structural changes in the joints of the feet often occur relatively early.

DR. A. CALIN: What is the rate of progression of these lesions? We have had the impression that some patients with RS have developed plantar spurs

rapidly over a period of six to twelve weeks. Have you any studies on sequential change?

DR. MARTEL: No, I have not.

DR. J. C. GERSTER: Achilles tendonitis is found very commonly in RS. In a study with Professor Fallet we found it in AS, PSA, and especially in RS. We did not find it in RA.

DR. MARTEL: We have seen achilles tendonitis in rheumatoid arthritis. Radiologically it is often different from the three conditions you mentioned.

DR. T. L. VISCHER: I was struck that you have very little joint narrowing in your RS patients.

DR. MARTEL: I agree that the cartilage often seems to be less affected than the bone. There is often bone erosion and bone apposition with relatively little change in the interosseous space. The cartilage may be altered and yet the interosseous space is not narrowed. The space does not reflect the degree of cartilage destruction because the fluid and soft tissue proliferation may take its place within the joint.

DR. CALIN: We have not emphasised the enthesopathic nature of the disease. Clinically we recognise sausage digits, insertional tendinitis, and other extrasynovial processes. These correlate with radiological evidence of periostitis, peri-insertional osteoporosis, and other changes that differentiate this enthesopathic disorder from the primary synovitides, typified by RA.