Association of Diffuse Idiopathic Skeletal Hyperostosis (DISH) and Calcification and Ossification of the Posterior Longitudinal Ligament

DONALD RESNICK,¹ JOSE GUERRA, JR.,¹ CHARLES A. ROBINSON,² AND VINTON C. VINT³

Diffuse idiopathic skeletal hyperostosis (DISH) is a common ossifying diathesis in middle-aged and elderly patients characterized by bone proliferation along the anterior aspect of the spine and at extraspinal sites of ligament and tendon attachment to bone. Four patients with DISH revealed extensive calcification and ossification of the posterior longitudinal ligament in the cervical spine. Review of cervical spine radiographs in 74 additional patients with DISH demonstrated bony hyperostosis of the posterior aspect of the vertebrae in 41%, posterior spinal osteophyosis in 34%, and posterior longitudinal ligament calcification and ossification in 50%. These ligamentous findings, which have previously been described almost exclusively in Japanese people, appear to be an additional skeletal manifestation of DISH.

Diffuse idiopathic skeletal hyperostosis (DISH) is a common disorder characterized by bone proliferation in axial and extraaxial sites [1–3]. The most characteristic abnormalities in this condition are ligamentous calcification and ossification along the anterolateral aspect of the vertebral bodies with localized osteophytosis. Changes in extraspinal locations are also frequent, including ligament and tendon calcification and ossification, paraarticular osteophytes, and bony excrescences at sites of ligament and tendon attachment to bone. Alterations along the posterior aspect of the vertebrae are rarely mentioned in this condition.

Ossification of the posterior longitudinal ligament of the cervical spine has been reported in a large number of Japanese patients and in a few non-Japanese individuals [4–13]. This ossification, which has a characteristic appearance on radiographs, may be associated with cervical myelopathy [4, 5, 7, 8, 10, 12] or produce no symptoms and signs [5, 10, 11, 13–15].

Recently we investigated four patients who demonstrated extensive posterior longitudinal ligament calcification in the cervical spine on initial evaluation. Subsequently, additional radiographs revealed findings of DISH. We present these four patients in detail and describe the incidence of radiographic abnormalities along the posterior aspect of cervical vertebral bodies and intervertebral discs in a large number of patients with DISH.

Case Reports

Case 1

A 71-year-old white man was evaluated at the Hospital of Scripps Clinic because of left lower extremity pain and weakness for 15 years. The pain began as a tingling sensation on the dorsum of the left foot and progressed to involve the ankle, knee, hip, and left buttck. An extensive neurologic and orthopedic evaluation 4 years prior to the current evaluation included myelography and electromyography with inconclusive results. The present physical examination outlined herpes zoster on the left buttck, pronounced restriction of motion of the cervical spine, and muscle atrophy and decreased pain and sensation in the left lower extremity. Laboratory evaluation was unremarkable, although nonspecific electromyographic alterations were apparent in the left leg.

Radiographic examination revealed the findings of DISH, including calcification and ossification along the anterior aspect of the entire vertebral column (fig. 1A), bony excrescences about the pelvis, and paracetabular osteophytes. Prominent calcification and ossification of the posterior longitudinal ligament was noted in the cervical spine (fig. 1B). Lumbar myelography demonstrated no significant abnormalities; the cervical canal was not examined. The final impression after extensive neurologic evaluation was that the symptoms were probably related to nerve root involvement in the lumbosacral spine, and that they were accentuated by the presence of herpes zoster.

Case 2

A 57-year-old white man had a complicated medical history which included pulmonary resection for a granuloma related to coccidioidomycosis, adult-onset diabetes mellitus, type IV hyperlipoproteinemia, hypertension, and a hydrocele of the left testicle. His current evaluation at the Hospital of Scripps Clinic for increasing pain and stiffness in the neck and lower back for several years revealed marked restriction of motion of the cervical spine with paraspinal muscle spasm. Some restriction of motion in the lumbar spine with flattening of the lumbar lordosis was also evident. Laboratory examination was unremarkable.

Radiographic evaluation outlined findings of DISH, including new bone formation along the anterolateral aspect of the entire vertebral column, paracetabular bony excrescences, sacroiliac joint osteophytosis, and patellar hyperostosis. Radiography including tomography of the cervical spine outlined exuberant calcification and ossification of the posterior longitudinal ligament (figs. 2A and 2B) which was further documented on computed tomography (fig. 2C). The patient was referred for appropriate physical therapy.

Case 3

A 64-year-old white man was seen at the Hospital of Scripps Clinic because of low back and lower extremity pain for about 13 years which had required lower lumbar laminectomy for "three slipped discs." Additional musculoskeletal complaints were numbness and tingling of both thighs, pain and stiffness...
in the cervical spine, and mild discomfort in the region of the Achilles tendon associated with "heel spurs." Physical findings included significant restriction of cervical spine motion, paraspinal muscle spasm of the cervical region, and restriction of forward flexion in the lumbar spine. Neurologic examination and laboratory analysis were within normal limits.

Radiography outlined the changes of DISH, including prominent anterior spinal new bone formation (fig. 3A), paracetabular osteophytes, calcification of iliolumbar ligaments, and pelvic bony excrescences. Cervical spine radiography demonstrated calcification and ossification of the posterior longitudinal ligament (fig. 3B). The patient was referred for physical therapy.

**Case 4**

A 57-year-old white man was evaluated at the Veterans Administration Hospital for pain and decreased range of motion in the neck for several years. The patient also noted pain and numbness along the lateral aspect of the right arm. Previous medical history included Ménière’s disease. Laboratory analysis was unrewarding, but electromyography outlined absent sensation of the right arm along the distribution of the ulnar nerve. There was no evidence of motor radiculopathy.

Radiography demonstrated the alterations of DISH with deposition of bone along the anterolateral aspect of the vertebral column, and extensive calcification and ossification of the posterior longitudinal ligament in the cervical spine (fig. 4). Although myelography was recommended, the patient was lost to follow-up.

**Cervical Spine Changes in DISH**

Review of cervical spine radiographs in 74 patients who met our previously published criteria for DISH [2] documented definite abnormalities along the posterior aspect of the vertebral bodies in 55 patients (74%). These abnormalities could be divided into three types which frequently were found together:

1. Bony hyperostosis (fig. 5). Bony eburnation or sclerosis along the posterior aspect of the vertebral bodies was apparent in 30 patients (41%). This abnormality was most apparent in the upper cervical vertebrae and produced “highlighting” or “whitening” of the posterior cortex.

2. Osteophytosis. Osteophytes protruding from the posterior aspect of the vertebral bodies were noted in 25 patients (34%). They were most frequent in the mid and lower cervical region where they produced bony excrescences, typically small, which protruded into the spinal canal.

3. Posterior longitudinal ligament calcification and ossification. Ligamentous calcification and ossification were apparent in 37 patients (50%). These deposits, particularly frequent in the upper cervical spine, were of variable size, linear in distribution, bumpy in contour, and typically were separated from the subjacent vertebral body by a radiolucency of variable thickness.

These three types of radiographic abnormalities were commonly, but not invariably, associated with alterations along the anterior aspect of the cervical spine which included osteophytes and flowing ossification anterior to the vertebral bodies and intervertebral discs. Although thoracolumbar changes were invariably present allowing
the diagnosis of DISH, there was no definite correlation between the extent of abnormality along the posterior aspect of the cervical vertebrae and that in the thoracolumbar region.

Discussion

Although DISH and posterior longitudinal ligament calcification and ossification have received considerable attention in the medical literature, their possible association has rarely been mentioned. Arlet et al. [16] analyzed 40 patients with cervical myelopathy and noted the frequency of vertebral hyperostosis in these patients. Of the 40 patients, 17 (43%) had both DISH and acquired stenosis of the cervical canal related to bony proliferation along the posterior aspect of the vertebral bodies. The pattern of proliferation included findings similar to those noted in our investigation, such as hyperostosis, osteophytosis, and ligament calcification and ossification.

Ono et al. [17] investigated 166 patients with ossification of the posterior longitudinal ligament. Symptoms in these patients, including motor and sensory disturbances in the lower extremity, were particularly prominent when the ossified posterior longitudinal ligament occupied 60% of the sagittal diameter of the cervical spine. Of 160 patients in that report, 71 (44%) demonstrated concomitant hyperostosis on the anterior aspect of the vertebral column. Postmortem examination of two patients with both posterior longitudinal ligament calcification and DISH revealed that the ossification of the posterior longitudinal ligament was particularly prominent in its superficial layer, whereas the unossified deep layer was thickened, creating a radiolucency between the ossified ligament and underlying vertebral body. At the craniocervical junction, histologic evaluation outlined proliferation of cartilagelike cells and hyperplasia of the matrix within the posterior longitudinal ligament. These findings did not document the sequence of events which occurs in this condition, but suggested that although anterior and posterior longitudinal ligament calcification and ossification frequently coexist, definite and remarkable differences in their pathology can be noted.

Although patients with posterior longitudinal ligament ossification may be asymptomatic [13], a variety of symptoms and signs have been associated with this disorder [4-12]. Parasthesias may vary from intermittent sensations, including numbness or tingling of several digits of one or both extremities, to extensive and severe anesthesia of the trunk and lower extremities [6]. Motor disturbances, such as weakness, incoordination, and instability, may be encountered in upper and lower extremities. Additional symptoms may include head and neck pain and stiffness, urinary and rectal incontinence and

Fig. 3.—Case 3. A, Typical flowing ossification in thoracic spine. B, Calcification and ossification of posterior longitudinal ligament at level of second and third cervical vertebral bodies (arrow).

Fig. 4.—Case 4. A and B, Lateral and frontal radiographs of cervical spine demonstrating widespread calcification and ossification of posterior longitudinal ligament (arrows). C and D, Lateral and frontal tomograms better delineating these findings.
dysfunction, and loss of libido. On physical examination, patients may reveal muscle atrophy, fasciculations, hyperreflexia, and sensory loss. The reported incidence of these findings has varied considerably, and the symptoms and signs are, in general, nonspecific, being present in other disorders of the spinal canal and cord.

Our previous investigations of patients with DISH did not emphasize abnormalities of the posterior aspect of the cervical vertebrae, although we did note some patients with DISH who revealed posterior longitudinal ligament ossification, and others who demonstrated small posterior cervical spine osteophytes and hyperostosis [18]. It is apparent from our closer evaluation of these and additional patients with DISH that such alterations are frequent in the disease. Furthermore, our recent experience with the four patients reported here suggests that posterior longitudinal ligament calcification and ossification in the cervical spine may become extensive in this disorder.

This observation is important, as deposition of calcium and bone along the posterior aspect of the vertebral bodies and intervertebral discs may compromise the integrity of the spinal cord, leading to significant neurologic findings. Some of the neurologic abnormalities in three of these four patients (cases 1, 3, and 4) may indeed have resulted from such ossification; it is therefore imperative that the radiologist search diligently for these changes. Thus, lower extremity muscle atrophy and sensory loss in case 1, numbness and tingling of the thigh in case 3, and upper extremity numbness and sensory loss in case 4 may have been related to posterior longitudinal ligament ossification. Tomography of the spine may be necessary for adequate evaluation; in one of our patients, computed tomography revealed not only the presence of posterior longitudinal ligament calcification and ossification but the extent of spinal canal impingement. Human et al. [19] previously described a patient with cervical myelopathy in whom computed tomography documented the presence and extent of ossification within the posterior longitudinal ligament.

It is apparent from this review that a great number of patients with DISH will reveal significant posterior vertebral abnormalities. Although we have not analyzed cervical spine radiographs in an age- and sex-matched “normal” control population, our brief review of about 20 cervical spine examinations in elderly patients yielded some with bony hyperostosis and minor degrees of osteophytosis. Posterior longitudinal ligament calcification and ossification were not apparent, suggesting that these latter changes are indeed associated with DISH. If DISH is considered a frequent disease in this country with an incidence that may reach 12% of middle-aged and elderly patients [18], calcification and ossification of the posterior longitudinal ligament should no longer be regarded as findings almost confined to Japanese individuals.

REFERENCES


