Vertebral Osteomyelitis After Cardiac Surgery

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Background. **Mediastinitis after open-heart surgery is a serious complication that has a decreasing incidence but still a significantly high mortality rate. Back pain may develop during the course of treatment for mediastinitis, and this should suggest vertebral osteomyelitis in the differential diagnosis. Diagnosis of vertebral osteomyelitis may be difficult because of the insidious onset and delayed diagnosis, and treatment may result in serious neurologic compromise and even death of the patient.**

Methods. **This retrospective study involves 5 patients who had open-heart surgery and mediastinitis that was further complicated by vertebral osteomyelitis. Average delay in diagnosis was 18 days after the onset of symptoms. Magnetic resonance imaging was the most helpful tool for diagnosis. Methicilline-resistant *Staphylococcus aureus* was identified as the responsible microorganism in all patients. Neurologic compromise occured (one paraplegia and one paraparesia) in 2 patients during medical treatment.**

Results. **Along with the medical treatment, all patients were surgically treated due to either one or more of the following reasons: unresolving symptoms, sudden neurologic compromise, or impaired spinal column stability despite appropriate conservative treatment. One patient died 10 days postoperatively. The mean follow-up period for the remaining 4 patients was 47 (12 to 95) months. Complete recovery was achieved, and they were able to return to their routine daily activities.**

Conclusions. **Vertebral osteomyelitis should be borne in mind when a patient develops back pain during the course of mediastinitis. Suspicion, early diagnosis with appropriate imaging, and proper treatment are crucial to prevent catastrophic complications.**

(Ann Thorac Surg 2003;75:1227–31)

Mediastinitis, which may develop after open-heart surgery, is a dreaded complication. Its yearly incidence is reported to be between 0.15% and 5% [1–5]. Its incidence has been decreasing with improvements in surgical techniques and postoperative care [1]. Although it was much higher (between 10% and 74%) in the past [2, 3], mediastinitis-related mortality rate is still significantly high, being between 8.3% and 40% [1, 4, 6], and it may reach up to 50% in the pediatric population [7]. Furthermore, there are a few case reports regarding vertebral osteomyelitis associated with mediastinitis [8–11]. Having experienced either one or both of these unpleasant complications, we have retrospectively analyzed cardiac surgery patients for mediastinitis and vertebral osteomyelitis in an effort to identify the underlying risk factors and discuss methods for prevention or proper management.

Material and Methods

As their own database demonstrated, 15,200 open-heart surgeries were performed in the Department of Cardiovascular Surgery at our institution between 1993 and 2001. Of these, 39 (0.25%) had mediastinitis after cardiac surgery. Three of these 39 patients (7.69%) and 2 other patients operated on and referred from elsewhere for the treatment of mediastinitis further developed back pain and were diagnosed to have vertebral osteomyelitis due to mediastinitis. Mediastinitis was diagnosed according to systemic findings, pain, wound dehiscence, and drainage, and was treated initially by cardiac surgeons. Besides medical treatment, surgical debridement was performed for mediastinitis in all 5 of these patients. Surgical treatment consisted of reopening, debridement, and open management initially because of the virulent infection and accompanying tissue necrosis. Patients were then given regular dressing changes, repeat debridements, and secondary closure after obtaining viable tissue and negative wound cultures. Methicilline-resistant *Staphylococcus aureus* (MRSA) was identified as the responsible microorganism in all patients by blood cultures in 4 patients and by cultures of tissue specimens obtained intraoperatively from the mediastinum in all 5 patients. These patients started suffering from back pain during the course of treatment for mediastinitis. Initially, during this period, back pain in these patients was thought to originate from mediastinitis, but because there was not much improvement in either clinical symptoms or laboratory findings, further cardiological and radiologic tests

Accepted for publication Oct 8, 2002.

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Published by Elsevier Science Inc

0003-4975/03/$30.00
PII S0003-4975(02)04803-8

Ann Thorac Surg
2003;75:1227–31

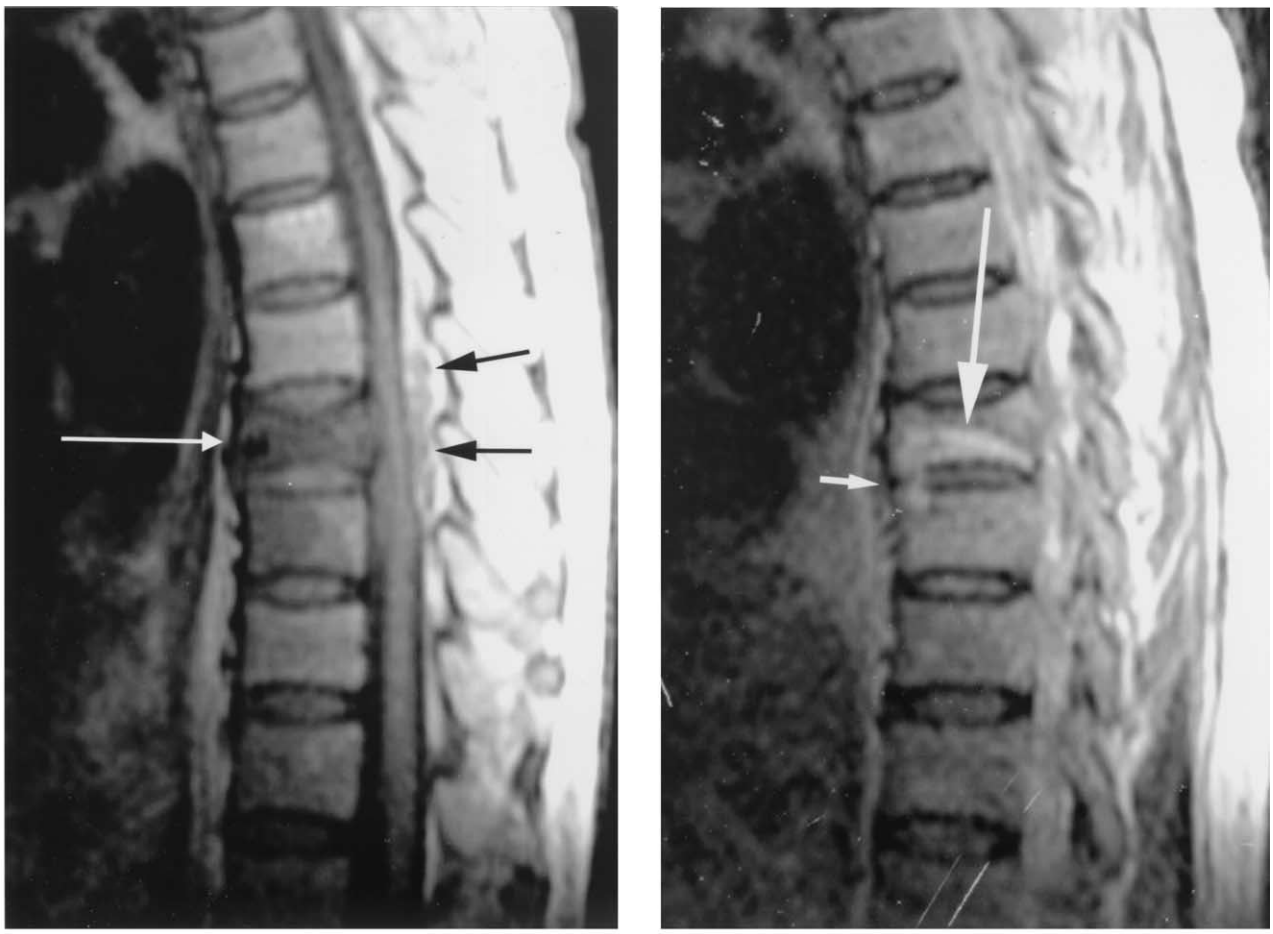

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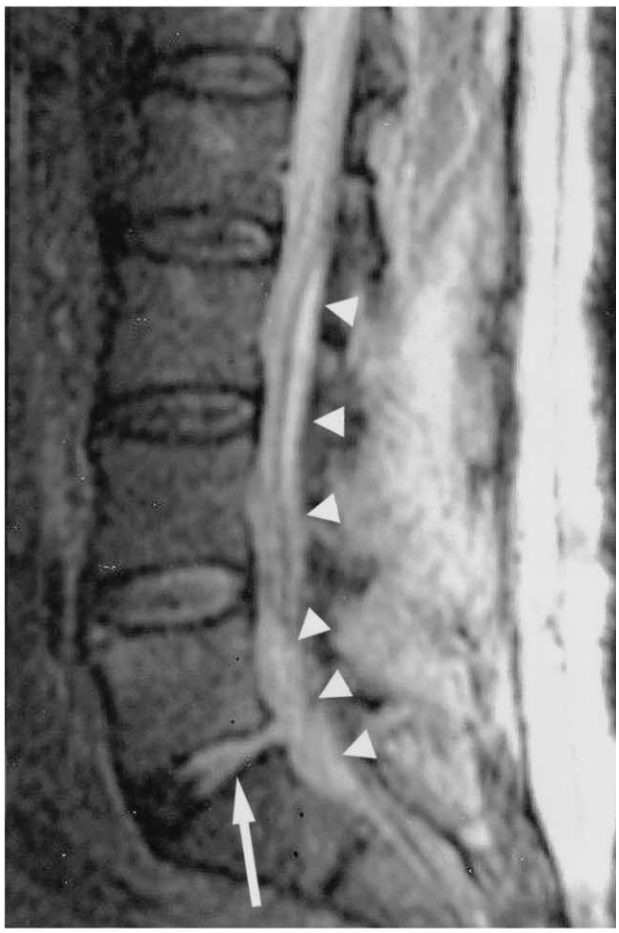
*Fig 1. Magnetic resonance imaging of case 4. (A) Spin echo (SE) T1-weighted image on midsagittal plane. T7 vertebral body (*white arrow*) has hypointensity and loss of height. Posterior margin bulges into the spinal canal and causes spinal cord compression. Posterior epidural abscess (*black arrows*) is seen as hypointense areas within hyperintense epidural fat. Note hypointense signal in the anterior part of T8 vertebral body due to osteomyelitis. (B) Fast spin echo (FSE) T2-weighted image of the same patient on parasagittal plane. Osteomyelitis of T7 (*large arrow*) extends into T8 vertebral body through the anterior part of the intervening disc (*small arrow*).*

were performed. All tests were negative for endocarditis. Orthopaedic consultation was requested an average of 18 days after the onset of symptoms because no significant relief of pain was obtained despite an adequate amount of analgesics. Subsequent orthopedic evaluation and history revealed that none of these patients had such complaints before the cardiac surgery or prior spinal trauma and surgery. Also, no spinal procedure was performed for perioperative analgesia. Chest and thoracolumbar spine roentgenograms were obtained after clinical examination, but these revealed no abnormal findings. Magnetic resonance imaging (MRI) of the spine was performed next in all patients for the relevant sites. MRI findings (Figs 1 , 2) led to the diagnosis of vertebral osteomyelitis (Table 1).

Results

Computed tomography (CT)-guided true-cut biopsy was then performed in order to confirm the diagnosis and identify the causative agent, and it was positive in 4 patients. MRSA was the most consistent and predominant microorganism isolated in the cultures (Table 2), and appropriate antibiotic treatment was then started after consultation with the Department of Infectious Diseases. It consisted of 6 weeks of intravenous vancomycine (1 g twice a day) in all patients and then oral cotrimetaksazole for 6 more weeks in 2 patients. Absolute bed rest was the initial decision. However, during medical treatment, 2 patients developed neurologic deficit (one paraplegia and one paraparesia), and urgent surgery was performed. The response to medical and surgical treatment was monitored by clinical findings and CRP levels on a weekly basis. The other 3 patients were also surgically treated because of unresolving symptoms and consistent levels of erythrocyte sedimentation rate and serum C–reactive protein (CRP) despite appropriate conservative treatment. Other than the patient (case 4) who had costotransversectomy for epidural abscess drainage, posterior instrumentation was performed for stabiliza-



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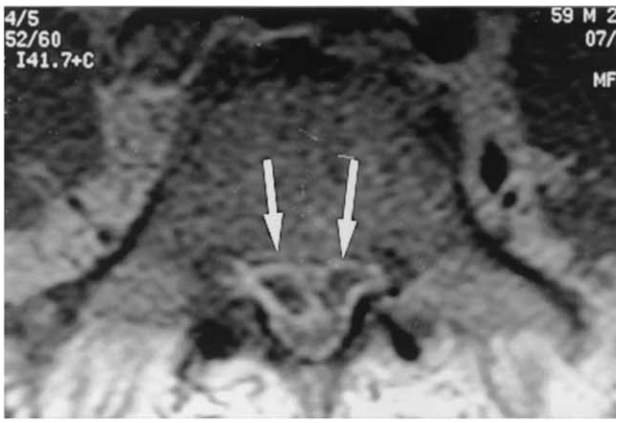

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Fig 2. Magnetic resonance imaging of case 1. (A) Fast spin echo (FSE) T2-weighted image on sagittal plane demonstrating L5 to S1 discitis (arrow) *within the posterior part of the disc and prominent epidural abscess* (arrowheads). *(B) Axial spin echo (SE) T1-weighted image after intravenous gadolinium injection showing anterior epidural abscess* (arrows) *with rim enhancement and central necrotic material.*

tion in all patients in order to prevent anterior column collapse and deformity and help early mobilization. Posterior instrumentation was not used for the costotransversectomy patient because there was no instability caused by either the infection or surgery. Furthermore, posterior elements were possibly contaminated during this procedure. Vertebral osteomyelitis caused by MRSA was confirmed as the diagnosis by microbiologic and pathologic analysis of material obtained intraoperatively. Postoperative follow-up consisted of reexaminations by both the cardiac and orthopedic surgeon, and roentgenograms were taken at regular intervals (at 3 and 6 weeks, and 3, 6, and 12 months after surgery). Although MRI can be used to evaluate the response to medical treatment, we used it only for the follow-up of 2 patients (cases 2 and 4) who had initial neurologic compromise at 3 months. The paraplegic patient developed respiratory insufficiency and could not be extubated, and died after 10 days postoperatively. The mean follow-up for the remaining 4 patients was 47 (12 to 95) months. Complete recovery was achieved and they were able to return to their routine daily activities.

Comment

Clinical or systemic findings may be vague or there may be signs such as wound drainage or deterioration in the general status of the patient if mediastinitis develops after cardiac surgery. Methods for treatment involve supportive treatment, appropriate and aggressive antibiotherapy, surgical debridement with or without open management, repeat debridement and secondary closure, resection of the sternum, and, if necessary, reconstruction with flaps [1, 4, 5, 7].

Osteomyelitis in the thoracic or lumbar spine may develop after a mediastinal infection either by hematogenous dissemination or direct contamination. Anatomical proximity of the posterior mediastinal pleura, especially the thoracic spine, leads to a higher risk of direct contamination either due to pleural injury during surgery or after an established locus of infection. However, as our records demonstrate, all patients had surgery on an elective basis and none had a redo surgery. To our knowledge, there was no surgical trauma to the posterior pericardium or mediastinum. Positive blood culture in 4 patients before spinal surgery do suggest a period of either bacteremia or septicemia, which was probably the mechanism involved in the pathophysiology of this complication. Also, lumbar spine was the involved region in 3 patients, and this fact further supports the hematogenous mechanism. Diabetes in 3 patients and chronic renal failure in 1 patient may have facilitated hematogenous dissemination or direct invasion, although Baskett and associates [4] found them to be insignificant risk factors. Chronic obstructive pulmonary disease, which was identified by them to be the only major risk factor was not noted in our patients.

Diagnosis of vertebral osteomyelitis may be difficult in the postoperative period because it has a relatively insidious onset and slower course, and the cardiac surgeon who is the primary physician following the patient is usually too focused on the mediastinal infection. In our series, back or low back pain that the patients experi-

Table 1. Preoperative Findings, Surgical Treatment, and Results

Case	Age (Years)/ Gender	Cardiac Intervention	Time to Onset of Mediastinal Symptoms After Cardiac Intervention (Days)	Risk Factors	Vertebral Lesion Site	Time to Operation After the Onset of Symptoms (Days)	Neurologic Status	Surgical Procedure to the Spine	Follow-up (Months)/ Result
1	59/male	CABG	8	DM	L5	52	—	PSI + PSF (L4–S1), anterior L5 vertebrectomy, AF with fibular strut graft	12/good
2	73/male	CABG	14	—	T7, T8	30	Paraparesia	PSI + PSF (T4–T10), anterior T7, T8, T9 vertebrectomy + AF with fibular grafting	95/good
3	72/male	CABG	28	HT, CRF	L5	28	—	PSI + PSF (L4–S1), anterior L5 vertebrectomy + AF with titanium mesh cage	35/good
4	73/female	CABG	17	DM	T7, T8, T9	15	Paraplegia	T7, T8, T9 costotransversectomy, epidural abscess drainage without instrumentation	Exitus
5	64/male	CABG	25	DM	L4	27	—	PSI + PSF (L3–L5), anterior L4 vertebrectomy + AF with titanium mesh cage	50/good

AF = anterior fusion; CABG = coronary artery bypass grafting; CRF = chronic renal failure; DM = diabetes mellitus; HT = hypertension; PSI = posterior spinal instrumentation; PSF = posterior spinal fusion.

enced and mentioned during the course of mediastinitis was thought to be a nonspecific postural symptom. Pain in those patients did not respond much to medical treatment. As is true for tuberculous spondylitis, plain roentgenograms and CT may not be helpful tools for early diagnosis. MRI has proved to be an invaluable method for early diagnosis of vertebral osteomyelitis and determination of multiple level involvement and degree of neural element compression [12, 13].

There have been cases where patients have had endocarditis with spondylodisciitis. Sudden onset of back pain during the course of endocarditis is reported to be an important sign of spondylodiscitis in these patients, who have responded well to early medical treatment [14, 15]. Cardiac tests did not reveal any sign of endocarditis in our patients with back pain. If early diagnosis can be achieved, then specific antibiotheraphy is reported to be the initial appropriate treatment method for vertebral osteomyelitis [16]. CT-assisted biopsy from the lesion site should be taken before the medical treatment.

According to the results of previous cultures and CT-guided biopsy, proper antibiotics were administered in all cases except for 2 patients who developed rapid and progressive neurologic signs, and we had to proceed with

Table 2. Results of All Cultures

Case	Blood Culture	CT-guided Biopsy	Mediastinal Cultures	Intraoperative Cultures	Pathologic Diagnosis
1	MRSA	MRSA + nonspecific inflammatory cells	MRSA + SE	none	Nonspecific osteomyelitis
2	None	MRSA + nonspecific inflammatory cells	MRSA	MRSA	Nonspecific osteomyelitis
3	MRSA + SE	MRSA + nonspecific inflammatory cells	MRSA	MRSA	Nonspecific osteomyelitis
4	MRSA	None	MRSA + SE	MRSA	Nonspecific osteomyelitis
5	MRSA	MRSA + nonspecific inflammatory cells	MRSA + SE	MRSA	Nonspecific osteomyelitis

MRSA = methicilline-resistant *Staphylococcus aureus*; SE = *Staphylococcus* epidermidis.

urgent surgery for spinal cord decompression. Anterior debridement and fusion after posterior instrumentation and fusion was performed in the remaining 3 patients whose symptoms did not respond to medical treatment. Although medical treatment is the preferred method of treatment for infections of the spine, it has not been effective in our series to relieve symptoms and stop progression. Considering the fact that vertebral infections in the elderly show a rapid progression, radical debridement as part of a more aggressive approach seems to be a better alternative. Initial posterior instrumentation as performed in four of our cases was crucial to prevent instability and deformity, which would be inevitable after anterior radical debridement of the vertebral bodies. This also prevents neurologic deterioration due to mechanical problems and helps early mobilization, which avoid complications related to immobilization in the elderly cardiac patients [17]. Titanium mesh cages were used for anterior column support after debridement in 2 patients (cases 3 and 5). Although they were left in potentially infected or contaminated tissue, mesh cages were preferred to achieve better and immediate stabilization in those patients who had less reliable bone quality due to osteoporosis. Furthermore, compared with other materials, titanium is thought to be more resistant to bacterial infections by preventing bacterial film formation [18, 19].

In conclusion, vertebral osteomyelitis should be kept in mind when a patient develops back pain during the course of mediastinitis. Early diagnosis with appropriate imaging and proper treatment are important to prevent potentially catastrophic complications, especially in this population of patients who usually have impaired general condition due to older age and cardiac problems.

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