Anterior cervical debridement and strut-grafting for osteomyelitis of the cervical spine

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A retrospective review of the surgical experience in treating 18 patients with osteomyelitis of the cervical spine is reported. The patients ranged in age from 20 to 60 years and all complained of neck pain upon admission. Ten patients had a prior history of intravenous drug abuse, three had previously suffered penetrating injuries of the neck, and one had an extraspinal site of osteomyelitis. Bacteria were isolated in 13 cases and tuberculosis in three. Neurological abnormalities were present in over one-half of the patients, consisting of myelopathy (nine cases) or radiculopathy (four cases). Plain cervical spine films and polytomography demonstrated vertebral and end-plate destruction, spinal instability, and increased paravertebral soft-tissue shadow in all cases. Computerized tomography and, more recently, magnetic resonance imaging have proven helpful in detecting bone involvement and the presence of epidural extension associated with cervical osteomyelitis. The risk of vertebral body collapse, kyphosis, and myelopathy in the osteomyelic cervical spine has standardized the management of this problem in this institution to consist of skeletal traction, needle aspiration or blood culture for organism identification, anterior cervical debridement, autogenous iliac graft fusion, and intravenous administration of antibiotics. Spinal stability and neurological improvement were achieved in all 18 patients.

KEY WORDS - cervical spine • osteomyelitis • operative approach • epidural abscess • spine fusion

OSTEOMYELITIS involving the cervical spine represents a diagnostic as well as a therapeutic challenge, mainly because of the nonspecific early signs and symptoms such as malaise, fever, or slight neck pain. Generally, mild complaints are associated with a long delay between symptom onset and diagnosis. Aside from published reports from Hong Kong, where tuberculosis of the spine is common, few series provide operative experience in more than 10 cases of cervical osteomyelitis. Consequently, experience with the natural history and treatment of cervical osteomyelitis is limited. A retrospective review of 18 patients with cervical osteomyelitis is reported.

Summary of Cases

Patient Population

The case records of 18 patients operated on for infection of the cervical spine during the period 1974 to 1987 at Cook County Hospital, Chicago, were reviewed. All patients were managed by the neurosurgical service and cared for by the senior author (J.L.S.) or more recently by the second author (G.R.C.). During this time, five additional cases were successfully treated with aspiration of the involved intervertebral disc space, rigid immobilization, and 6 weeks of intravenous antibiotic coverage. These five nonoperated cases were neurologically intact and lacked overt radiological evidence of spinal instability.

Clinical Observations

This series included 15 men and three women, with an age range of 20 to 60 years (mean 25 years). Ten of the patients had a prior history of intravenous drug use, three had previously suffered penetrating neck injuries (two gunshot wounds, one stab wound), and one patient had an extraspinal source of osteomyelitis (in the foot). All patients complained of pain and limited motion of the neck; six of the patients were febrile or complained of chills. The average duration of symptoms was 8.5 weeks.
Physical examination revealed neck fullness, erythema, or torticollis in nine patients. Neck motion was mildly or moderately limited in 10 patients, and was severely limited in eight. Neurological examination demonstrated myelopathy or myeloradiculopathy in nine patients and radiculopathy in four patients. Myelopathy tended to be present in patients with more severe kyphotic angulation, but was also associated with compressive epidural granulation or abscess regardless of angulation. Five patients had normal neurological examinations. Three patients complained of dysphagia, and one with C-3 and C-4 destruction had purulent drainage into the posterior oropharynx.

Radiological Features

Plain cervical spine radiography, conventional polytomography, and myelography were performed on all patients. Involvement of the disc space with end-plate destruction but no spinal instability was found early in the infection. Obvious evidence of instability, such as collapse or dissolution of a vertebral body with variable angulation/subluxation, was present in all 18 patients in the surgical group. Computerized tomography (CT) in combination with myelography was valuable in determining the extent of bone destruction and epidural compression.

More recently, magnetic resonance (MR) imaging has combined many of the advantages of the radiographic studies used previously. Sagittal MR imaging more effectively delineates the extent of bone involvement and epidural spinal cord compression from associated posterior longitudinal ligament thickening or abscess (Fig. 1).

Preoperative Treatment

Ten of the 18 patients underwent initial needle aspiration (with a No. 16 or 18 spinal needle) of the radiological abnormality (disc space) via an anterior approach under fluoroscopic guidance. In each case, the aspirate or washing was sent for aerobic, anaerobic, tubercular, and fungal cultures. In three patients, more than 20 cc of pus was aspirated by this method and improvement of the patient’s neck pain resulted. In eight patients, needle-aspirate bacterial cultures were positive, and specific intravenous antibiotic therapy was instituted 5 to 7 days prior to surgery, for a total of 6 weeks. Blood cultures were performed in nine cases and yielded an organism in four patients, one of whom had no growth from a needle aspirate. Bone destruction, producing kyphosis and subluxation of the cervical spine, and symptoms of myelopathy or radiculopathy prompted an aggressive surgical approach to include anterior cervical debridement and autogenous bone graft fusion.

Operative Procedure and Findings

Prior to operation, all patients were placed in either Gardner-Wells or Trippi-Wells tongs with 10 to 20 lb of traction on a Stryker frame. With the patient in the supine position, an oblique incision along the medial border of the right sternocleidomastoid muscle was used to approach the anterior portion of the cervical spine. The longus colli muscles and anterior longitudinal ligament were invariably boggy, thickened, and vascularized. Frank pus (in 13 of 18 cases), granulation tissue, and necrotic bone were debrided down to the dural sac in all cases, with resection of the posterior longitudinal ligament. Resection of this ligament is necessary to insure adequate drainage and decompression of the epidural space. The posterior longitudinal ligament was markedly thickened and compressive in seven cases. When thorough debridement provided clean bone edges superior and inferior to the osteomyelitic process, immediate cervical strut-grafting was per-
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formed in 14 cases. In four patients, an abundance of free pus, extensive soft-tissue involvement, or oropharyngeal fistula was present, so drains were placed after debridement and bone graft fusion was delayed for 2 to 3 weeks.

Autogenous iliac-crest bone was used to fashion the cervical graft in all cases. A one-level interbody fusion was performed in seven patients, one vertebral body was removed in four, two vertebral bodies were removed in four, and three had three-body removal. For multilevel replacement, the bone grafts were fashioned to fit into a groove made in the inferior and superior vertebral body surfaces with an air drill (Fig. 2). This configuration takes advantage of a lock action obtained by slowly releasing the axial distraction provided by tong traction after the graft is placed into grooves in the superior and inferior vertebral bodies. After the graft is locked into place, the traction weight is decreased, and a lateral x-ray film is obtained to confirm position.

Thirteen patients were found to have a bacterial infection (Pseudomonas or a related organism in eight, Staphylococcus aureus in three, alpha Streptococcus in one, Escherichia coli in one) and three patients had pathological evidence of tuberculosis (granulomas, caseation, giant cells). In two patients the etiology remained unknown. Intravenous antibiotic therapy (for 6 weeks) or triple-therapy antitubercular agents were given to all patients.

Postoperative Course

Postoperative immobilization early in the series consisted of placing the patient in a Minerva jacket, and patients treated within the last 10 years have been placed in a halo jacket. All patients were immobilized for at least 12 weeks by these methods, and cervical collars were prescribed for an additional 2 to 3 months. Patients with two- or three-level vertebrectomies were rigidly immobilized for 4 to 6 months.

Five patients had a postoperative unilateral vocal cord paresis and one patient required reoperation several weeks later for a dislodged bone graft. Successful anterior fusion was accomplished in all patients with follow-up periods ranging from 6 months to 10 years (Fig. 3). One patient with extension into C-2 underwent a posterior bone and wire fusion preceding the anterior fusion. All patients are ambulatory and free of spinal cord or radicular deficits. One patient treated for C4–5 osteomyelitis developed a skip lesion at C2–3; he is asymptomatic and is being followed at present.

Discussion

While osteomyelitis of the cervical spine is not a common cause of neck pain, its presence should be suspected when neck pain and torticollis are associated with fever, especially in patients with a history of intravenous drug abuse or penetrating injury of the neck. Evidence suggests that the incidence of vertebral osteomyelitis has grown due to an increase in intravenous drug addiction and the greater occurrence of sepsis in hospitalized patients. Additional factors that result in hematogenous dissemination of bacteria produce vertebral osteomyelitis. The proposed mechanism postulates spread to the metaphysial region of the vertebral body in close proximity to the anterior longitudinal ligament via a rich supply of nutrient arterioles. From this nidus, extension of infection anteriorly from the vertebral body can occur, accounting for the findings of prevertebral soft-tissue swelling on lateral cervical x-ray films. These radiological and
pathological findings were present with regularity in our group of patients. Infection from this nidus may just as likely spread across the periphery of the disc to ascending and descending branches of the posterior spinal arteries or veins to involve the metaphyses of adjacent vertebrae. With few exceptions, pyogenic cervical osteomyelitis and tuberculosis are localized to the vertebral body, and the posterior bone elements are rarely involved. As the disc and vertebral body become progressively involved, inflammatory changes also affect the posterior longitudinal ligament, setting up epidural compression by granulation tissue more often than actual abscess formation. Such was the case in seven of our patients who exhibited myelopathy.

Laboratory tests such as the erythrocyte sedimentation rate and white blood cell count (although both are usually elevated in osteomyelitis) are nonspecific indicators of inflammation; thus further diagnostic studies are required when clinical suspicion is aroused. Plain cervical spine x-ray films and tomograms may show destructive changes of the vertebral bodies and vertebral end-plates, but they are often negative during the initial 2 to 8 weeks of the disease process. An enlarged prevertebral shadow was present in all of our cases, although it more often represented soft-tissue thickening than frank abscess formation. Nuclear scans may produce false-negative or false-positive results. Blood cultures are positive in about one-half of patients with spinal osteomyelitis.

Computerized tomography offers several advantages over conventional radiological techniques in evaluating vertebral osteomyelitis, including elucidation of bone changes and spinal canal stenosis in the axial plane and detection of paraspinal soft-tissue masses or epidural collections. More recently, we have utilized MR imaging in evaluating suspected osteomyelitis of the cervical spine and have found improved resolution in demonstrating the extent of epidural compression (Fig. 1). In the future, the use of sagittal MR imaging may obviate the need for myelography or postmyelography CT scanning.

Definitive therapy of cervical osteomyelitis is controversial. Treatment described in the literature consists mainly of either antibiotic therapy with external cervical support or surgical debridement with or without autogenous bone fusion followed by antibiotic therapy. Our experience is similar to results from other reported series in that spine fusion with an autogenous bone graft placed into a site of spine infection appears acceptable, provided that most of the infected tissue is removed.

Much of the reported experience with conservative management of cervical osteomyelitis with antimicrobial therapy and external support has been with triple-drug therapy (isonicotinohydrazine, para-aminosalicylic acid, and streptomycin) for tuberculous cervical osteomyelitis. In the small number of patients with cervical involvement in these series, minimal kyphosis did not increase; however, immobilization and drug therapy may fail, leading to surgery months later. In another series of 40 patients with tuberculosis of the lower cervical spine, over 40% of patients had spinal cord compression, contrasting with a 15% to 30% incidence elsewhere in the spine. In addition to antituberculous therapy, all patients in that series underwent anterior debridement. Neurological improvement occurred in all patients treated by this approach.

Comparable-sized series of medically treated pyogenic cervical osteomyelitis are not available. The largest series of conservatively managed patients with pyogenic cervical osteomyelitis consisted of 12 patients who were treated with skeletal traction and antibiotics. All patients were placed in cervical tong traction for 5 to 12 weeks with achievement of bone fusion. Radiculopathy was present in five of these patients, but none had signs of myelopathy. When myelopathy is present, other authors favor anterior decompression and stabilization.

The rationale for a surgical approach to cervical osteomyelitis includes: 1) relief of pressure and pain symptoms by incision and drainage of paravertebral abscess, thereby obtaining additional material for culture and pathological analysis (because of the broad spectrum of organisms that can cause vertebral osteomyelitis, precise identification is important); 2) relief of compression from epidural sequestra, abscess formation, or kyphosis; 3) stabilization by debriding destroyed vertebral bodies and performing a fusion; and 4) hastening recovery and reducing the chance for recurrence. Our approach to the anterior cervical spine is based on modification of the surgical approach described by Hodgson, and others. This technique utilizes intraoperative cervical tong traction and postoperative placement of the patient in the device connected to a halo jacket to provide rapid mobilization. The halo is worn for at least 3 months to maintain alignment during healing of the fusion. In addition, our patients have in total a 6-week course of intravenous antibiotics. Because the posterior and lateral elements are not frequently involved by the osteomyelitic process, anterior debridement and fusion has been successful in our cases as well as in the majority of those reported in the literature. Only one of our 18 patients underwent a posterior as well as an anterior fusion.

The risk of cervical spinal cord compression from kyphosis or extradural abscess extension secondary to osteomyelitis of the cervical spine remains significant, and we advocate anterior cervical debridement and fusion. Although neurological dysfunction was more common in patients with marked vertebral collapse or angulation, compressive extradural abscess can be present with only a mild kyphus. Patients with only neck pain and no neurological findings or radiological signs of instability may be treated with neck immobilization and intravenous antibiotics following needle aspiration of the radiologically involved disc space or recovery of
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an organism from the blood. This was done with five additional patients.

Osteomyelitis of the cervical spine should be suspected in any patient with neck pain, torticollis, and fever. A history of intravenous drug abuse or penetrating neck injury is also suggestive of osteomyelitis. Plain cervical spine films or tomograms will generally be diagnostic. While MR imaging may not be the first-line diagnostic test, its utility in illustrating abnormal signal intensity from affected vertebrae as well as in demonstrating the extent of extradural abscess formation and spinal cord compression make it a valuable diagnostic aid. Patients with angulation/subluxation should be operated on. Adequate surgical debridement, antibiotic coverage, and autogenous strut-graft fusion appear to be curative. Postoperative plain films or conventional tomography serve an important purpose in evaluating the status of the fusion.

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References


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