In the surgical treatment of pyogenic spondylitis in patients with paralysis, anterior debridement and posterior fusion with or without instrumentation in a two-stage procedure are currently advocated to prevent recurrence and worsening of infection around the hardware. It is sometimes difficult to adhere to this principle, however, because of anatomical limitations in some cases. The cervicothoracic junction is especially difficult to approach anteriorly because of the complicated anatomy. In addition to describing the course of our patient, the objectives of this report are to increase the awareness of anatomical specificity in anterior surgery for the upper thoracic spine, especially in the presence of a high-positioned aortic arch, and to discuss the validity and safety of anterior debridement and posterior fusion for pyogenic spondylitis.

Case Report

Presentation and Examination. This 87-year-old woman with severe back pain and low-grade fever that had been refractory to a 1-month period of treatment initiated at an outside center presented to Eniwa hospital. She was slightly febrile and there was a severe tenderness in her back near the prominence; however, neurological abnormalities were absent. Laboratory investigations showed a moderate inflammatory reaction, with CRP and erythrocyte sedimentation rate both raised at 12.53 mg/dl and 85 mm/hour, respectively. A diagnosis of T1–2 pyogenic spondylitis was easily established using MR imaging (Fig. 1 left). There were obvious changes of MR imaging signal intensity in and around the T1–2 disc space and an epidural abscess causing mild cord compression. Examination of blood culture and needle biopsy specimens failed to reveal the causative organism, probably because of the oral antibiotic agents administered by a previous physician. Tuberculin reaction was negative.

Conservative Treatment. Because neurological dysfunction was absent, conservative therapy involving broad-spectrum antibiotic agents and collar immobilization were immediately instituted. Thereafter, fever, CRP, and erythrocyte sedimentation rate were quickly reduced. Three weeks later, despite reduced inflammatory reactions, thoracic myelopathy gradually developed and intensified to Frankel Grade B. Several MR imaging investigations demonstrated progressive T1–2 collapse and retropulsed sequestra resulting in remarkable spinal cord compression (Fig. 1 right).


Pyogenic spondylitis in the cervicothoracic junction with high-positioned aortic arch

Case report and review of the literature

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The authors report the case of an 87-year-old woman who suffered from T1–2 pyogenic spondylitis resulting in progressive and severe paraplegia. Debridement and anterior manubrium-splitting fusion were difficult because a high-positioned aortic arch was very close to the infectious lesion. Because adequate intravenous antibiotic agents had nearly resolved the inflammation, the authors undertook anterior debridement and posterior fusion that involved costotransversectomy and the placement of a posterior cervical pedicle screw fixation system. At 1.5 years postoperatively, there were no signs of recurrent infection. Solid osseous union was documented, and the patient’s paraplegia had improved.

A high-positioned aortic arch will likely interfere with an anterior approach to the cervicothoracic junction. If adequate antibiotic therapy has successfully controlled the spinal infection, anterior debridement and posterior fusion can be conducted in cases involving such anatomical limitations.

KEY WORDS • pyogenic spondylitis • cervicothoracic junction • costotransversectomy • aortic arch • pedicle screw

Abbreviations used in this paper: CRP = C-reactive protein; CT = computerized tomography; MR = magnetic resonance.
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Operation. Considering the surgical treatment for pyogenic spondylitis, surgeons are advised to perform posterior placement of instrumentation anterior debridement, and anterior autogenous strut bone graft–assisted fusion in two stages. Sagittal CT reconstruction revealed that the top of the manubrium was higher than the T1–2 level (Fig. 2 left). Therefore, we planned on performing anterior debridement via the manubrium-splitting approach; however, preoperative examination revealed that the position of the aortic arch was unexpectedly high and covering the inferior half of the T-2 vertebral body (Fig. 2 right). It seemed, thus, that performing debridement via the anterior approach would be both difficult and dangerous.

Fortunately, adequate preoperative antibiotic therapy had reduced the inflammatory reaction for several days before surgery such that tests were negative. Therefore, anterior debridement and posterior strut bone graft–augmented fusion were performed using cervical pedicle screws and the ISOLA system (AcroMed, Inc., Cleveland, OH) (Fig. 3 left and center). In detail, anterior debridement was completed after T-2 and T-3 costotransversectomies. No obvious pus formation was noted and, in addition, the sequestra were nearly organized and consolidated masses. The second and third ribs were excised via the extrapleural procedure to be used as anterior struts. En bloc resection of these structures from rib head to rib body at a length of approximately 10 cm was successful. In addition, neurovascular bundles were also adequately separated from pleura and adjacent tissues to allow more effective manipulation. In undertaking these careful steps, it was not necessary to sacrifice the nerve roots to place the anterior rib strut into the interbody space. Circumferential spinal cord decompression and anterior placement of the strut graft were performed without complications (Fig. 3 right). Specifically, the anterior struts were inserted with care from the space between each neurovascular bundle, from the caudal side to the rostral side. Posterior iliac crest–augmented C6–T5 fusion was performed using the cervical pedicle screws and the ISOLA system.

Postoperative Course. The patient was allowed to sit up wearing a simple collar immediately after surgery. Collar immobilization was undertaken for 2 weeks. At 1.5 years after surgery, she is doing well and her paralysis has improved to Frankel Grade D. Although we carelessly over-
looked the excessively long inferior rod intraoperatively, no findings of skin protrusion have been noted (Fig. 3 left and center). Tests for CRP have remained negative for more than 12 months and there are no signs of local recurrence. Postoperative sagittal CT reconstructions demonstrated apparently solid bone fusion with slight correction loss (Fig. 4).

Discussion

Many surgeons have advocated two-stage anterior debridement and fusion combined with placement of posterior instrumentation for the surgical treatment of pyogenic spondylitis. Biofilm formation around the hardware is thought to be one of the primary causes of locally recurrent infective lesions in instrumentation-based surgery for pyogenic spondylitis. Therefore, if there are no extenuating reasons, surgeons are advised to avoid spinal instrumentation that will be directly contaminated by the infective lesions.

The cervicothoracic junction is considered one of the difficult regions in which to operate because of its complicated anatomy. In most cases, the T1–2 region can be approached anteriorly without the need for sternotomy. In our case, the manubrium-splitting approach or another modified method was needed to perform anterior debridement and fusion because the top of the manubrium was by far higher than the T1–2 segment; however, preoperative investigation revealed that an anterior approach to T1–2 would be either extremely difficult or impossible because of the high-positioned aortic arch covering the inferior half of the T-2 vertebral body. There are a couple of reports in which investigators have noted such anatomical alteration interfering with the anterior approach to the cervicothoracic junction. To ensure complete decompression of the spinal cord and thorough debridement of the infective tissue, we were compelled to undertake anterior debridement, posterior decompression, costotransversectomy, and placement of a cervical pedicle screw system. In addition, the anterior manubrium-splitting approach is not recommended in elderly patients because of a prolonged recovery time.

There have also been several articles in which authors have reported good outcomes after one-stage posterior decompression and interbody pedicle screw–based fusion as well as after anterior debridement and instrumentation-augmented fusion. The results of these studies have shown that if the infection itself is controlled by adequate antibiotic therapy, then simultaneous placement of instrumentation within the same operating field may be acceptable after thorough debridement of the infective lesion and cleaning of the necrotic tissue. In the present report, although the causative organism was not detected, the inflammatory reaction had been almost completely healed by administering broad-spectrum antibiotic agents. In addition, no evidence of pus formation at T1–2 had been observed. This may be a rationale for successful anterior debridement and posterior fusion in such cases. As we observed in this case, the satisfactory response of inflammatory reaction to antibiotic therapy allowed us to undertake anterior debridement and posterior fusion for pyogenic spondylitis.

Costotransversectomy is sometimes performed to reach thoracic lesions such as thoracic disc herniation. Some authors have also undertaken this procedure for ossification of the posterior longitudinal ligament and tumor resection. There were no reports, however, concerning costotransversectomy for the treatment of pyogenic spondylitis.

The cervical pedicle screw system used in the present case is the most stable instrumentation for reconstructive surgery of the cervicothoracic junction. In our case, solid bone union without remarkable correction loss and no recurrence of infection. Right: Axial CT scan obtained at T1–2. The right T2–3 costotransversectomies effectively allowed circumferential spinal cord decompression and the thorough resection of sequestra.

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bone union without remarkable correction loss was obtained by simple collar immobilization. It will be of great relief to patients who suffer from such paraplegia to be allowed early rehabilitation without concern for the stability of the spinal construct; however, the cervical pedicle screw system has been reported to have inherent and unresolved risks such as the potential for neurovascular injuries. Therefore, its placement should be undertaken after adequate instruction and/or under supervision of experienced surgeons.

In conclusion, anterior debridement and posterior fusion will be useful in treating pyogenic spondylitis in patients with neurological dysfunction after a successful course of appropriate antibiotic therapy reduced the inflammation.

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