Diffuse Idiopathic Skeletal Hyperostosis (DISH): Forestier’s Disease with Extraspinal Manifestations

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The extraspinal manifestations of Forestier’s disease are described in 21 consecutive cases; diffuse idiopathic skeletal hyperostosis (DISH) is suggested as a more appropriate description of this ossifying diathesis. Characteristic roentgen abnormalities of the spine were present in all individuals and associated with significant axial clinical complaints. In extraspinal locations, hyperostosis at ligament attachments usually occurs in the pelvis, calcaneus, tarsal bones, ulnar olecranon and patella, and is occasionally associated with clinical signs and symptoms requiring surgery. The radiographic appearance in the peripheral skeleton is frequently distinctive and allows the radiologist to suggest the correct diagnosis, even in the absence of axial radiographs.

INDEX TERMS: Bones, diseases • Foot • Knee • Pelvis, calcification • Sacroiliac Joint • Soft Tissues, calcification • Spine, diseases • Ulna

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In 1950, Forestier and Rotes Querol (10) described a peculiar type of ankylosing hyperostosis of the spine characterized by ossification of the anterior and right lateral aspects of the vertebral column, particularly in the thoracic region. The clinical, pathologic, and roentgenographic features of the disorder allowed its differentiation from other spinal diseases including ankylosing spondylitis and osteoarthrosis. Although occasional reports describe bony outgrowths in extraspinal locations (8), a systematic radiographic study of the entire skeleton in patients with Forestier’s disease has not been accomplished.

In the first of two articles on the roentgenographic manifestations of diffuse idiopathic skeletal hyperostosis (DISH), we wish to emphasize the type and location of extraspinal abnormalities in this disorder, and to relate these to clinical and laboratory alterations. A second report correlating the radiographic and pathologic abnormalities of the spine is in progress at this time.

MATERIAL AND METHODS

I. Twenty-one consecutive patients with ankylosing hyperostosis of the spine discovered in the Radiology Departments, Veterans Administration and University hospitals, San Diego, underwent extensive clinical, laboratory and roentgenographic evaluation.2

Clinical and Laboratory Evaluation: A complete rheumatologic history and physical examination was obtained for each patient, including weight, chest expansion, spinal mobility, and tenderness and crepitus over axial and peripheral joints. Laboratory determinations included hematocrit, leukocyte count, Westergren sedimentation rate, serum calcium, phosphorus, alkaline phosphatase, uric acid and glucose, and serologic testing for syphilis, rheumatoid factor and antinuclear antibody (ANA).

Radiographic Evaluation: A radiographic survey of each patient included the following projections:

1. Spine: Anteroposterior (AP) and lateral views of the cervical, thoracic and lumbar vertebrae.
2. Pelvis including hips: AP.
3. Femurs: AP, lateral.
5. Forelegs including ankles: AP, lateral.
7. Feet: AP.
8. Humeri including shoulders: AP.
10. Forearms: AP.
11. Hands including wrists: Postero-anterior (PA).

In addition, axial views of the patella and lateral projections of the skull were available in some individuals. The osseous alterations were recorded and graded as absent, mild-to-moderate, or moderate-to-severe in degree.

II. Pathologic material obtained at autopsy in 10 individuals with spinal or extraspinal manifestations of the disease was investigated. A more detailed description of these alterations in the vertebral column will be reported in a subsequent article.

RESULTS

Clinical and Laboratory Study (Table I)

The 21 men studied ranged in age from 49 to 80 years, with a mean age of 66 years. There were two blacks (CASES 4 and 11); the remainder were white. Family and geographic histories were nonrewarding; 11

1 From the Departments of Radiology (D. R.) and Internal Medicine (S. R. S.), University Hospital, University of California, San Diego and the Veterans Administration Hospital, San Diego; and the Department of Radiology (J. M. R.), Alvarado Community Hospital, San Diego, Calif. Revised manuscript accepted for publication in February 1975.

2 One patient was included whose films from a neighboring community hospital were seen in consultation during this period at the Veterans Administration Hospital.
more. Among the 12 individuals whose occupations re-

quired a moderate degree of physical activity were a construction worker, 2 ranchers, 2 janitors, a butcher and a roofer.

Eighteen of the 21 patients had a history of significant musculoskeletal complaints. Although their duration was variable, symptoms in many of the patients had been present for longer than 10 years. Mid or low back pain was an initial complaint in 12 patients and an eventual one in 14. It was characteristically dull, non-radiating and associated with "stiffness," varying in severity from

patients who had lived in California for the last 10 years or more. Among the 12 individuals whose occupations re-

Fig. 1. Spinal Abnormalities. A. Cervical spine: In a lateral radiograph of the cervical spine, extensive ossification along the anterior margins of the vertebral bodies (closed arrows) has resulted in ankylosis. The heights of the discs in the upper cervical region and the apophyseal joint spaces (open arrows) have been relatively maintained (Case 10).

B and C. Thoracic spine: A sagittal section and corresponding radiograph reveal a flowing pattern of new bone deposition along the anterior margins of the vertebral bodies and disc spaces (closed arrows). Disc-space height is preserved (open arrows) (Case 2).

D. Lumbar spine: Osteophytes are most prominent on the anterosuperior margins of the vertebral bodies (closed arrows) and extend proximally to unite with those of the adjacent vertebrae. The disc spaces are maintained (open arrows) (Case 15).
(For legend to Fig. 1, see opposite page.)
Fig. 2. Pelvic Abnormalities. A. Irregular projections of bone (curved arrows) extend from the iliac crest and the lateral margins of the ilium (CASE 11).
B. Alterations include ischial tuberosity (curved arrows) and lesser trochanter "whiskering" (open arrow), and a large paracetabular osteophyte (closed straight arrow). Prostatic calcification is apparent (CASE 16).
C. Osseous bridging across the superior margin of the symphysis pubis is noted (arrow) (CASE 13). (Fig. 2, D is on opposite page.)

mild to incapacitating. Cervical pain, an initial symptom in one individual, eventually appeared in 8 others. Cervical dysphagia was historically present in 6 patients, an initial complaint in one, and required surgical removal of spinal osteophytes in 2 patients (CASES 1 and 15).

Peripheral musculoskeletal complaints, significant in 8 of the men, most commonly involved the shoulders (4 patients), knees (4 patients), elbows (3 patients), and heels (2 patients). In one man with elbow pain (CASE 15), steroid injections and spur removal had been accomplished, while in another patient (CASE 12), epicondylitis was successfully treated with local steroids. One man (CASE 8) had left carpal tunnel syndrome. The pattern of "polyarthralgia" noted in these men was non-inflammatory except in one man (CASE 2) in whom rheumatoid arthritis apparently developed a short time before death (positive rheumatoid factor, symmetrical proximal interphalangeal joint tenderness and swelling in the hands). Although peripheral symptoms were the initial finding in 4 patients (CASES 2, 7, 14, 17), only 2 individuals (CASES 2 and 14) had isolated extraspinal symptomatology, and one of these was the patient with probable rheumatoid arthritis.

The most prominent physical finding was decreased range of motion in the low back in 10 patients and in the cervical spine in 11 patients. The degree of chest expansion, averaging 2.3 cm in this group, correlated well with the range of motion of the lumbar spine.
ished range of motion in the peripheral skeleton was apparent in the hips (5 patients), subtalar joints (4 patients), shoulders (3 patients), knees (3 patients), elbows (2 patients), and ankles (2 patients). One man (CASE 14), had palpable firm, nodular masses adherent to the quadriceps and patellar tendons.

Other physical findings included relative obesity (6 patients), (2), Dupuytren's contractures (2 patients), and neurological deficits (2 patients). No historical or clinical evidence of acromegaly or fluorosis was noted.

Laboratory abnormalities included mild elevation of sedimentation rates (6 patients), and alterations in fasting and two-hour post-prandial serum glucose levels and/or glucose tolerance tests suggesting diabetes mellitus in 6 others. Rheumatoid factors were positive in 2 of the men. The remainder of the laboratory evaluation was unrewarding.

*Radiographic Study (Tables II and III)*

**Spine:** All 21 men had abnormalities of the spine; in 15, cervical, thoracic and lumbar segments of the vertebral column were involved.

Sixteen individuals had alterations in the cervical spine; these most frequently involved the fourth through seventh cervical levels. Abnormalities of the third cervical vertebra were less common and involvement of the second and first, unusual. Hyperostosis varied from an ill-defined increase in density or well-defined triangular outgrowth in front of the disc to a more extensive flowing pattern of new bone formation (Fig. 1, A); mild-to-moderate abnormalities were present in 7 individuals and moderate-to-severe changes were seen in 9.

Twenty-one patients had alterations in the thoracic spine, of a mild-to-moderate degree in 6, and moderate-to-severe in 15. The most commonly involved levels were in the lower thoracic region, particularly between the seventh and eleventh vertebrae although involvement of most of the thoracic region was evident in 9 patients. The radiographic pattern was distinctive at the thoracic level, with laminated new bone formation along the anterior aspects of the vertebral body and disc space (Fig. 1, B and C). The hyperostosis was generally continuous throughout the area of involvement although in 2 individuals, two abnormal segments were separated by an area of normality.

Nineteen patients had abnormalities at the lumbar level which were mild-to-moderate in 10 men and moderate-to-severe in 9. The bony outgrowths, which varied from small, triangular projections extending superiorly from the anterosuperior edges of the vertebral body to large, irregular osteophytes bridging one or several levels, showed little predilection for any particular lumbar segment (Fig. 1, D).

In all segments of the spine, preservation of disc height was distinctive; in the lumbar level in 2 individuals, slight loss of disc space and vacuum phenomena were noted. The integrity of the apophyseal joints and

**Pelvis:** Radiographic abnormalities of the pelvis were demonstrated in all 21 patients. Sites of involvement included the iliac crest in 14, ischial tuberosities in 11, iliolumbar ligaments in 10, lesser trochanters in 9, greater trochanters in 8, acetabular margins in 7, sacroiliac joints in 4, sacrotuberous ligaments in 4, and the symphysis pubis in 2. Alterations were usually symmetrical and included irregular outgrowths or whiskering (iliac crest, ischial tuberosities, trochanters) (Fig. 2, A and B), and broad, well-defined para-articular osteophytes (acetabular margins, sacroiliac joints, symphysis pubis) (Fig. 2, B and C). Extensive ossification in the ilio-lumbar and sacrotuberous ligaments was distinctive (Fig. 2, D).
The sacroiliac para-articular ossifications favored the inferior margin (Fig. 2, D); in addition, indistinctness of the superior portion of the space between the ilium and sacrum was noted. In one patient, complete bridging of the fibrocartilaginous joint about the pubis was noted (Fig. 2, C).

Shoulders and Humeri: Abnormalities were evident in 8 patients and were bilateral in 7. Prominence and bony irregularity were observed along the deltoid tuberosity in 4 patients, medial humeral shaft was seen in 2 patients, inferior glenoid in 3, and inferior distal clavicle and coracoclavicular ligament in 2 of the men (Fig. 3, A).

Elbows: Alterations about the elbows in 12 individuals (bilateral in 11) included olecranon spurs (10 patients) and hyperostosis along the distal medial humerus (2 patients). The former were frequently large, well-defined, and extended from the olecranon in a superior direction (Fig. 3, B).

Forearms: Irregularities at the site of attachment of the interosseous membrane along apposing surfaces of the radius and ulna were bilaterally evident in 3 patients and pronounced in 2.

Hands and Wrist: Abnormalities in these sites, noted in 8 patients, were bilateral in 6. Hyperostosis along the distal lateral radius was demonstrated in 4 patients, metacarpal and phalangeal heads in 3, and terminal tufts were seen in 5 patients (Fig. 3, C). In the lat-
Fig. 4. Lower Extremity Abnormalities. A. Cloud-like new bone formation along a segment of the medial femur (arrows) may be seen (CASE 20).

B and C. Photograph and radiograph of the knee reveal extensive calcification of the quadriceps and patellar tendons which has produced a large soft-tissue mass (arrows) (CASE 14).

D. An axial view of the patella outlines anterior hyperostosis (arrow) (CASE 16).

E. Note the osteophyte extending from the proximal tibia to the fibular head (straight arrow) and hyperostosis of the lateral tibial shaft (curved arrow) (CASE 15).

F. Bony excrescences on the distal lateral tibia (straight arrow) and medial malleolus (curved arrow) may be noted (CASE 15).
Fig. 5. **Heel and Foot Abnormalities.** A. Calcaneal spurs along posterior and inferior surfaces (straight closed arrows) are associated with ossification adjacent to the cuboid and base of the fifth metatarsal (curved arrows). A small osteophyte on the dorsum of the navicular is apparent (open arrow) (CASE 16).

B. Sagittal section of the heel demonstrates calcaneal spurs incorporated into the Achilles tendon (straight arrow) and plantar aponeurosis (curved arrow).

C. Hyperostosis in the dorsum of the foot has produced a large talar beak (curved arrow), cortical thickening of the tarsal navicular and a small osteophyte of the cuneiform (straight arrows) (CASE 19).

D. Peculiar new bone formation on the medial navicular (arrow) is typical (CASE 15).

Femurs and Knees: Hyperostosis along the posterior or medial femur was seen in 3 patients. It was cloud-like in 2 and well defined in the third (Fig. 4, A).

Bilateral ligamentous ossification about the knee was evident in 6 individuals. Predilection for the superior margin of the patella at the quadriceps mechanism was noted; inferior pole patellar abnormalities were less frequent. In one man, extensive calcification along the entire quadriceps mechanism on the right side produced distinctive clinical and radiographic findings (Fig. 4, B and C). Irregularities of the tibial tuberosity were seen in 2 patients. In several individuals in whom axial views of the patella were available, irregular whiskering on the anterior surface of this bone was noted (Fig. 4, D).

Forelegs: Abnormalities, bilateral in 4 and unilateral in 2, were noted in 6 patients, particularly involving the proximal fibula, bony attachments of the interosseous membrane, proximal medial tibia, and ankle. Osseous bridging between the lateral proximal tibia and fibular head was seen in 2 patients (Fig. 4, E). About the ankle, hyperostosis was most extensive on apposing surfaces of the tibia and fibula (Fig. 4, F).

Heels: Calcaneal spurs, evident in 16 patients, were bilateral in 14 and involved the posterior aspect of 27 calcanea and the inferior aspect of 18; plantar and posterior spurs were evident in 15 heels. They were frequently large and irregular although well defined (Fig. 5, A and B). Associated calcification in the plantar ligaments was noted in one individual.

Feet: Hyperostotic abnormalities of the feet, present in 15 patients, were bilateral in 12. They were most common on the dorsum of the mid and hindfoot (9 patients) where outgrowths along the talus and navicular...
Fig. 6. Spectrum of Abnormality in One Patient (CASE 15).  
A. Anterior "flowing" osteophytes extending from the fourth through the seventh cervical vertebrae (straight arrows). Smaller outgrowths are apparent on the second and third vertebrae (curved arrows).
B. An "armor" of new bone is deposited along most of the thoracic spine (arrows). Note the integrity of the disc spaces.
C. Excrences on the anterior and inferior patella (arrows) are seen.
D. Note the prominent calcaneal spurs and similar outgrowth on the dorsum of the foot and on the fifth metatarsal (arrows).

were noted (Fig. 5, C). Large talar beaks were seen in 4 patients (Fig. 5, C). Hyperostosis along the medial navicular and cuneiform were not infrequent (5 patients) (Fig. 5, D). Occasionally, similar abnormalities of the cuboid were present (Fig. 5, A). Additional sites of hyperostosis in the feet included the base of the fifth metatarsal (7
patients) (Fig. 5, A) and the phalanges (3 patients).

**Skull:** Radiographs of the skull were available in 7 of the 21 patients. Mild hyperostosis frontalis interna was noted in 3 of the men; no other abnormalities of the cranium could be appreciated.

**CASE REPORT**

**CASE 15.** This 50-year-old Caucasian man, a retired office worker, presented at the Veterans Administration Hospital in October 1973 for evaluation of arthritis. His current difficulties began in 1966 when he experienced neck pain radiating down his left upper arm. Radiographs of the cervical spine revealed "degenerative" changes and shoulder x rays demonstrated calcific tenosynovitis. The patient experienced symptomatic improvement following physical therapy and no medication was required. In 1968 he noted cervical dysphagia, particularly with solid foods, and repeat radiographs showed extensive anterior cervical osteophytes which encroached upon a barium-filled esophagus. Multiple spurs were surgically removed. Six months later, right elbow pain and tenderness were evaluated, the radiographs outlining a large olecranon osteophyte which was also removed at surgery, with symptomatic relief. Five months prior to his current evaluation, the patient noted the acute onset of right elbow pain, redness, and swelling which responded to local steroid injections. At the time of his initial presentation, the patient's complaints included occasional neck pain and stiffness and left shoulder and elbow discomfort, with numbness of the hands.

There was no familial history of diabetes or arthritis. The patient had lived in western Pennsylvania for 27 years and in California for the last 5 years.

On physical examination, he was 6 feet (180 cm) tall and weighed 230 pounds (104 kg). Dental evaluation was unremarkable. Chest expansion was 2.0 cm. There was decreased range of motion in the thoracic and lumbar spine, particularly in flexion. The right sacroiliac joint was tender to palpation. Neurologic evaluation was normal. Laboratory values were normal for serum electrolytes. The fasting blood sugar was 114 mg/100 ml. A two-hour postprandial serum sugar was 164 mg/100 ml with 4+ glucosuria noted at one and two hours. Serum rheumatoid and ANA titers were negative. Radiographs revealed extensive anterior osteophytes of the cervical (Fig. 6, A), thoracic (Fig. 6, B), and lumbar spine (Fig. 1, D). Moderate "whiskering" along the iliac crests was noted. Mild cortical irregularities on the inferior aspect of the distal right and left clavicles and bilateral extensor and flexor carpi ulnaris spurs were apparent (Fig. 3, B). Osseous outgrowths were also seen about both knees (Fig. 6, C), forelegs (Fig. 4, E), ankles (Fig. 4, F), and feet (Figs. 5, D and 6, D). Large calcaneal spurs were also revealed (Fig. 6, D).

Treatment with aspirin brought clinical improvement. In January 1974, a steroid injection was administered for left shoulder bursitis but the pain recurred. He has been taking 6 to 8 aspirin tablets each day and intermittently wears a cervical collar for neck pain.

**DISCUSSION**

In the classic descriptions of ankylosing hyperostosis of the spine (8, 10), distinctive radiographic abnormalities are emphasized. Bony outgrowths, predominating in the thoracolumbar area, form along the anterior and right lateral aspects of the vertebral column; their evolving roentgenographic pattern differs somewhat according to their level of development (8). In the cervical and lumbar regions, early thickening of the bone along the anterior surface of the vertebral bodies eventually becomes pronounced and spur-like and may ultimately result in flowing ankylosis of a few or several vertebrae. In the thoracic region, the pattern is linear or laminated, and can produce anterior ankylosis extending over a longer segment. The integrity of the disc spaces and apophyseal joints is maintained, and allows differentiation from ankylosing spondylitis and disc degeneration.

The extraspinal manifestations of this disease have not been emphasized or systematically studied but according to our observations, they are frequent and similarly distinctive. Particularly prominent are abnormalities in the following sites:

**Pelvis:** Osseous or soft-tissue radiographic abnormalities, present in all 21 patients in this series, have occasionally been reported (6, 9, 15). Osseous "whiskering" at sites of ligament attachments (iliac crest, ischial tuberosity, troCHANTERS), not unlike that occurring in ankylosing spondylitis, and ligament ossification are frequent. The latter has a predilection for the iliolumbar and sacrotuberous ligaments. Para-articular osteophytes along the inferior aspect of the sacroiliac joint (6), lateral acetabular (8), and superior pubic margins (9) may apparently restrict motion (17), produce para-articular osseous bridging and, on rare occasions, intra-articular bony ankylosis (6). The latter was not apparent in our series; in fact, the integrity of the joint space adjacent to the exostosis was frequently striking.

**Elbow:** Spurs on the posterior and/or inferior surface of the calcaneus were common, and occasionally have been noted in previous reports (8). They occurred in 16 of our 21 patients (76%); evaluation of the calcaneus in "controls" indicates spur formation in 16% (1). The calcaneal outgrowths in our patients were of variable size, but were frequently large. Occasionally, multiple spurs on either surface of the calcaneus were apparent. They were well defined, without adjacent reactive sclerosis or erosions, and differed from the calcaneal spurs which accompany the granulomatous arthropathies (4). The calcaneal outgrowths were at the attachments of the Achilles tendon and planter aponeurosis. A similar inferior or plantar spur has been noted in obese men (17); it may result from mechanical stress on the longitudinal arch of the foot. All 6 obese patients in our series had calcaneal spurs; they were bilateral in 5, and on the plantar surface in 9 of the 12 calcanea.

**Foot:** Distinctive bony outgrowths occurred along the dorsal surface of the talus, dorsal and medial tarsal, navicular, and lateral and plantar portions of the cuboid and base of the fifth metatarsal. At the latter sites, they may represent calcification in the plantar aponeurosis or resemble variations of the peroneal sesamoid (17). Large talar "beaks" simulate those occurring with tarsal coalition (5) or athletic injuries (17); special radiographic projections to detect talocalcaneal fusion were not available in our 4 patients with talar beaking.

**Elbow:** Olecranon spurs are frequent, well defined, and occasionally of considerable size.

**Other Sites:** Although scattered osseous outgrowths occur at other sites of ligament attachment in the body,
they are particularly striking about the patella (24) and distal tibia and fibula. In the former location, they are noted on the superior and inferior margins of the patella; axial views may identify peculiar hyperostosis of this bone (27). Widespread calcification of the quadriceps and patellar tendons occurred in one of our patients; clinical tendinitis was apparent in 3 individuals. Additionally, exostosis about the shoulder (8), knee and phalanges or metacarpals (11), and hyperostosis of the skull (8, 11) may be noted.

Axial symptoms and signs dominate the clinical picture in this disorder. Mild or low back pain and decreased range of motion are prominent and cervical spine osteoarthrosis may produce dysphagia due to compression of the esophageal lumen (19). Peripheral musculoskeletal complaints, present in 8 of the 21 patients, may be the initial clinical manifestation of the disease. These symptoms are "para-articular" with pain, tenderness and decreased range of motion and surgical removal of osteophytes may be necessary. Joint inflammation is characteristically absent although concomitant osteoarthritis in these elderly patients is not infrequent.

The etiology of this disorder is obscure. Its association with hyperglycemia and obesity (16, 21) and its occurrence in cats with hypervitaminosis A (22) have been noted. Ligament ossification in adult human beings with vitamin A poisoning has also been demonstrated (12). Its resemblance in some respects to acromegaly may be appreciated but assays of growth hormones in affected patients have not been rewarding (3). Toxic exposure to fluorine has also been suggested as an etiologic factor.

The roentgen features of DISH are distinctive. Ankylosing spondylitis produces squaring of the vertebral bodies, thin bony syndesmophytes, and apophyseal and sacroiliac articular alterations. Acromegaly may result in bony deposition along the anterior and lateral aspects of the vertebral bodies (7, 20) with preservation of disc height, but the "flowing" pattern of new bone is not seen, posterior scalloping of the vertebral bodies may be noted (26), and typical alterations in the skull and peripheral skeleton are apparent. The prominent tufts of the terminal phalanges noted in several of our patients with DISH were mild compared to those occurring in acromegalias. Fluorosis (23) may produce spinal osteoarthrosis, ligament ossification, pelvic "whiskering," and peripheral periostitis (25), but increased skeletal density is apparent. Pertinent geographic history and clinically evident dental abnormalities may allow accurate diagnosis. Pachydermoperiostosis (14, 18) may produce periosteal new bone formation involving the distal ends of long bones which may simulate the extraspinal manifestations of DISH. The presence of digital clubbing, coarsening of the facial features, and furrowing and oiliness of the skin, and the absence of radiographic abnormalities of the spine allow its differentiation. Hypertrophic osteoarthropathy (13) produces diaphyseal and metaphyseal periostitis which differs from the appearance of DISH. Additionally, digital clubbing, absence of spinal involvement and the frequent presence of pulmonary pathology allow accurate diagnosis of hypertrophic osteoarthropathy.

It would appear that diffuse idiopathic skeletal hyperostosis is a common "ossifying diathesis" occurring in middle-aged and elderly patients in which bony hyperostosis results at tendon and ligament attachments; although such involvement predominates in the axial skeleton, initial or concomitant involvement at extra-axial locations occurs. The spinal osteophyte production in our group of patients was generally widespread and extensive. Localized outgrowths, particularly in the thoracic spine, are frequently encountered, demonstrating typical Forestier-like characteristics (flowing pattern of ankylosis and absence of disc space narrowing, vacuum phenomena and end-plate sclerosis) and may be unassociated with axial symptoms or signs. Pathologically, these smaller osteophytes are similar in all respects except size and represent one end of the disease spectrum. Although we have not specifically investigated the extra-axial manifestations in a group of patients with typical but localized spinal changes, we would suspect that the incidence of such abnormalities would be considerably lower than in the present group of patients and that the degree of alteration would similarly be less striking. Several additional patients seen at the Veterans Administration Hospital during this period demonstrated similar widespread extraspinal radiographic alterations without spinal abnormality. These patients are being carefully observed to determine their eventual proclivity to spinal involvement.

ADDENDUM: Axial and extra-axial radiographs of 21 age-matched male controls (who had been examined for metastatic bone disease) were reviewed. In each instance, x-ray views comparable to those obtained in the patients with Forestier's disease were available, including radiographs of the peripheral joints. In the pelvis, small, irregular outgrowths were present at the iliac crests, ischial tuberosities and/or trochanters in 5 patients. Additional findings included olecranon spurs (2 cases), calcaneal spurs (4 cases), and anterior patellar spurs (1 case). Slight hyperostosis of the distal medial humerus was noted in 1 patient. Hyperostosis was mild and localized in all of these men.

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REFERENCES