

Pyogenic vertebral osteomyelitis: a review of 14 cases

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ABSTRACT

Purpose. To review and evaluate the management of 14 patients with pyogenic vertebral osteomyelitis at National University Hospital, Singapore between 1998 and 2001.

Methods. Demographic pattern, predisposing factors, clinical presentation, co-morbidities, microbiology, treatment, and complications of 14 patients were retrospectively reviewed.

Results. The mean age at presentation was 62.5 years and the male to female ratio was 6:1. The mean follow-up duration was 12.5 months. The most common predisposing condition was diabetes mellitus (n=5). The most common site of infection was the lumbar spine (n=8), followed by the thoracic (n=4) and cervical (n=2) spine. *Staphylococcus aureus* was the most common causative organism isolated (n=9), followed by methicillin-resistant *S aureus* (n=3), *Pseudomonas pseudomallei* (n=1), and *Streptococcus agalactiae* (n=1). 12 patients were treated surgically: 8 by an anterior approach, 3 by a posterior approach, and one by a

combination of the 2. The mean period of antibiotic use was 11.4 weeks. One patient with melioidosis involving the T9 to T11 vertebrae caused by *Pseudomonas pseudomallei* died of empyema and septicaemia 22 months after presentation.

Conclusion. Pyogenic vertebral osteomyelitis is not uncommon in the elderly, especially those with predisposing conditions such as diabetes mellitus. Computed tomography-guided needle biopsy is recommended to investigate causative microorganisms. Aggressive surgical debridement and prolonged antibiotic therapy were necessary in patients with methicillin-resistant *S aureus*, *Pseudomonas pseudomallei*, and *S agalactiae*.

Key words: osteomyelitis; spine; suppuration; treatment outcome

INTRODUCTION

Pyogenic vertebral osteomyelitis is a relatively uncommon condition.^{1,2} In cases of infection caused

by methicillin-resistant *Staphylococcus aureus* (MRSA), *Pseudomonas pseudomallei*, and *Streptococcus agalactiae*, early recognition, aggressive debridement, and prolonged antibiotic therapy are crucial to successful treatment.

METHODS

From January 1998 to January 2001, 14 patients (12 men, 2 women) with pyogenic vertebral osteomyelitis were treated at the Division of Spinal Surgery of National University Hospital, Singapore. Demographic pattern, predisposing conditions, clinical presentation, co-morbidities, microbiology, treatment, and complications of the 14 patients were retrospectively reviewed.

The patients were assessed clinically and radiologically, including full blood count, erythrocyte sedimentation rate, C-reactive protein, blood culture, computed tomography (CT)-guided biopsy, and magnetic resonance imaging.

RESULTS

The patients' ages ranged from 44 to 75 years (mean, 62.5 years) and the male to female ratio was 6:1. There were 11 Chinese, 2 Malays, and one Indian. The duration of the follow-up ranged from 10 to 21 months (mean, 12.5 months) [Table]. Of the 14 patients with pyogenic vertebral osteomyelitis, 7 had conditions that predispose to the infection (3 had more than one such condition), including diabetes mellitus (n=5), previous MRSA infection (n=3), intravenous drug addiction (n=1), malignancy (n=1), and renal failure (n=1). Of the 3 patients with predisposing MRSA, one had become infected with MRSA after surgery to clear an intestinal obstruction, the second had a history of MRSA bacteraemia following a ureterotomy for ureteric stones, and the third of MRSA sepsis after creation of an arteriovenous fistula for haemodialysis (Table).

Co-morbidities were seen in 9 patients (3 of whom presented with multiple co-morbidities) and included hypertension (n=5), ischaemic heart disease (n=4), partial gastrectomy (n=1), cerebrovascular accident (n=1), congestive heart failure (n=1), and hypertrophic cardiomyopathy (n=1) [Table].

Clinical presentation

All patients presented with localised back pain corresponding to their sites of infection: 8 in the lumbar

spine (4 involved L3/L4, 2 involved L2/L3, one involved L3-S1, one involved L1-L5 with epidural abscess), 4 in the thoracic spine from T9 to T11, and 2 in the cervical spine (Table). Two patients presented with radiating pain: patient 10 had neck pain radiating to the left shoulder with brachialgia on the left side, patient 13 had bilateral girdle pain in the chest radiating down to the umbilicus. Only 4 patients presented with fever. Patients 3 and 10 with cervical involvement had weakness in both upper limbs but not in the lower limbs. No patient presented with loss of bladder or bowel control.

Blood and microbiological tests

Each patient's white blood cell count, haemoglobin level, erythrocyte sedimentation rate, and C-reactive protein level was measured. Leukocytosis was observed in only 4 patients; anaemia was present in 10 patients. Erythrocyte sedimentation rate and C-reactive protein level were raised in 13 and 10 patients, respectively.

13 patients were found positive for microorganisms through various tests: 5 out of 9 patients had blood cultures that tested positive, 4 patients underwent CT-guided needle biopsies that yielded positive results. Ten of the 12 patients who underwent surgery had intra-operative specimens cultured that were found positive. The 13 cases with positive cultures for microorganisms consisted of *S aureus* (n=9), MRSA (n=2), *Pseudomonas pseudomallei* (n=1) and *S agalactiae* (n=1). The causative pathogen was not isolated in patient 12 who had previously been treated for MRSA sepsis after the creation of an arteriovenous fistula for haemodialysis. The patient was treated conservatively for osteomyelitis of L3/L4 6 months later (Table).

Surgical treatment

Patients 4 and 12 were treated conservatively, while other patients were treated surgically: 8 by an anterior approach, 3 by a posterior approach, and one by a combination of the 2 (Table). Of the anterior group, 2 patients underwent corpectomy and fusion, while 6 underwent debridement and fusion. All 3 patients of the posterior group underwent drainage and debridement. Combined surgery utilised Moss Miami instrumentation (DePuy Spine, Raynham [MA], US) from the posterior, and corpectomy and fusion from the anterior.

Antibiotics

Antibiotics were the mainstay of treatment, and agents

Table
Characteristics, causative pathogens, and treatment of patients with vertebral osteomyelitis

Patient No.	Sex/age (years)	Predisposing condition*	Comorbidities [†]	Site of infection	Surgical approach	Organism cultured [‡]	Antibiotics used (weeks)		Outcome
							Intravenous	Oral	
1	M/67	Nil	IHD	L1–L5	Posterior drainage for epidural abscess	<i>S aureus</i>	Cloxacillin (7)	Cloxacillin (4)	Developed septicaemia with perinephric abscess
2	M/58	Nil	Nil	L2/L3	Anterior debridement	<i>S aureus</i>	Cloxacillin (5)	Cloxacillin (8)	Successful
3	M/66	DM	HPT	C3/C4	Anterior debridement	<i>S aureus</i>	Cloxacillin (3)	Cloxacillin (4)	Successful
4	M/46	IVDA	Nil	L3/L4	Nil	<i>S aureus</i>	Cloxacillin (6)	Cloxacillin (6)	Successful
5	M/44	Nil	Nil	L3/L4	Anterior debridement	<i>S aureus</i>	Cloxacillin (4)	Cloxacillin (8)	Successful
6	M/50	Nil	HC	T9/T10	Posterior drainage	<i>S aureus</i>	Cloxacillin (4)	Cloxacillin (6)	Successful
7	M/72	DM	PG	T9/T10	Anterior debridement	<i>S aureus</i>	Cloxacillin (5)	Cloxacillin (4)	Successful
8	F/69	Nil	IHD	L3/L4	Posterior drainage	<i>S aureus</i>	Cloxacillin (6)	Cloxacillin (4)	Successful
9	M/75	Nil	HPT	L2/L3	Anterior debridement	<i>S aureus</i>	Cloxacillin (3)	Cloxacillin (6)	Successful
10	M/50	Malignancy, MRSA infection after intestinal obstruction surgery	Nil	C3/C4, C6/C7	Anterior corpectomy	MRSA	Vancomycin (7)	Clindamycin, fusidic acid (12)	Successful
11	M/73	DM, MRSA bacteremia after ureterotomy for stones	CHF, HPT	T9/T10	Anterior debridement	MRSA	Vancomycin (6)	Clindamycin, fusidic acid (6)	Successful
12	M/68	DM, RF, MRSA sepsis after creation of arterio-venous fistula	HPT, IHD	L3/L4	Nil	MRSA	Vancomycin (8)	Clindamycin, fusidic acid (6)	Successful
13	M/71	Nil	Nil	T9–T11	Combined	<i>P pseudomallei</i>	Piperacillin (6), vancomycin (10)	Clindamycin (6)	Developed neutropenia, eosinophilia, then MRSA infection, paraplegia with loss of sphincter control, finally died of septicaemia
14	F/66	DM	HPT, CVA, IHD	L3–S1	Anterior corpectomy (L4/L5)	<i>S agalactiae</i>	Crystalline penicillin (11)	Penicillin V, cloxacillin (2)	Successful

* DM denotes diabetes mellitus, IVDA intravenous drug addiction, MRSA methicillin-resistant *Staphylococcus aureus*, and RF renal failure

[†] IHD denotes ischaemic heart disease, HPT hypertension, HC hypertrophic cardiomyopathy, PG partial gastrectomy, CHF congestive heart failure, and CVA cerebrovascular accident

[‡] *S aureus* denotes *Staphylococcus aureus*, MRSA methicillin-resistant *Staphylococcus aureus*, *P pseudomallei* *Pseudomonas pseudomallei*, and *S agalactiae* *Streptococcus agalactiae*

with a high sensitivity were initiated once the causative organism had been identified. There was no standardised antibiotic regimen because of the variety of causative organisms and the preferences of different surgeons. *S aureus* was treated with cloxacillin, and MRSA with intravenous vancomycin followed by oral clindamycin and fusidic acid. The antibiotic regimen for MRSA, *Pseudomonas aeruginosa*, and *S agalactiae* was based on the recommendations of the hospital's infectious diseases specialist. The mean duration of antibiotic administration was 11.4 weeks (range, 7–19 weeks). This duration of therapy varied depending on clinical response and changes in erythrocyte sedimentation rate.

Complications

Patients 1 and 13 developed complications following surgery. Patient 1 with an epidural abscess developed *S aureus* septicaemia and a urinary tract infection leading to a perinephric abscess. Patient 13 developed neutropenia and eosinophilia caused by ceftazidime, and vancomycin and piperacillin, respectively. This 71-year-old male patient with melioidosis later developed paraplegia with loss of sphincter control. He subsequently developed MRSA infection, kyphosis, urinary tract infection, and empyema, and died of septicaemia 22 months after admission (Table).

DISCUSSION

Pyogenic vertebral osteomyelitis usually affects older men,^{2–6} which is consistent with this study's mean age at diagnosis of 62.5 years and predominantly male cohort. Nonetheless, some have reported a higher prevalence in younger age-groups.^{7,8}

Seven of our 14 patients presented with a predisposing condition, mainly diabetes mellitus, a correlation which has been well documented.⁹ Previous MRSA infection was another common predisposing condition that affected 3 patients; Torda et al.¹⁰ found nosocomial infection in all of their 6 patients with MRSA. Predisposing condition is important in the pathogenesis of vertebral osteomyelitis, which is caused by haematogenous seeding and is more prevalent in immunocompromised patients.

Associated neurological deficits involving the cervical spine were present in patients 3 and 10, although most infections occurred in the lumbar spine (8 of 14). Eismont et al.⁷ found that patients with cervical spine involvement were more likely to have neurologic deficits. One of their patients had diabetes

mellitus and was predisposed to neurological deficits.⁷ In contrast, Hadjipavlou et al.¹¹ found a higher incidence of neurologic deficits with involvement of the thoracic spine than with the cervical spine. Carragee² reported a higher incidence of neurological involvement in patients with impaired immune status. Cervical or thoracic spine involvement, as well as diabetes mellitus and immunocompromised conditions, are more likely to be associated with neurological deficits.

In the present study, only 5 of the 9 blood cultures tested turned out to be positive, but the 4 patients who tested negative by blood culture were found positive by CT-guided needle biopsy. Sapico¹² found that only about 25% of blood cultures identified positive results, and that needle biopsy could give better results when better imaging equipment was available to guide needle placement. As the sensitivity of blood cultures is not adequate, CT-guided needle biopsy is recommended in cases of abscess formation around the spine.

The most common microorganism involved in this study was *S aureus* (9 cases), which is comparable to the results of other studies.^{13–15} Three patients developed MRSA vertebral osteomyelitis, which is now also a common infection.^{10,16,17} *S agalactiae* was isolated in patient 14. This organism is a rare cause of vertebral osteomyelitis in adults.^{18,19} It usually causes infections in newborn babies or women in the puerperium period, as reported in 4 such cases by Solis-Garcia del Pozo et al.¹⁹ *S agalactiae* is often associated with extensive tissue destruction resulting in spinal instability requiring operative intervention.¹⁸ Its aggressive nature was evident in our patient, who had a paraspinal abscess extending from L3 to S1 drained, and returned a month later for radical debridement involving an L4 partial corpectomy and tri-cortical iliac crest bone grafting. *S agalactiae* is susceptible to penicillin,¹⁹ and the patient received 13 weeks of penicillin and cloxacillin. Radical debridement, prolonged antibiotic use, and even repeated surgery may be needed when dealing with *S agalactiae*.

Pseudomonas aeruginosa was isolated from patient 13 whose condition involved the posterior elements of the spine from T9 to T11. To achieve radical resection of all vertebral bodies invaded by osteomyelitis, this patient required 2-stage surgery after the initial posterior debridement: posterior debridement and stabilisation, followed by a corpectomy of T10, T11, and part of T9. Despite radical debridement and aggressive antibiotic treatment with piperacillin, vancomycin, and clindamycin, this patient developed empyema and died of septicaemia 22 months after admission. To our knowledge, this is the first case of

Pseudomallei involving the posterior elements of the spine and causing extensive osteomyelitis of 3 vertebral bodies (T9–T11). Kosuwon et al.²⁰ reported 4 patients with tuberculosis spondylitis and 2 with septic discitis in a series of 21 patients with melioidosis; nonetheless, no vertebral osteomyelitis due to melioidosis was described.

Anterior surgery was chosen for 8 of the 12 patients operated on. The pathology of pyogenic vertebral osteomyelitis mainly affects the vertebral bodies and disc spaces; therefore, the anterior approach is recommended because it allows adequate debridement and reconstruction of affected vertebrae.^{9,17}

CONCLUSION

Pyogenic vertebral osteomyelitis is not uncommon in the elderly, especially those with predisposing condition such as diabetes mellitus. CT-guided needle biopsy is recommended in cases of abscess formation around the spine because it has higher sensitivity in identifying the causative microorganism. Aggressive surgical debridement and prolonged antibiotic therapy, and even repeated surgery, were necessary for the treatment of MRSA, *Pseudomallei*, and *Sagalactiae* infection.

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