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Treatment of Cervical Spondylosis by Anterior Subtotal Vertebrectomy and Iliac Bone Fusion

Received: 02.01.1998

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Abstract: There is no ideal surgical technique for cervical spondylosis. The choice of surgical procedure remains controversial. A series of 25 patients who had undergone subtotal vertebrectomy and iliac bone fusion between 1985 and 1995 were reviewed. There were 19 men and 6 women with an average age of 55.6 years. All of the patients had cervical myelopathy and /or radiculopathy due to multi-level spondylosis and 7 with associated ossification of the posterior longitudinal ligament. In 6 patients 1 vertebral body, in 10 patients 2 vertebral

bodies, and in 9 patients 3 vertebral bodies were resected. After a mean 15-month follow-up period, 76% of patients exhibited good results.

It was concluded that if cervical spinal cord compression is caused by lesions located in the anterior aspect of the spinal canal, the surgical treatment of choice is subtotal vertebrectomy and fusion.

Key Words: Cervical spondylosis, myelopathy, radiculopathy, vertebrectomy

Introduction

A significant number of patients over the age of 50, although asymptomatic, show evidence of chronic cervical disc degeneration resulting in varying degrees of spondylotic change. Patients with large posterior spondylotic spur formation, developmentally small cervical canals, hypertrophy of the ligamentum flavum, or ossification of the posterior longitudinal ligament (OPLL) may have a slowly progressive myelopathy or an acute myelopathy after relatively trivial trauma resulting from spinal cord compression. Because spondylosis may affect more than one cervical segment, symptoms may be more diffuse than those associated with a unilateral soft disc protrusion. Radiculopathy and myelopathy are typical in cervical spondylosis, but one may exist without the other. Surgical treatment is generally reserved for those patients with intractable pain, progressive neurological deficits, and documented compression of the cervical nerve roots, the spinal cord, or both (1).

Selecting the best operation to relieve symptoms and signs may be difficult. Several options via anterior or posterior approaches are available. We therefore report our experience with a series of patients with cervical spondylosis who were treated by subtotal vertebrectomy and iliac bone fusion.

Patients and methods

Between 1985 and 1995, 25 patients with cervical spondylotic myelopathy and radiculopathy underwent

anterior cervical subtotal vertebrectomy and iliac bone fusion in the Neurosurgery Department of Cerrahpaşa Medical Faculty. All of the patients had cervical myelopathy and/or radiculopathy due to multi-level spondylosis. There were 19 men and 6 women. Their ages ranged from 40 to 64 years, with an average age of 55.6 years.

Before the operation, cervical X-ray, metrizamide myelography followed by axial computed tomographic (CT) scans and/or magnetic resonance imaging (MRI) were obtained for each patient.

Operative technique

The patient is placed in the supine position, the head is slightly extended. Exposure is obtained through a long incision along the anterior border of the right sternomastoid muscle. After confirmation of the operative level by intraoperative X-ray film, the anterior longitudinal ligaments is incised, discectomies are performed and subtotal vertebrectomy of 12 to 15 mm width is performed with a high-speed air drill. Then using an operative microscope, osteophytes and OPLL are removed. The T-shaped piece of iliac bone is grafted onto the resected vertebral bodies under manual traction on the neck (Figure 1).

After the operation, the patient is kept supine for about two days. The patient is then permitted to walk with a Philadelphia collar.



Figure 1. Post-operative lateral radiograph of cervical spine showing notched iliac strut graft following anterior decompression at C5-C6 levels.

The clinical follow-up was done through outpatient examinations, review of chart records, and telephone conversations. This follow-up period ranged from 7 to 24 months with a mean duration of 15 months. The results of the operations on myelopathy were evaluated using the Harsh myelopathy grading scale (Table 1) (2).

Results

The duration of symptoms before the operation ranged from 10 months to 60 months. Gait disturbance and dysesthesia were the most common symptoms. Before the operation, only two patients were identified as grade I according to the Harsh myelopathic scale and none of them were grade IV.

Eight patients displayed signs of radiculopathy. In the CT scan, all patients showed a narrowed spinal canal. There were 7 patients with associated OPLL. OPLL was of the segmental type in all 7 patients (Figure 2). In 10 of the patients, there were 2 intervertebral spaces; in 13 patients, 3 intervertebral spaces; and in 2 patients, 4 intervertebral spaces.

In 6 patients 1 vertebral body, in 10 patients 2 vertebral bodies, and in 9 patients 3 vertebral bodies were resected (Figure 3). In four patients, minor complications at the donor side were observed. In one

patient, a Brown-Sequard syndrome appeared immediately after the operation. The symptoms had partially disappeared at 3 months. In two patients with 2 and 3 level lesions, control CT-scans after the operation revealed fusion extrusion. A second operation was performed on both patients in order to replace the graft. In 6 patients, the Harsh myelopathic scale did not improve. Nineteen patients showed improvement of 1 to 2 grades according to the Harsh scale after a mean follow-up period of 15 months. There was no surgical mortality in the follow-up period.

Discussion

The best treatment for multisegmental cervical spondylotic myelopathy remains unclear. Cervical laminectomy, the oldest and perhaps the most frequently used procedure (3,4), seems to offer the least favorable outcome (5) because of incomplete decompression posteriorly, enhanced instability and the formation of epidural fibrosis at the site of the laminectomy (1,6). Anterior discectomy, osteophylectomy, and interbody fusion by either the Cloward or Smith-Robinson techniques have yielded results that are somewhat superior to laminectomy (7), but only if the disease process is confined to one or two spaces. Although

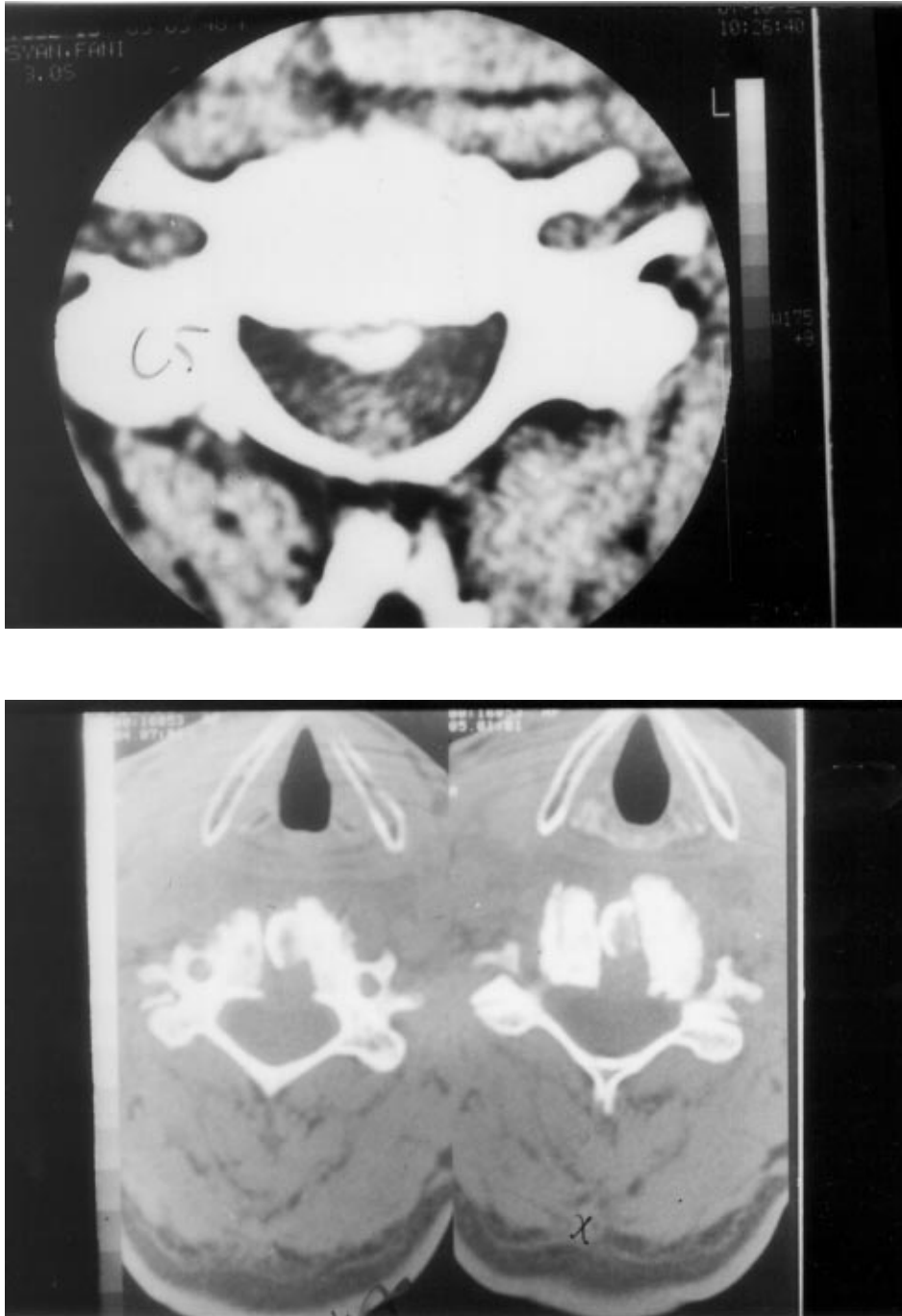


Figure 2. (a) Preoperative computerized tomography scans showing segmental type OPLL at C5 level. (b) After decompression and iliac bone fusion, the canal is now capacious.

primarily used in the management of OPLL, laminoplasty has also been used to treat spondylotic myelopathy. A comparative study of laminoplasty versus subtotal corpectomy (8) showed that the durability of surgical benefit after subtotal corpectomy is better. In terms of canal diameter, the results showed no significant difference between laminoplasty and subtotal corpectomy, but the rate of complication was found to be higher in subtotal corpectomy. Regression of improvement after laminectomy is reported as between 10% and 53% and is in large part due to instability

and/or kyphosis (9). In addition, Galera and Tovi (10) reported poor results in long-term follow-up after the Cloward procedure.

Several factors are important in deciding the type of surgery to be used. These are the curvature of the cervical spine (lordotic, neutral, or kyphotic), the side of the compression (ventral, dorsal, or symmetric), and the number of levels requiring decompression. A kyphotic cervical spine and a ventral cord compression should be decompressed anteriorly (11-13). Laminectomy is the treatment of choice in cases with hyperlordotic cervical

Table 1. Harsh myelopathy grading scale.

Grade 0	no evidence of myelopathy
Grade I	able to run, but abnormal strength, tone or reflexes
Grade II	difficulty in running or climbing stairs
Grade III	difficulty in walking
A	independent but unsteady
B	cane or crutch dependent
C	walker or assistant dependent
Grade IV	difficulty in standing



Figure 3. In T1-weighted sagittal MRI scans 12 months after C4-C5 vertebrectomy, the subarachnoid space can be clearly seen between the iliac bone graft and spinal cord.

spine and posterior cord compression (11, 13). In the presence of anterior compression by large osteophytes, laminectomy will not relieve the compression. A flexion-

extension arc was also proposed as an important factor determining the success of the posterior decompression by laminectomy (12, 13). If the arc is 40 degrees or

Table 2. Published corpectomy series for cervical spondylotic myelopathy.

Authors & Year	No.of cases	Age (mean)		Outcome	
		Range	Average	Improved	Worse
Hanai, et al., 1986 (11)	30	38-70	54,5	100%	0
Yonenobu, et al., 1984 (8)	21	-	53 ± 8,5	-	0
Bernard & Whitecloud, 1987 (9)	21	-	-	76%	9,5%
Kojima, et al., 1989 (1)	45	35-70	55	87%	1
Seifert & Stolke (13)	22	32-74	53	77%	0
Saunders, et al., 1991 (12)	40	-	64	62,5%	0
Kaynar, et al.	25	40-64	51	76%	0

-- Data not available

more, posterior stabilization procedures should follow laminectomy (12).

Anterior decompression and stabilization with strut graft have recently been proposed by many authors as a treatment modality ensuring satisfying decompression and stabilization. Table 2 summarizes the results of published corpectomy series for cervical spondylotic myelopathy (Table 2) (1, 8, 9, 14-16). 62.5% to 100% improvement in neurological status was reported by these authors. Seventy six percent of our patients showed improvement according to the Harsh scale. Yonenobu et al. (8, 17) recommended subtotal spondylectomy and fusion for cervical spondylotic myelopathy because of the wide operative field offered by spondylectomy, which allows the use of a surgical microscope. Consequently, posterior osteophytes are more safely managed and this may be a reason why spondylectomy is superior to anterior interbody fusion. Seven of our patients had OPLL, which were removed via this large operative field.

Three types of bone graft are available for fusion: autogenous fibula, fibular allograft, and autogenous iliac crest. We used autogenous iliac crest graft because, in contrast to fibular graft, fusion occurs rapidly, usually within 3 months (6, 15). The use of fibular allograft has the advantage of reducing the operative time and morbidity related to the side of the iliac crest. In 4 of our patients, minor complications, occurred at the donor site, but we prefer autogenous graft because the fusion is slower with allograft. Fusion extrusion is a potential

complication and this occurred in two patients. Graft problems were reported in 3% to 21% of cases (9, 14, 18). A screw stabilization system can help to prevent this complication (6, 15, 19). However, postoperative immobilization in a Philadelphia collar for 3 months was sufficient in most of our cases.

Complications, other than those related to the graft, were: transient worsening of neurological status in one patient and Horner syndrome in another. Although the surgical procedure, involving structures close to the neural tissue, is highly aggressive, complications causing neurologic deterioration are preventable. The removal of posterior or posterolateral osteophytes through a small and deep operative field, as in the Smith-Robinson method, may be dangerous. As reported by Hanai et al. (14), the range of motion of the cervical spine is affected in proportional to the number of fused discs.

Failure to improve after surgery may be due to inadequate decompression as seen in our 15th patient. This is also preventable with careful surgical technique. Longer decompressions are related positively to outcome (15). It is also reported that when symptoms exist for less than one year, improvement in neurologic status following surgical decompression can be predicted (9, 15).

Finally, we suggest that subtotal vertebrectomy and spinal fusion is a reasonable operative method for cervical spondylotic myelopathy because: (1) there is adequate anterior decompression, even if there is associated OPLL;

(2) stabilization of the cervical spine is ensured in the early or late follow-up; (3) the large operative field permits removal of posterior or posterolateral osteophytes compressing the cervical cord; and (4) mortality and morbidity can be minimized by the use of an operative microscope and high speed drill.

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