

Management of Vertebral Osteomyelitis

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ABSTRACT

This is a study of 11 patients treated from January 1998 to June 2000 – 10 males and 1 female. Their ages ranged from 44 to 75, average being 61.5. Average duration of follow-up was 8.7 months. Predisposing factors were found in 6 patients and included diabetes mellitus, previous MRSA infection, intra-venous drug addiction, malignancy and renal failure. The majority involved the lumbar spine (6). Three involved the thoracic spine and 2 the cervical spine. Commonest organism was *Staphylococcus Aureus* in 6 cases, followed by MRSA in 3 patients. There was an increasing incidence of MRSA vertebral osteomyelitis. Anterior surgery was performed in 6 cases, posterior surgery in 3 cases, and combined surgery in 1 case. One patient was treated conservatively. The duration of antibiotics administered ranged from 7 to 19 weeks, the average being 12 weeks. Complications were seen in 4 cases for which repeat surgeries were performed.

INTRODUCTION

Vertebral osteomyelitis is an important clinical condition that must be recognized early and be given adequate treatment. Whilst tuberculous osteomyelitis is very uncommon, pyogenic osteomyelitis is not uncommon and must be treated aggressively with debridement and adequate antibiotic cover to avoid flare-up of the infection. This is a study of 11 cases treated in the department over the last 2 years.

MATERIALS AND METHODS

Study Population

This is a retrospective study of 11 patients treated for vertebral osteomyelitis in the Department of Orthopaedic Surgery, National University Hospital from January 1998 to June 2000.

There were 10 males and 1 female. Their ages ranged from 44 to 75 years with an average age of 61.5 (Fig 1). Majority of the patients were Chinese (9), followed by Malays (1) and Indians (1). The duration of follow-up

ranged from 6 months to 16 months, the average being 8.7 months.

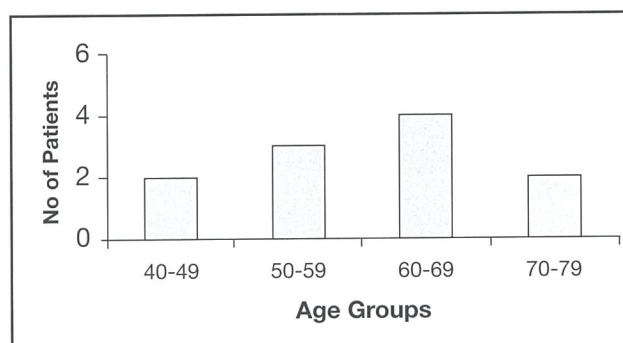


Fig. 1. Age distribution.

Predisposing factors were in 6 patients. These included diabetes mellitus, previous MRSA infection, intra-venous drug addiction, cancer of the stomach and renal failure. (Table 1). Three patients had more than one predisposing factor.

Table 1. Predisposing factors

Predisposing Factors	No of Cases
Diabetes Mellitus	4
*Previous MRSA infection	3
** IV drug addict	1
Ca stomach	1
Chronic renal failure	1

- *i. MRSA infection in 1998 after operation for intestinal obstruction
- ii. MRSA bacteraemia in 1999 after ureterotomy for ureteric stones
- iii. MRSA sepsis in 1999 after AV-Fistula for haemodialysis
- **Staphylococcus Aureus infection

Associated illnesses were seen in 7 patients. These included hypertension, ischaemic heart disease, partial gastrectomy, cerebrovascular accident, congestive cardiac failure and hypertrophic cardiomyopathy (Table 2). Three patients had more than one associated illnesses.

Table 2. Associated illnesses

Associated Illness	No of Cases
Hypertension	4
Ischaemic heart disease	3
Partial gastrectomy	1
Cerebrovascular accident	1
Congestive cardiac failure	1
Hypertrophic cardiomyopathy	1

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Clinical Presentation

All patients presented with localised pain in the spine, 2 in the cervical spine, 3 in the thoracic spine and 6 in the lumbar spine.

Radiation of pain occurred in only 2 cases. In 1 patient presenting with neck pain, there was brachialgia on the left side with pain radiating to the left supraclavicular region. In the other patient with pain in the thoracic region, girdle pain was experienced bilaterally, the pain radiating to the umbilicus.

Fever was present in only 3 cases. Neurologic deficit occurred in 2 patients only. Both were due to involvement of the cervical spine. Both had weakness in the upper limbs bilaterally but no weakness in the lower limbs and no loss of sphincter control.

The sites of infection were localized to the thoracic spine in 3 cases, lumbar spine in 6 cases and cervical spine in 2 cases. (Fig. 2). Of those involving the thoracic spine, all cases were localized to T9-T11 region. In the lumbar spine, three involved L3/L4 level, one L2/L3 level, one L4/L5 level and another with epidural abscess extending from L1 to L5.

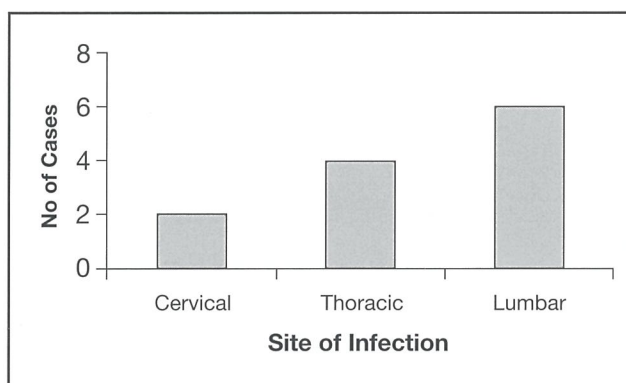


Fig. 2. Sites of infection.

Laboratory Investigations

Erythrocyte sedimentation rate was raised in all except one case. C-reactive protein (CRP) was raised in 8 of the 9 cases where it was performed. Leucocytosis was seen in only 2 patients. Anaemia was present in 8 cases (Table 3).

Table 3. Hematological findings

	Pos	Neg	Not performed
WBC >11.0 x 10 ⁹ /L	2	9	0
Hb M <13.1			
F <11.3 g/dL	8	3	0
ESR >14 mm / h	10	0	1
CRP >0.6 mg / dL	8	1	2

Microbiological Tests

Blood cultures were performed in 9 cases. Of these, 5 were positive for microorganisms. CT guided biopsy was performed in 4 cases.

Intra-operatively, specimens were sent for culture and sensitivity in all 10 cases operated upon. One patient was treated conservatively. Positive cultures were obtained in 8 cases. The types of microorganisms cultured were shown

in Table 4. Six grew *Staphylococcus Aureus* and 2 Methicillin-Resistant *Staphylococcus Aureus*.

Table 4. Types of microorganisms cultured

Organisms	No of Cases
<i>Staphylococcus Aureus</i>	6
MRSA	2
<i>Pseudomonas Pseudomallei</i>	1
<i>Streptococcus Agalactiae</i> (Group B)	1
*No organism isolated	1

*MRSA sepsis in 1999 after AV-Fistula for haemodialysis. Developed osteomyelitis L3/L4 6 months later.

Treatment

Ten cases required surgery. One case was treated conservatively. Of those where surgery was performed, 6 cases were operated by anterior surgery, 3 by posterior surgery and 1 by combined anterior and posterior surgery (Table 5).

Table 5. Types of surgery

Type of Surgery	No of Cases
<u>Anterior surgery</u>	
Corpectomy + Fusion	2
Debridement + Fusion	4
<u>Posterior surgery</u>	
Drainage of thoracic spine	1
Drainage of lumbar spine	1
Drainage of epidural abscess	1
Anterior + Posterior *	1

*MRSA infection treated with first stage posterior stabilization from T7 to T12 using Moss Miami Instrumentation. Second stage anterior corpectomy of T9 and T10 performed 1 week later.

Of those operated anteriorly, corpectomy and fusion was performed in 2 cases, debridement and fusion in 4 cases.

Of those drained by the posterior route, one was for T9/T10 and T10/T11 vertebral osteomyelitis with involvement of the posterior elements due to melioidosis (*Pseudomonas Pseudomallei*). This patient required two further operations.

A second operation was performed 7 months later, consisting of a first-stage costotransversectomy for another debridement at T9/T10 level and posterior stabilization using Moss Miami Instrumentation. A second-stage third operation was performed 3 weeks later using the anterior approach for corpectomy of T9/T10 and T11 vertebral bodies to achieve radical resection of the infected vertebral bodies. The defect was reconstructed using tricortical iliac crest and rib graft. Another patient presented with a right paraspinal abscess from L3 to S1 which was drained anteriorly due to *Streptococcus Agalactiae* (Group B). This patient later developed L4/L5 vertebral osteomyelitis which required a second operation – a radical anterior debridement. The third patient presented with epidural abscess from L1 to L5 which grew *Staphylococcus Aureus*.

Antibiotic Regime Employed

Table 6 showed the individual antibiotic regime used for all 11 patients treated. *Staphylococcus Aureus* was treated with Cloxacillin and MRSA with Vancomycin.

The duration of antibiotics administered ranged from 7 weeks to 19 weeks averaging about 12 weeks.

Complications

Complications were encountered in 4 cases. These included *Staphylococcus Aureus* septicaemia and urinary tract infection leading to perinephric and psoas abscess in one patient. The second patient developed urinary tract infection. In the third patient the bone graft displaced anteriorly with acute kyphosis over L2. In the fourth patient complications included neutropenia due to Fortum, eosinophilia due to Vancomycin and Piperacillin. This patient with melioidosis later developed paraplegia with loss of sphincter control. He subsequently developed MRSA infection, kyphosis, urinary tract infection, empyema and finally died of septicaemia 22 months after admission.

Repeat Surgery

Four repeat surgeries were performed in 3 patients.

The first patient required revision of anterior spinal fusion for graft dislodgement anteriorly. The second patient presented with a right paraspinal abscess which was drained and grew *Streptococcus Agalactiae*. He required radical anterior debridement with excision of L4-L5 disc and L4 (lower half) corpectomy with stabilization using tricortical iliac crest bone graft. In the third patient with melioidosis, after drainage by the posterior route, two additional operations were required. The second operation consisted of a first stage costotransversectomy and debridement of T9/T10 with posterior stabilization of the spine using Moss Miami Instrumentation. This was followed 3 weeks later by a second-stage total corpectomy of T10 and T11 and partial corpectomy of T9 with reconstruction of the defect with tricortical iliac crest and rib graft.

DISCUSSION

Infections of the spine are bimodal in age distribution¹. In this study, paediatric infections of the spine are excluded. Nine out of 10 patients are above 50 years of age consistent with the findings of Digby and Kersley².

Males are predominantly affected in our study (10:1). Male dominance is noted by several workers²⁻⁹.

In our study, predisposing factors present included diabetes mellitus (4), previous MRSA infection (3), chronic renal failure (1), IV drug addict (1) and carcinoma of stomach (1).

The commonest predisposing factor in our study is diabetes mellitus which has been well documented^{1,10}. We have found a previous MRSA infection to be an important predisposing factor not described previously. Of the 3 cases, the first patient developed MRSA infection in 1998 after operation for intestinal obstruction. The second patient developed MRSA bacteraemia in 1999 after ureterotomy done for ureteric stones. The third patient developed MRSA sepsis in 1999 after creating an IV fistula for haemodialysis.

All patients presented with localized persistent pain in the spine¹¹. Pain is the primary symptom and is not mechanical but organic in nature^{12,13}.

Only 3 patients presented with fever. Blumberg et al¹¹ noted that not all patients had fever.

Only 2 patients developed neurological deficit. Both cases involved cervical infections. Both cases developed weakness in upper limb bilaterally but there was no involvement of the lower limb and no loss of bladder or bowel control.

It is well known that cervical involvement is associated with a higher predilection for neurological involvement¹⁴. One case had diabetes mellitus which is also known to predispose to neurological deficit¹⁴. The other case had an underlying carcinoma of the stomach.

In this study all infections were due to vertebral osteomyelitis except for one case with epidural abscess following the classification by Calderone and Larsen¹⁰.

Table 6. Antibiotic regime employed

Organisms	IV Antibiotic	Oral Antibiotic
<i>Staphylococcus Aureus</i>	1. Cloxacillin x 7 weeks 2. Cloxacillin x 5 weeks 3. Cloxacillin x 3 weeks 4. Cloxacillin x 6 weeks 5. Cloxacillin x 4 weeks 6. Cloxacillin x 4 weeks	Cephalexin 4 weeks Cloxacillin x 8 weeks Cloxacillin x 4 weeks Cloxacillin x 6 weeks Cloxacillin x 8 weeks Cloxacillin x 6 weeks
MRSA	1. Vancomycin x 7 weeks 2. Vancomycin x 6 weeks 3. Vancomycin x 8 weeks*	Clindamycin & Fusidic Acid x 12 weeks Clindamycin & Fusidic Acid x 6 weeks Clindamycin & Fusidic Acid x 6 weeks
<i>Pseudomonas Pseudomallei</i>	Fortum x 8 weeks	Doxycycline x 2 weeks
<i>Streptococcus Agalactiae</i> (group B)	Crystalline Penicillin & Cloxacillin x 11 weeks	Penicillin V & Cloxacillin x 2 weeks

*Patient treated conservatively for MRSA.

The majority involved the lumbar spine (6 out of 11 cases). Three involved the thoracic spine and only 2 cases the cervical spine.

Leucocytosis was present in only 2 out of 11 cases¹².

All cases had raised ESR^{12,15}. In one case this investigation was not done. CRP is more sensitive than ESR^{12,16}. CRP was found to be raised in 8 out of 9 cases where the investigation was performed.

Blood culture was positive in 5 out of 9 cases where it was carried out. Sapico¹⁷ found blood cultures to be positive in about 25%.

CT guided biopsy on the other hand was positive in all the 4 cases in which it was performed. Sapico¹⁷ found that needle biopsy gave better results with better imaging procedures to guide needle placement.

Open biopsy was performed in 10 cases. Eight of them yielded positive culture. In the 2 cases with negative result, they were treated with IV antibiotics before the open biopsy was done.

The commonest microorganism involved is *Staphylococcus Aureus* (4 out of 11 cases). This is comparable to research of other research workers^{12,13,17}.

In these papers, 3 cases developed MRSA vertebral osteomyelitis. This has not been reported in the literature so far.

The one case due to IV drug addiction in this paper was due to *Staphylococcus Aureus*. This is also comparable to the results of Sapico¹⁷ who found *Staphylococcus Aureus* to be more common than *Pseudomonas Aeruginosa*¹⁸.

REFERENCES

1. Frank CJ, Hanley EN. Profiles of patients with spine infections and infections that have a predilection for the Spine. *Seminars in Spine Surgery* 1996; 8(2): 95-104.
2. Digby JM, Kersley JB. Pyogenic non-tuberculous spinal infection. *J Bone Joint Surg (Br)* 1979; 61: 47-55.
3. Henson SW, Coventry MB. Osteomyelitis of the vertebrae as the result of infection of the urinary tract. *Surg Gynecol Obstet*; 102:207-214.
4. Garcia AK, Grantham SA. Hematogenous pyogenic vertebral osteomyelitis. *J Bone Joint Surg (Am)* 1960; 42: 429-436.
5. Griffiths HED, Jones DM. Pyogenic infection of the spine. *J Bone Joint Surg (Br)* 1971; 53: 383-391.
6. Hazlett JW. Pyogenic osteomyelitis of the spine. *Can J Surg* 1958; 1:243-246.
7. Stauffer RN. Pyogenic vertebral osteomyelitis. *Orthop Clin N Am* 1975; 6:1015-1027.
8. Wedge JH, Oryschak AF, Robertson DE et al. Atypical manifestations of spinal infections. *Clin Orthop* 1997; 123:155-163.
9. Wood GW. Spinal infections. *Spine : State of the Art Reviews* 1989; 3:461-493.
10. Calderone RR, Larsen JM. Overview and classification of spinal infections. *Orthop Clin North Am* 1996; 27(1): 1-8.
11. Blumberg KD, Silveri CP, Balderston RA. Presentation and treatment of pyogenic vertebral osteomyelitis. *Seminars in Spine Surgery* 1996; 8(2): 115-125.
12. Lestini WF, Bell GR. Spinal infection : Patient evaluation. *Seminars in Spine Surgery* 1996; 8(2):81-94.
13. Sapico FL, Montgomerie JZ. Pyogenic vertebral osteomyelitis : Reports of 9 cases and review of the literature. *Rev Infect Dis* 1979; 1:754.
14. Eismson FJ, Bohlman HH, Soni PL, et al. Pyogenic and fungal vertebral osteomyelitis with paralysis. *J Bone Joint Surg (Am)* 1983; 65: 19-29.
15. Schulak DJ, Rayhack JM, Lippert FG, et al. The erythrocyte sedimentation rate in orthopaedic patients. *Clin Ortho* 1982; 167:197.
16. Deodhar SD. C-reactive protein : The best laboratory indicator available for monitoring disease activity. *Clev Clin J Med* 1989; 56: 126.
17. Sapico FL. Microbiology and antimicrobial therapy of spinal infections. *Orthop Clin North Am* 1996; 27(1): 9-13.
18. Sapico FL, Montgomerie JZ. Vertebral osteomyelitis in intravenous drug abusers : Report of 3 cases and review of the literature. *Rev Infect Dis* 1980; 2: 196-206.