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Cervical spine stenosis due to ossification of the posterior longitudinal ligament in Italian patients: surgical treatment and outcome

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Abstract Ossification of the posterior longitudinal ligament (OPLL) of the cervical spine is a frequent pathological entity in people of Japanese and Asian extraction and is reported with increasing frequency also in the USA; on the contrary, reports in the European and particularly in the Italian literature remain rare. This paper describes 8 Italian patients with cervical spine stenosis due to OPLL extending three to five vertebral segments (and above C3 in four cases). Magnetic resonance imaging shows the extent of the ossification well in terms of height and cord compression, while computed tomography is useful to measure the thickness of the bone mass and the residual spinal canal. Anterior cervical decompression by discectomy, corpectomy, and removal of the ossified ligament is the treatment of choice and results in clinical improvement in most cases. Decompressive laminectomy may be reserved for patients with ossification extending to four or five levels and above C3. The surgical technique and intraoperative findings are discussed.

Introduction

Ossification of the posterior longitudinal ligament (OPLL) of the cervical spine is very frequent among people of Japanese extraction [1, 6, 10], where it may be found in 2% of the cervical plain radiograms of patients with spinal problems. Some recent reports [3, 5] have also shown a high incidence of this condition (up to 25%) in patients operated on for cervical myelopathy in the USA. However, the incidence of OPLL of the cervical spine in European countries has not been defined, and reports in the European and particularly the Italian literature are rare [2, 4, 7, 9]. In addition, most reports concern cases with ossification involving only a few levels (one to three) with moderate cord compression; multilevel OPLL and marked spinal stenosis appear to be rather unusual.

This paper reports 8 Italian patients with very extensive OPLL of the cervical spine causing myelopathy; they represent 9% of 88 cases of cervical spondyloarthrosis myelopathy operated on between 1988 and 1995.

Patients and methods

Eight Italian patients with a diagnosis of OPLL of the cervical spine were observed and treated in our Department between 1988 and 1995. They were 5 men and 3 women, ranging in age from 45 to 68 years (average 57 years). All were free from diabetes or other methabolic dieseases and skeletal hyperostosis elsewhere.

From the clinical point of view, the patients were classified according to the myelopathy grading scale as follows: grade 0, no evidence of myelopathy; grade I, able to run, but with abnormal strength, reflexes or tone on examination; grade II, difficulty in running or climbing stairs; grade III, difficulty in walking: (a) independent but unsteady, (b) cane or crutch dependent, (c) dependent on assistance; grade IV, difficulty in standing. The sphinteric function was graded as follows: grade 0, continent urine and stool, voids spontaneously; grade 1, minor sphincteric disturbance; grade 2, sphincteric disturbance requiring catheterization.

Diagnostic studies included radiograms of the cervical spine and computed tomography (CT) axial scans with sagittal reconstructions in all patients and magnetic resonance imaging (MRI) in 5 patients. The spinal canal dimensions and the OPLL were measured on CT and MRI.

Seven patients were operated on, whereas one refused operation and was treated conservatively with bed rest and neck immobilization.

Results

The clinical status at examination, according to the myelopathy grading scale, is summarized in Table 1. The mean evolution time before diagnosis was 14 months. Abnormal findings on spine radiograms were longitudinal retrovertebral opacity in 6 cases (Fig. 1) and isolated osteophy-

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Table 1 Data of 8 patients studied with ossification of the posterior longitudinal ligament (OPLL) of the cervical spine

	Age/ sex	Duration of history (months)	Grade of myelopathy at clinical examination	Radiologic diagnosis	Extent of ossification	Stenotic ratio	Treatment	Outcome (grade)
Case 1	68/M	15	III-2	CT, MRI	Cl–4	70%	Laminectomy C1–4	II-1 (60 m)
Case 2	54/M	13	III-0	CT	C2–6	60%	Laminectomy C2–6	III-0 (72 m)
Case 3	45/F	8	IV-1	CT, MRI	C2–6	75%	Laminectomy C2–6, anterior discectomy at C3/4 and C5/6	Died from lung embolism
Case 4	56/M	7	I-0	CT	C2–5	30%	Conservative	I-0 (36 m)
Case 5	57/M	14	III-1	CT, MRI	C3–6	60%	Anterior discectomy and corpectomy of C4 and C5, removal of the OPLL	II-0 (40 m)
Case 6	65/F	10	II-0	CT, MRI	C3–6	50%	Anterior discectomy and corpectomy of C4 and C5, removal of the OPLL	I-0 (12 m)
Case 7	54/F	14	III-0	CT, MRI	C4–7	60%	Anterior discectomy and corpectomy of C5 and C6, removal of the OPLL	I-0 (7 m)
Case 8	57/F	17	II-0	CT	C4–7	40%	Anterior discectomy and corpectomy of C5 and C6, removal of the OPLL	0-0 (5 m)

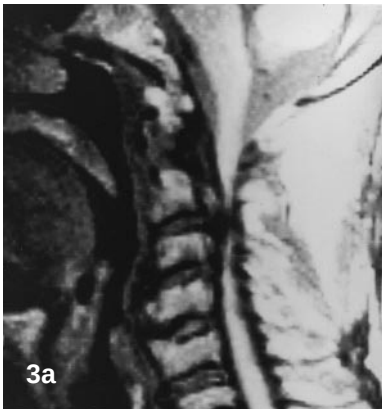

Fig. 1 a, b Plain radiograms of the cervical spine in lateral view. **a** Case 1: thick retrovertebral longitudinal opacity extending from C1 to C4, more marked at level of C2 and C3. **b** Case 3: linear retrovertebral opacity, more evident between C2 and C4

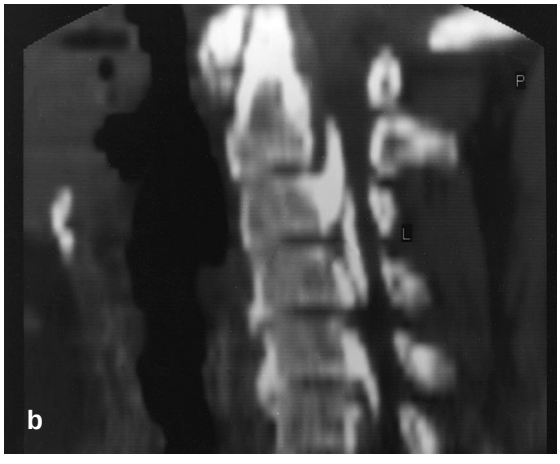

Fig. 2 Computed tomography (CT) scan, axial section at C4 (**a**) and sagittal reconstruction (**b**): retrovertebral hyperdense structure extending between C2 and C6, corresponding to the ossified posterior longitudinal ligament. Severe stenosis of the spinal canal (> 75%) at level of the ossification

Fig. 3 Magnetic resonance imaging (MRI). **a** Case 1: sagittal T1-weighted sequence: low-signal stria along the posterior aspect of the vertebral bodies of C1–4, with backward displacement of the spinal cord, more marked at C2–3 level. **b** Case 3: sagittal T1-weighted sequence: low signal striae, corresponding to the ossified ligament between C2 and C6; increased signal intensity of the spinal cord at level of the compression

tosis in 2. Axial CT with sagittal reconstruction showed in all cases an intraspinal hyperdense mass along the posterior aspect of the vertebral bodies (Fig. 2). On MRI, the ossified ligament appeared as a low-signal stria on both T1- and T2-weighted images, causing backward displacement of the spinal cord (Fig. 3). The ossification involved five vertebral levels in 2 patients and four levels in 6. The stenotic ratio of the spinal canal was more than 50% in 5 cases and 50% or less in 3.

Four patients were treated by anterior decompression, with discectomy of three spaces and median corpectomy of two vertebral bodies; the posterior longitudinal ligament was always solidly calcified and adhered tightly to the posterior aspect of the vertebral bodies; tenacious adhesions to the dural sac were found in one case. Three patients were treated by decompressive laminectomy extended upward and downward to the limits of the ossified ligament, because of the extent of the ossification to five vertebral bodies and/or being located above C3; in one case a two-level discectomy was also performed because of two large osteophytic protrusions.

The outcome is summarized in Table 1. One patient who underwent laminectomy and two-level discectomy died from lung embolism. In the other 6 patients, the postoperative follow-up ranged from 22 months to 9 years (average 57 months). All four cases treated by anterior discectomy and median corpectomy had variable improvement. Two patients who underwent laminectomy had slight and no improvement, respectively.

Discussion

OPLL presents with some particular characteristics, including male prevalence, onset of symptoms in middle age, more frequent involvement of mid-cervical segments with an average of three vertebral levels, and usual occurrence of a slowly progressive myelopathy [3, 5]. Our series shows some rather unusual features, including a remarkable extent of ossification to four or five vertebral segments, involvement of the high cervical region (C1 and C2 levels) in 4 of 8 patients, and marked thickness of the ossified ligament with a stenotic ratio of the spinal canal of more than 50% in 5 patients.

The diagnosis of OPLL of the cervical spine is usually easy with the current image techniques. MRI is essential to define the true extent in height of the ossified ligament (low-signal striae) and the signal intensity of the spinal cord at the level of the compression [8, 10]. CT defines the size of the ossified ligament well and allows measurement of the residual spinal canal [5]. Sagittal reconstructions aid in estimating the thickness and extent in height of the ossified mass (Fig. 2).

The indication for surgical treatment of OPLL is rather controversial. Most authors [1, 5] advise surgery only for patients with progressive myeloradiculopathy, while others suggest operating also upon patients with minor symptoms and signs, before they evolve into permanent neurologic deficits.

Posterior decompressive laminectomy was the usual surgical treatment until about 15 years ago. It eliminates the spinal stenosis and allows a multilevel decompression. However, the benefit of this technique is limited for many reasons, mainly because the OPLL is not completely removed and may continue to enlarge. Other techniques, such as a combination of laminectomy with anterior cervical fusion, an open-door laminoplasty [6], a laminoplasty with bone graft from the iliac crest, have been sometimes used to prevent neck deformity and spinal instability. Anterior cervical discectomy combined with fusion as the sole treatment is useful only in rare cases where the OPLL is of the bridging type, exclusively limited to the level of the intervertebral space.

Anterior cervical decompression by discectomy, median corpectomy, and removal of the OPLL is the best surgical approach to this disease [1, 3, 5]. This technique has many relevant advantages. First, it allows complete removal of the ossified ligament, thus eliminating the cord compression and avoiding futher ossification and enlargement of the ligament. In addition, stretching of the nerve roots around the ligament is also relieved. However, the anterior decompression may be performed only when ossification of the ligament occurs below the C2/3 level and extends less than three to four vertebral bodies. We performed a median corpectomy so that the posterior part of the vertebral body was scraped away more extensively than the anterior part, up to the lateral edge of the ossified ligament. This allowed us to preserve the lateral parts of the vertebral body and may avoid the placement of a bone graft when only two vertebral bodies are involved. No spinal instability was observed in our 4 patients treated by median corpectomy at two vertebral levels.

The ossified ligament may be solidly calcified into an ivory-hard osteoma, hardened but malleable, or of mixed consistency. It must be removed in small fragments with a microrongeur or an air drill with the aid of an operative microscope, to avoid any compression of the spinal cord. The ossified ligament may adhere tightly to the dural sac; otherwise, ossification of the dura itself is rare.

In this and in other series [1, 5], anterior decompression with removal of the ossified ligament led to neurological improvement or remission in most patients. Both spinal cord and radicular arm signs improve. However, complete neurological remission with return to a normal life is obtained in fewer than half of the patients, mainly in those with low grades (0 to II) of cervical myelopathy; in patients with high grades (III and IV), clinical remission is more often incomplete. Unsatisfactory postoperative results may be due to a delay in the diagnosis and treatment, severe preoperative cord damage, and difficulty to achieve sufficient decompression along the entirety of the ossification.

Anterior cervical decompression is the treatment of choice in patients with OPLL. Complete removal of the ossified ligament must be achieved in all cases to relieve the cord compression. An early and accurate diagnosis by CT and MRI and more aggressive and prompt surgical treatment will reduce the incidence of irreversible cord

damage and will increase the rate of complete clinical remission.

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