Anterolateral Surgery for Cervical Spondylosis in Cases of Myelopathy or Nerve-Root Compression

H. Verbiest, M.D., and H. D. Paz Y Geuse, M.D.

Neurosurgical Department, State University of Utrecht, Utrecht, The Netherlands

It is necessary in our discussion of cervical spondylosis to first define the term "hard protrusion," which is used differently in America and Europe. We use it here to indicate either the protrusion created by hypertrophic changes in Luschka's joints and transverse ridges, or that caused by subluxation of a vertebra. These hard protrusions are important factors in cervical spondylosis.

The pains occurring in cervical spondylosis are due not only to derangements of the intervertebral discs and Luschka's joints, but also to changes in the capsular structure of the joints and ligaments of the back which alter the normal cervical curvature. In 1946 Belart identified the signs and symptoms of cervical spondylosis as "the cervical syndrome." This syndrome has been studied extensively by French, German, and Swiss physicians. They found that a number of the patients suffered not only from brachialgia and neck pains but also from migraine cervicale, migraine pharyngée, occipital headaches, disorders of the arm joints and tissues, and pains in some of the internal organs. The individual variations in symptoms could not all be explained by involvement of the somatic or vegetative nervous systems and the related effects on various organs. Nor did the deformities shown in the radiographs explain the amount of radicular pain or its fluctuation.

Therefore, surgical treatment of the hard protrusions, which are but one aspect of cervical spondylosis, does not guarantee that the patient will be free from other manifestations of the cervical syndrome in the future. Derangements may develop at other levels of the vertebral column or joint disease may appear elsewhere, especially in the shoulder and shoulder girdle. The complexity of the situation is clearly demonstrated in Nugent's classification. He divided the causes of the cervical syndrome into three overlapping groups: vascular, connective tissue, and mechanical. Not all can be eliminated by anterior operations. The effectiveness of anterolateral surgery is determined by the significance and interaction of the specific causes producing symptoms in each individual case.

Preoperative Considerations

We selected patients who suffered from severe, persistent, or recurring radicular pain that had not responded well to conservative treatment. We found it difficult to differentiate true radicular pain from that originating in the cervical ligaments, the paravertebral muscles, or shoulder joints. We therefore decided to limit our selections in this first series of operations to those patients having radicular pains accompanied by abnormal neurological signs. Obviously, radicular pains may have also been complicated by referred pains. In cases of extensive nerve-root involvement accompanied by massive muscular atrophy, we preferred forameneotomy.

Myelopathy. Myelopathy in cervical spondylosis is presently thought to be caused by either mechanical or vascular compression of the cord. Various possibilities of vascular compression have been suggested, such as compression of the anterior spinal artery by spondylotic bars, intraforaminal compression of radicular arteries, or impairment of both the venous and arterial circulation. Girard, et al., found histological alterations in the spinal cord that were of vascular origin, yet did not involve compression of the cord, and were apparently unrelated to the territory of supplying vessels. Since different modes of vascular compression may be present in the same patient, adequate surgical treatment must include decompression at all possible sites as in a combined foramenec-
tomy and laminectomy.\textsuperscript{26,29,30} The question is whether removal of the compressing agents by an anterior approach has a similar effect. In spondylosis, encroachment on the cervical spinal canal frequently occurs at more than one level. This was true in 85\% of the 117 patients in Clarke and Robintho's series.\textsuperscript{13} In 11 of 17 patients examined by Wilkinson, there were three or more levels.\textsuperscript{31} Surgical decompression, whether anterior or posterior, must be extensive in most cases of cervical cord compression. Even then, the result depends on whether the removal of hard protrusions alone can effectively decompress the spinal cord.

Anterior compression may not be the only mechanical agent involved in cervical myelopathy. Clarke and Little\textsuperscript{12} described a case of cervical myelopathy with anterior compression due to a ridge, and posterior compression due to hypoplastic laminae. Other authors have stressed the relatively high incidence of congenital anomalies of the cervical spine in spondylosis.\textsuperscript{8,28} In 1955, Mayfield\textsuperscript{32} mentioned the possibility that a shallow vertebral canal could be of importance in the development of cord compression. Payne and Spillane\textsuperscript{34} found that the antero-posterior diameter of the cervical spinal canal was smaller in spondylotic spines than in normal ones, especially when there was paraplegia, and they suggested that the development of myelopathy might also be related to the initial size of the canal. This finding was confirmed by other authors.\textsuperscript{11,22,32} Albouker, \textit{et al.},\textsuperscript{1} stated recently that all their paraplegic patients had, besides their disc protrusions, extensive dysmorphic stenosis of the cervical spinal canal which narrowed the sagittal as well as the transverse diameter.

In this series, we are reporting anterior operations for cervical spondylotic myelopathy that were only performed in cases of localized (focal) pressure on the spinal cord. Where there was extensive, abnormal narrowness of the cervical spinal canal, we performed decompressive posterior operations.

\textit{X-ray diagnosis.} Discography is no diagnostic help. Sagittal tomography and air myelography are very useful, however, since they may demonstrate deformities not visualized in plain roentgenograms. The following patient is a striking example:

G. E., a man of 46, had suffered from progressive paraplegia for 2 years. X-ray studies are reproduced in Fig. 1. The sagittal tomogram of his upper cervical spine showed considerable narrowing of the spinal canal because of posterior spurs between C2–3. These spurs did not show in the plain lateral roentgenogram. The air myelogram in flexion showed interruption of the contrast medium at the C2–3 level, both anterior and posterior to the spinal cord. Extension of the neck resulted in so great a reduction of the sagittal diameter of the cervical canal that all air disappeared in front of the cord while only a small strip of air remained in the posterior spinal subarachnoid space. The diagnosis of spinal-cord compression by anterior spurs at C2–3 in a narrow cervical canal was confirmed by laminectomy of C1 through C-3. The operation was followed by a dramatic improvement in the neurological signs, including recovery of the use of his legs.

\textbf{Use of Bone Grafts in the Anterior Operation}

We used a modified Smith and Robinson's procedure.\textsuperscript{28} Through the emptied disc space, we removed the intraforaminal osteophytes (Figs. 2 and 3) and transverse ridges. In some of the cases this required resection of part of the uncinate process. When there was a backward luxation of a vertebra causing spinal cord compression, we removed the posterior-inferior portion of the vertebral body (Fig. 4). Anterior angulation of the cervical spine should be corrected, since in itself it is a source of neck pain and may cause undue stretching of the spinal cord.\textsuperscript{9,25} We tried to prevent the development of postoperative anterior angulation by reducing operative damage to the vertebral bodies and by using autogenous tibial cortical grafts instead of iliac bone. Fusion by means of the relatively soft, iliac grafts may result in anterior angulation, which is usually slight in one-level fusions (Fig. 5) but more pronounced following fusion at several levels.

Because of their weight-bearing properties, tibial cortical grafts can be used to restore the original height of a flattened disc space. This protects the intervertebral foramina from the superior articular processes when there is backward displacement of the adjacent vertebra. We have also found that the use of wedge-shaped tibial cortical grafts is a reliable way to correct the forward angulation of
the spine as well as to maintain the cervical lordosis. The grafts are taken from the anterolateral surface of the tibia below the tubercle, including the crest. Their shape adjusts well to the anterior-inferior lip of the overlying vertebra, which prevents forward-slipping of the graft. In the absence of such a lip, we cut one out of the lower surface of the next higher vertebra by means of the osteotome (Fig. 4 C and D). The grafts are placed with their narrowest vertical dimensions toward the spinal canal (Fig. 5) to prevent backward-slipping of the graft. We use calipers to measure the dimensions of the emptied disc space and prepare the grafts slightly oversized. They are introduced into the disc space by means of mallet and bone set.

It has been argued that the use of autogenous tibial-cortical grafts causes tibial fracture. Of the 70 patients with tibial

![Fig. 1. A. Lateral view of upper cervical spine at C2-3 does not show spur formation or canal narrowing. B. Sagittal tomogram shows the posterior spur formation and narrowing of the spinal canal. C. Sagittal tomo-air-myelogram with flexion of the spine shows interruption of the contrast at the level of spur formation. D. With the spine in extension only a small strip of air is present in the posterior spinal subarachnoid space.](image-url)
grafts, three had a postoperative fracture of the tibia at the site of the defect. These were our early cases, and in all three the fracture was caused by a single rotational stress. More recently we have used an oscillating saw to remove grafts from the most proximal part of the tibial shaft. We pack the tibial defect with Kieler spongious bone (commercially prepared, sterilized, macerated, animal bone) and instruct the patients to avoid rotational movements of the leg for 3 months after operation. No fractures have been observed since we instituted this procedure.

**Postoperative Treatment**

Patients with one-level fusions were mobilized after 1 or 2 weeks, if the interbody grafts were well-locked. They wore a Schanz or other type of cervical collar for another 4 to 6 weeks.

Patients with two- or three-level fusions had from 4 to 6 weeks bedrest with the head placed between padded immobilizers. One of the reasons for this more prolonged bedrest is the larger gap in the upper tibial crest produced by the removal of the cortical grafts. The initial stages of bony substitution of the Kieler spongious bone, used for packing this gap, may be expected to take place during this period of bedrest. After mobilization these patients had an adjustable plastic cervical collar supporting chin and occiput, with shoulder pieces and attachment to the upper chest.

The remodeling of the Kieler spongious

---

**Fig. 2.** Preoperative bony spurs (arrows) shown in A and C are no longer present 42 months after operation as shown in B and D where the tibial cortical graft appears completely fused, showing texture similar to that of the vertebral bodies.
Anterolateral Surgery for Cervical Spondylosis

Of 439 cases of cervical spondylosis treated during the past 5 years in the neurosurgical and neurological departments of Utrecht University, only 27 patients (6.1%) met these qualifications for anterior operation. These were 20 males and 7 females; ages varied between 39 and 65. We performed anterior decompression and fusion at one level on 12 patients, 11 of these presenting hard disc protrusions and one a posterior dislocation of a vertebra. We performed the operation at two levels on nine patients, five of whom had hard protrusions. Although the remaining four had a hard protrusion at only one level, we performed a fusion at two levels because there was abnormal motion relative to the adjoining vertebrae or a possibility that the radicular signs and symptoms did not arise from the level of the hard protrusion but from this second level. The same procedure was followed in six patients with 3-level operations, one having hard protrusions at 3 levels, four at 2 levels, and one at one level.

Results

Complications. One patient died 24 hours after a 3-level fusion. Autopsy findings did not reveal the cause of death. One patient...
developed severe dyspnoea on the eighth day after operation. The first signs were restlessness and anxiety after which severe dyspnoea developed rapidly. Intubation for 3 days resulted in complete cure.

Clinical signs and symptoms. We have not tried to classify the patients according to clinical results, since the cases were so varied. The concept of cervical spondylosis includes more manifestations than radiculopathy and myelopathy. Also, myelopathic disturbances are often dependent not only on the verte-

Fig. 4. A. Myelogram during extension of cervical spine shows complete obstruction at C2-3 interspace. B. During anteflection of the cervical spine, contrast medium passes in front of spinal cord. C. Backward dislocation of C-3 body and posterior bony spurs. D. Postoperative lateral view shows the posterior-inferior portion of C-3 removed; the canal is no longer narrowed in this area. An anterior lip has been cut out in the lower surface of C-3 for locking of the graft. E. Preoperative lateral tomogram with extended cervical spine shows narrowing between the posterior-inferior margin of C-3 and the arch of C-4. F. Postoperative tomogram showing a view comparable to that in D.
bral deformities but also on duration of illness, and the age of the patient. Intangible factors such as constitutional characteristics or changes in the tissues of the spinal cord and nerve roots may be significant. A much larger number of patients would be required for a valid statistical analysis. Therefore, we have simply reported our data.

Fusion. In each of the other 25 surviving patients, we checked the result of the fusions regularly by profile roentgenograms with the spine in ante- and retroflexion. Our follow-up covered periods of less than 6 months for two patients; 9 to 12 months for five patients; 1 to 2 years for nine; 2 to 3 years for three; 3 to 4 years for five, 55 months or more for two.

We only found signs of pseudarthrosis in one patient who had had a one-level fusion because of radiculopathy, which had been completely cured. In two patients with one-level fusions, we found no radiological evidence of bony union between the superior surface of the tibial graft and the vertebral body, but bridging osteophytes in front of the graft had prevented the development of pseudarthrosis. We found that all other fusions were solid and that the dense shadow of the tibial grafts on the radiographs gradually transformed into a texture resembling that of the adjoining vertebrae (Fig. 2C and 5D).

Myelopathy. We operated on 10 spondyloptic patients with myelopathy, six of whom also had symptoms of radiculopathy. One of the 10 patients had local narrowing of the cervical canal because of backward subluxation of C-3, seven had local narrowing due to a hard protrusion at one level (four at C5–6 and

![Fig. 5. Use of tibial cortical grafts. A. Slight wedging of the block vertebrae following fusion by means of iliac bone. B. Wedge-shaped tibial cortical grafts, inserted with their narrowest vertical diameter pointing posteriorly. C. Three-level fusion, 8 months after operation. D. Two-level fusion 2 years after operation shows transformation of the tibial graft’s texture into that of vertebral bodies. No wedging of block vertebrae.](image)
three at C6-7), and two (one of whom died) had considerable protrusions both at C5-6 and C6-7. Table 1 gives some details of our pre- and postoperative findings in the surviving nine patients.

A history of trauma preceded the onset of symptoms in Cases 5, 6, 7, and 8. One patient recovered completely, five recovered function and lost most of their neurological symptoms, one had functional recovery without any change in neurological signs, and two remained the same. The patients who recovered completely or greatly had a preoperative history of 9 months or less, with the exception of two patients who had a history of 7 years. The two patients who did not improve at all had preoperative histories of 10 and 14 years respectively.

Radiculopathy. Radiculopathy was present in 23 patients. Twenty patients had radicular pains and neurological signs of spinal nerve-root involvement, and three patients had neurological signs of spinal nerve-root involvement without radiating pains, but were operated on because of myelopathy. Following operation, radicular pains completely disappeared in 19 out of 20 patients including all five patients with bilateral brachialgia; one patient still experienced slight residual discomfort. Hypaesthesia completely disappeared in 13 patients including three with bilateral hypaesthesia, improved in three, and remained unchanged in seven including three with bilateral hypaesthesia.

Thirteen patients showed complete postoperative recovery from preoperative hypaesthesia of the fingers. Of these, four had had numbness for 3 months, six for 5 months, and three for 2 years. Three patients showed partial improvement in hypaesthesia which they had had preoperatively for 6, 7, and 17 months. Eight patients showed no postoperative improvement from hypaesthesia. Of these, three had had numbness for less than 8 months, one for 1 year, two for 5 years and one for 8 years. The eighth patient showing no improvement could not be followed in detail.

**TABLE 1**

Anterior operation for cervical spondylosis with myelopathy: Clinical data in 9 cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Sex</th>
<th>Age</th>
<th>Duration Preop.</th>
<th>Neurological Findings</th>
<th>Hard Protrusion Level</th>
<th>Fusion Level</th>
<th>Result</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>female</td>
<td>43</td>
<td>few mos.</td>
<td>Atypical; Brown-Sequard syndrome.</td>
<td>C5-6</td>
<td>C5-6</td>
<td>Complete disappearance of signs and symptoms.</td>
<td>45</td>
</tr>
<tr>
<td>2</td>
<td>male</td>
<td>47</td>
<td>few mos.</td>
<td>Bilateral weakness, exaggerated tendon reflexes of legs, hypaesthesia and hypalgesia of right leg, bilateral Babinski.</td>
<td>C5-6</td>
<td>C4-5</td>
<td>Recovery of power and sensation. Residual sign: exaggerated patellar and ankle reflexes and positive Babinski on right.</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>male</td>
<td>48</td>
<td>9 mos.</td>
<td>Weakness, exaggerated tendon reflexes, positive Babinski on right, hypaesthesia and hypalgesia of both legs.</td>
<td>C6-7</td>
<td>C6-7</td>
<td>Recovery of sensation, no weakness, normal plantar reflexes. Residual sign: exaggerated tendon reflexes of right leg.</td>
<td>62</td>
</tr>
<tr>
<td>4</td>
<td>male</td>
<td>42</td>
<td>7 yrs.</td>
<td>Ataxia and weakness of legs, bilateral hypalgesia below T-3 level, bilateral Babinski, hyperactive tendon reflexes on right.</td>
<td>C6-7</td>
<td>C6-7</td>
<td>Recovery of power and sensation, no ataxia. Residual sign: bilateral Babinski, hyperactive tendon reflexes on right.</td>
<td>38</td>
</tr>
<tr>
<td>5</td>
<td>male</td>
<td>52</td>
<td>3 mos.</td>
<td>Weakness, hyperactive tendon reflexes on right, positive Lhermitte (sudden painful discharge through body on flexion of head).</td>
<td>C3-6</td>
<td>C5-6</td>
<td>Lhermitte sign absent, recovery of power in right leg. Residual sign: short attacks of weakness right leg of 1-3 min duration. New development of posterior spurs C-7 to T-1.</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>male</td>
<td>54</td>
<td>7 yrs.</td>
<td>Ataxia and weakness of legs, right more than left; hypalgesia below T-4 level; hyperactive tendon reflexes; positive Babinski.</td>
<td>C5-6</td>
<td>C5-6</td>
<td>Recovery of power, no ataxia. Residual sign: hypalgesia below T-6.</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>male</td>
<td>65</td>
<td>2 yrs.</td>
<td>Weakness, hyperactive tendon reflexes, positive Babinski on right, bilateral hypalgesia C-8 to T-6.</td>
<td>Backward luxation</td>
<td>C3-4</td>
<td>Considerable increase motor power of right leg. Neurological signs unchanged.</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>male</td>
<td>43</td>
<td>14 yrs.</td>
<td>Weakness, hypalgesia, hypalgesia or right leg, bilateral Babinski, hyperactive tendon reflexes of arms and legs.</td>
<td>C6-7</td>
<td>C6-7</td>
<td>Unchanged. Disabled.</td>
<td>24</td>
</tr>
<tr>
<td>9</td>
<td>male</td>
<td>38</td>
<td>10 yrs.</td>
<td>Weakness, hypalgesia, hypalgesia and hyperactive tendon reflexes of right leg, bilateral Babinski.</td>
<td>C5-6</td>
<td>C6-7</td>
<td>Unchanged. Disabled.</td>
<td>55</td>
</tr>
</tbody>
</table>
Reduced tendon reflexes became normal after operation in eight of the 13 cases. Preoperative motor weakness of the hands in five patients improved considerably. There was no improvement in postoperative muscular atrophy.

Neck pain. Preoperatively, neck pains were present in 21 patients and disappeared after operation in 16. They improved considerably in one patient. They were unchanged in three of the four remaining patients, all of whom also had arthropathy of the sternoclavicular joint on the same side. Pressure on this joint produced radiating pains in the neck, but after intra-articular injection of procaine, all neck pains temporarily disappeared.

Shoulder pain. Of the 26 patients, 16 had serious complaints of the shoulder joint, of the shoulder girdle, or of both. Table 2 shows the results of decompression, fusion, and postoperative physical treatment. The shoulder joint itself, in the solitary as well as the complicated or combined forms, reacted well to treatment with one exception. This fact supports the view of Frykholm and other authors who state that shoulder-joint complaints may be due to involvement of cervical spine-nerve roots. A different problem was presented by the disorders of the joints of the shoulder girdle, since they persisted after the operation. The sternoclavicular joint was especially involved; percussion of such a joint always provoked radiating pains in the neck and in the axilla and ulnar side of the ipsilateral arm. In one of these patients the pains extended even to the ipsilateral temporal area of the skull. The condition, caused by subluxation in the sternoclavicular joint, could have been related to the occupations of two patients and to a previous injury in a third. Three patients suffering from preoperative pains in the shoulder joint developed postoperative arthropathy of the shoulder girdle, two on the ipsilateral and one on the contralateral side. Altogether, six patients suffered after the operation from arthropathy of the shoulder girdle, all on the right side.

Miscellaneous symptoms. Occipital headaches in two patients did not improve after the operation. Two other patients suffering from Ménière's disease, one of whom also had attacks of collapse, were free from these symptoms after the operation.

---

**TABLE 2**

_Shoulder pain data on 16 patients_

<table>
<thead>
<tr>
<th>Joint Involvement</th>
<th>No. of Cases</th>
<th>Location</th>
<th>Results of Decompression and Fusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Joint</td>
<td>10</td>
<td>5 left</td>
<td>6 Completely cured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 right</td>
<td>1 Pains disappeared but stiff shoulder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9 on side of radiculopathy;</td>
<td>1 Cured but arthropathy of ipsilateral sternoclavicular joint</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 without radiculopathy</td>
<td>1 Cured but arthropathy of contralateral sternoclavicular joint</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 Not cured</td>
</tr>
<tr>
<td>Shoulder-Hand Syndrome</td>
<td>3</td>
<td>3 right</td>
<td>1 Cured</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 Only residual stiffness of fingers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 Cured but arthropathy in ipsilateral sternoclavicular joint</td>
</tr>
<tr>
<td>Shoulder and Shoulder Girdle</td>
<td>2</td>
<td>2 right</td>
<td>2 Shoulder joint cured but arthropathy in sternoclavicular joint</td>
</tr>
<tr>
<td>Sternoclavicular Joint</td>
<td>1</td>
<td>1 right</td>
<td>1 Not cured</td>
</tr>
</tbody>
</table>
Development of new signs and symptoms. During the follow-up period, 11 patients developed new signs and symptoms, which are listed below:

- Migraine pharyngée (Terracol) (3 patients)
- Radiculopathy at a higher level (1 patient)
- Arthropathy of shoulder girdle (1 patient)
- Lumbar and lumbar radiculopathy (2 patients)
- Lumbar (2 patients)
- Lateral epicondylitis at the elbow (1 patient)
- Ulnar neuropathy in cubital arthropathy (1 patient)
- Tremor of hand and head (1 patient).

Working capacity. Table 3 summarizes the working capacity of the 26 patients on whom we operated. We may conclude that the complete or partial disability for work in five out of the 26 patients was due to lumbar arthrosis, together with myelopathy in two cases, and neck pains and extravertebral abnormalities in the other three. These latter three were all involved in heavy work and, for economic reasons, did not want to take up lighter jobs.

Anterior operations following posterior surgical decompression in cervical spondylosis. Laminectomy and foramenectomy, especially when extensive, may be followed in some cases by vertebral instability, anterior angulation, or even dislocation. All may be corrected by anterior fusion. Fig. 6 demonstrates some of our secondary anterior operations. Sometimes a one-level fusion may be followed by anterior angulation at a higher level (Fig. 6 B); for this reason, a prophylactic two-level fusion was performed in a later case (Fig. 6 C).

Summary

We have described our anterior operations for cervical spondylosis in cases of myelopathy or nerve-root compression. Our method consisted of anterior decompression and interbody fusion using a modified Smith and Robinson procedure. We selected patients who had severe, untreatable radicular pains accompanied by neurological signs of radiculopathy, and limited myelopathy caused only by local (focal) pressure of hard protrusions. We rejected patients who had extensive nerve-root involvement with marked muscular atrophy. Using these criteria we could select only 27 patients for anterior surgery out of a total number of 439. In all but one patient, radicular pains disappeared following operation. Of nine patients with myelopathy, only two did not improve, and they had had exceptionally long preoperative histories. Arthrosis or subluxation of the sternoclavicular joint was the main factor responsible for residual, unilateral neck pains and

### Table 3

**Working capacity of 26 patients after surgery**

<table>
<thead>
<tr>
<th>Work Status</th>
<th>Physical Condition</th>
<th>No. of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resumed original work</td>
<td>Symptoms cured</td>
<td>16</td>
</tr>
<tr>
<td>Fully engaged in new, less strenuous work</td>
<td>Residual myelopathy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Arthropathy of shoulder girdle</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Residual symptoms of shoulder-hand syndrome and epicondylitis at elbow</td>
<td>1</td>
</tr>
<tr>
<td>Partially disabled</td>
<td>Neck pains and arthropathy of sternoclavicular joint</td>
<td>1</td>
</tr>
<tr>
<td>Totally disabled</td>
<td>Myelopathy and lumbar</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Myelopathy, lumbar and lumbar radiculopathy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Compensation neurosis, neck pains and arthropathy of shoulder girdle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Arthropathy of shoulder girdle with subluxation of sternoclavicular joint</td>
<td>1</td>
</tr>
</tbody>
</table>
FIG. 6. A. Anterior angulation between C-7 and T-1 accompanied by neck pains and following laminectomy. B. Same case, 3 years after anterior fusion. Angulation has been corrected and neck pains have disappeared, but now there is a tendency toward anterior angulation of the adjacent vertebra. C. Prophylactic two-level fusion for symptomless anterior angulation following laminectomy. D. Pronounced anterior dislocation of C-4, 5 years after laminectomy. E. Same case, 1 year after reduction and anterior fusion.

Radiating pains in the ipsilateral arm. We noted new symptoms during the follow-up period in 11 patients. Partial or total postoperative disability was greatly influenced by arthropathy at other vertebral levels or extravertebral abnormalities. Secondary anterior operations were performed in some patients because of vertebral instability, or anterior angulation, or dislocation following posterior surgical decompression.

References


