Management of Spontaneous Spinal Infection: A Review of 40 Consecutive Patients

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Abstract

Study Design: A retrospective study of 40 cases of spontaneous spinal infection, excluding postoperative infections. Data were obtained through medical record review, imaging examination, and patient follow-up evaluation in Neurology and Neurosurgery Departments.

Objectives: To analyze the bacteriology, pathologic entities, results and complications of treatment options.

Method: All patients received plain radiographs and gadolinium-enhanced magnetic resonance imaging scans. Patients who had been operated upon had tissue biopsies. All patients received intravenous and oral antibiotics. A total of 18 patients underwent surgery. Patient outcomes were correlated with clinical status, and treatment method.

Results: The study included 28 males and 12 females with mean age of 45 years. Main symptoms were back pain and fever, with mean duration was 6.3 months. There were 28 cases at lumbosacral region, 5 at the dorsal, and 7 at cervical region. The erythrocyte sedimentation rate (ESR) was elevated in all cases. 30 cases were tuberculous, and 10 cases were non-tuberculous. 18 cases were treated surgically, and 22 cases were treated medically. Clinical pictures respond well to either medical or surgical treatment. However, increased kyphotic deformity was reported in medically treated cases and those who had no fixation especially. Also patients who were treated nonsurgically reported residual back pain more often (55%) than patients treated surgically (17%)

Conclusions: Spontaneous spondylodiscitis (SD) is not an uncommon cause of low back pain in adults. It should be considered in any patient with acute or subacute pain with elevated acute-phase reactants. MRI is the radiological method of choice for establishing the diagnosis. Patients with SD can be successfully treated conservatively or surgically with progressive neurological manifestations.

Key Words: Spinal infection – Spondylodiscitis – Antibiotics and braces – Decompression and fixation.

Introduction

It’s could occurs through hematogenous spread by two routes; Retrograde spread via Batson’s venous plexus or direct spread via posterior spinal arteries. The segmental arteries supplying the vertebral bifurcate to supply two adjacent bone segments, explaining why vertebral osteomyelitis usually affecting two adjacent vertebrae and intervening disc space. Other source is from soft tissue abscess from contiguous structures [1].

Spectrum of spinal infection (Anatomical Location):

Spondylodiscitis (SD), this is the most common spinal infection and affects primarily anterior elements of the vertebra and adjacent discs. Spondylitis, including septic facet arthropathy. Discitis, this infection primarily involve the space between adjacent vertebral bodies, which can be subdivided into three categories: Adult hematogenous (spontaneous), childhood discitis, and postoperative. Spinal Canal Infections, infections in this location are classified according to the relationship of the abscess to the meninges into: Epidural abscesses, are the most common infection within the canal, Subdural abscesses, and intramedullary abscesses. This anatomical consideration is not highly reflected on the clinical calcification because all are not separate entity [1-3].

Treatment options:

• Conservative therapy (Nonsurgical management): Antibiotics, Rest and Bracing.
• Surgical therapy: On the base of three principles 1) infected tissue should be thoroughly debrided; 2) the infected area should receive adequate blood flow for tissue healing; and 3) spinal stability should be maintained or restored if it’s compromised. Surgical interventions are in the form of: Abscess drainage, Disc curettage, Fusion, and Fixation.
Study design: Retrospective analytic study, all forms of spontaneous spinal infections, managed at Neurology and Neurosurgery department and followed at the outpatient clinic, through 2007-2010.

Aim of the work: Evaluate the results of management of various forms of spinal infections.

Patients and Methods

This study was done on 40 consecutive patients, 28 males and 12 females, ranging in age from 10 to 76 years, median age = 44.9 years, while 70% more than 40 years, they were admitted to our institute with clinical and radiological signs of spontaneous (non-iatrogenic) spinal infection. Pre- and postoperative clinical data, medical records, a full neuroimaging workup (MR images, CT scans, conventional spine X-ray films), and laboratory data were analyzed for all patients. Neurological and neuroimaging outcome was assessed at routine intervals, with follow-up visits at 3, 6, 12, and 24 months.

Thus, individual follow-up duration ranged from 6 to 24 months. Additionally, all patients were required to answer a structured medical questionnaire (intensity of pain, social and economic situation, activities of daily living).

Patients with an intense or rapidly progressing neurological deficit underwent surgery. In patients with minor or no deficits or a stable (non-progressive) neurological condition were treated with immobilization and intravenous antibiotic drugs. Surgical procedures included ventral or dorsal approaches in one- or two-stage operations. Antibiotic treatment included the use of intravenous broad-spectrum drugs for at least 10 days, followed by oral antibiotics for 3 months (therapy was eventually continued if inflammation-specific laboratory values [CRP, serum leukocytes, ESR] were still not within the normal range). After hospital discharge, all patients were sent for rehabilitation.

Results

Spinal levels (Table 1):

Disease was distributed throughout the spine, from 40 patients, 70% were Lumbosacral (LS) lesions (N=28 Patients), 5 patients in dorsal spine, and 7 cervical affection.

Risk factors (In 40% of patients):

The main predisposing factor was diabetes (8 cases), other risk factors include; drug abuse (two cases), another two patients are heavy smokers, and one patient had chronic renal failure. Predisposing factors are lack in rest of patients.

Presumed source of infection: The source of the spinal infection could be presumed in only nine patients most of those from urinary tract infection (UTI) (three cases).

Clinical presentation (Table 2):

At least one episode of back or neck pain before admission was reported by all patients (40 patients), radicular pain was noted by nineteen of them, and eight patients presented with a transversal syndrome (myelopathy); five of myelopathic patients were presented with incomplete and progressing paraparesis and three presented with tetraparesis; and 13 were neurologically intact.

Systemic effects of the infection includes; history of increased temperature (<37°C) was observed in only sixteen patients; ten of whom had septicemic manifestations, associated with anaemia and weight loss.

Duration of Symptoms ranging from 2 months to 10 months (Mean = 6.3 mos).

Laboratory signs included elevation of ESR in all cases (20 patients above 60mm/h), half of patients had CRP values greater than 40mg/L, an increase of white blood cell count (WCC) in 20% of studied patients.

Type of infection (Table 3):

Cultures from intraoperative specimens (bone, disc, and abscess material) were obtained in all surgically treated cases (18 patients; 45%), and blood culture and/or computed tomography needle biopsy from non surgical patient. The causative organism in two-third of our patients was Mycobacterium tuberculosis, the other one third were Staphylococcus aureus, Staphylococcus epidermidis, and one patient with E. coli infection.

Types of managements (Table 4):

Non surgical group:

Twenty-two patients were treated medically. Indications for nonsurgical management included absence of neurological deficit or minimal and not-progressive neurological deficits, no associated epidural abscess, good pain control with analgesic medications, and no significant deformity. Treatment duration and type of antibiotic therapy was tailored by the blood culture for the infecting organism; with a predominance of Mycobacterium tuberculosis.
starting course by; Streptomycin, Refampecin, INH, and Ethambutol. If proven or suspected other pyogenic infection with S.aureus and other gram-positive organisms, Vancomycin, Quinolone, 3rd and 4th G. Cephalosporins was frequently administered for long-term intravenous therapy for at least 10 days, or if clinical and laboratory signs of improvement had been occurred. Oral antibiotics were continued for at least 3 months.

Surgical management (Table 5):

Surgical indications include symptomatic compression of neural structures, structural instability, spinal deformity, and medically intractable pain. The aims of this surgical treatment were as follows: Decompression of the spinal cord; debridement of the affected vertebral body with removal of all necrotic bone tissue, evacuation of abscess formation if present, and realignment of the deformed spine.

Eighteen patients (45%), were treated surgically. 6 cases (4, lumbar, 1 dorsal, and 1 cervical) with Epidural abscess (EDA), were managed via laminectomies and evacuation of the abscesses; other 6 cases of Spondylodiscitis (SD) with slip treated by posterior fixation and interbody fusion; disc curette and debridement via bilateral fenestration had been done for 4 patients with discitis. Two patients with SD and anterior neural compression (one cervical and one lumbar) treated via anterior corpectomy with anterior fixation and fusion.

Outcome (Table 6):

All surgical group (N=18), showed respond well to therapy in the form of hospital stay range from 10 to 35 days (mean of 22 days), early mobilization and improvement of clinical and laboratory status. Back pain, root pain, and cord deficits showed dramatic response postoperative in 80% of patients. Only 20% of root pain improved over 3-4 weeks postoperatively.

There were only minor complications that could be attributed to surgical therapy. Two patients of SD, and EDA had deep wound infections at the surgical site, (one of them had to undergo repeated operation for wound debridement) but did not required removal of the implanted material for spondylodesis. Another two cases (one of disc curette and other of laminectomy) showed slight increase of deformity.

Medical group (N=22) showed average hospital stay from 15 to 62 days (mean of 33 days) clinical improvement in the back pain and root pain in 14 cases in 2 weeks, while 8 cases lasting from >2 to 8 weeks for good response to therapy. Complications were only observed as side effects of long term antibiotic therapy, were colitis, elevated serum creatinine (acute renal failure), and allergic reactions in older patients. Further complications of the underlying disease included decubitus ulcers, pulmonary and urinary tract infections; these were only transient. One patient died of his underlying disease (that was severe septicemia resulted in multi organ failure). Increased kyphotic deformity was reported in 3 patients at strained areas of dorsal spine with bone destruction without significant neurological effect.

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<th>Table (1): Level of spine infection.</th>
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<tr>
<td>Lumbar (LS)</td>
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<td>Dorsal (DS)</td>
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<td>Cervical (CS)</td>
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<th>Table (2): Clinical distributions among patients.</th>
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<td>Symptoms</td>
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<td>Axial Pain</td>
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<td>Root Pain</td>
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<tr>
<td>Myelopathy:</td>
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<td>- Paraparesis</td>
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<td>- Tetraparesis</td>
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<th>Table (3): Type of infection.</th>
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<td>Type of infected organisms</td>
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</tr>
<tr>
<td>Mycobacterium Tuberculi</td>
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<tr>
<td>Staphylococcus auras</td>
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<td>Staphylococcus epidermis</td>
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<td>E-coli</td>
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<th>Table (4): Distribution of patients according to type of management.</th>
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<td>Type of management</td>
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<tr>
<td>Non Surgical</td>
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<td>Surgical</td>
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<th>Table (5): Types of surgical intervention.</th>
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<td>Type of surgery</td>
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<tr>
<td>Laminectomy</td>
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<td>Curette via bilateral fenestration</td>
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<td>Posterior Fixation</td>
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<td>Anterior corpectomy and fixation</td>
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Table (6): Comparison of results among two groups.

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<th>Outcome</th>
<th>Surgical group (N 18)</th>
<th>Non surgical group (N 22)</th>
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<tbody>
<tr>
<td>Mean hospital stay</td>
<td>22 days*</td>
<td>33 days*</td>
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<tr>
<td>Early neurological improvement</td>
<td>80%*</td>
<td>63.5%*</td>
</tr>
<tr>
<td>Late neurological improvement</td>
<td>20%</td>
<td>27.5%</td>
</tr>
<tr>
<td>Early return to work</td>
<td>90%*</td>
<td>70%*</td>
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* Shows statistically significant

Complications:
- Minor complications (including increase deformity) 22% 22%
- Major complications (including 1 death) 0% 9%

Fig. (1A,B): Pre-and Post operative T2 respectively Lumbar MRI show Spondylodiscitis LV5-SV1 and forward slip of LV5. Post fixation show curette of disc space and reduction of LV5 slip.

Fig. (1C): Shows Plain X-ray same patient with LV5-SV1 transpedicular fixation and PLIF.

Fig. (2A): Gadolinium enhanced cervical MRI shows spondylodiscitis and epidural abscess.

Fig. (2B): Post evacuation of epidural abscess and disc curette.

Fig. (3A): MRI shows LV-1 spondylitis with ant. cord compression.

Fig. (3B,C): Plain X-ray A-P & Lat. Respectively post corpectomy with ant fixation and reconstruction of ant. column.
Discussion

Spinal infections divided into two groups: pyogenic and nonpyogenic [4]. The culprit in pyogenic infections may be bacteria or mycobacteria, and in nonpyogenic infections it may be fungi, yeasts, or parasites. Spinal pyogenic osteomyelitis represents 2% of all cases of osteomyelitis and 7% of cases of this disease in adults. The spine is the most common site for hematogenously acquired osteomyelitis [5].

Acute pyogenic spondylodiscitis is a disease that mainly affects the older population [6,7] or patients with known risk factors [8,9]. In our study 70% of patients over 40 years, while other 40% had predisposing risk factors.

In patients with spinal osteomyelitis, 15% present with neurological deficits and of patients with tuberculous spondylitis, 50 to 75% present with deficits. The typical patient with acute spondylodiscitis presents with acute pain at the site of the infection, combined with fever [10,11]. History of recent febrile episodes and back or neck pain was present in all patients on admission to Suez Canal University hospital. Radicular pain (47.5%) was also common symptom in this study and also had been reported in the literature [12]. Laboratory examinations specific for infections showed abnormal values in all of our patients (ESR, CRP, white blood cell count) [13-15].

The major diagnostic tool in this study was MR imaging in all patients, and this modality had proven to be the diagnostic tool of choice [16,17]. In acute spondylodiscitis the classic findings on T1-weighted MR images are low-signal areas of the VB and destruction of the cortical margins of the VB. A high signal in affected areas of the VB and the adjacent discs is typical on T2-weighted MR images.

The least-invasive method available to obtain a bacteriological diagnosis is the blood culture. These, however, are positive in only 35% of cases [18-20]. Needle biopsy sampling followed by conservative treatment may be an option in early cases of spinal infection [21-23].

The main advantage of the surgical approach is that it addresses all aspects of the disease: Debridement of the infected tissue; neural decompression, identification of the causative organism, enabling specific antibiotic therapy; correction of the eventually deformed spine. Surgical treatment also allows immediate mobilization, thus avoiding the side effects of long-term bed rest, such as deep venous thrombosis [24].

In this study all patients improved significantly after surgery comparing to medically treated patients: In the form of bedside improvement of their general condition (fever, infection parameters, hospital stay, and long term usage of antibiotics). At their last follow-up visit, neurological recovery was observed in most surgically treated patients and restored their functional scores.

Patients with pyogenic spondylodiscitis who underwent surgical decompression generally had favorable outcomes, with improvement or return to normal neurological function occurring in 66 to 83% [25,26]. Przybylski and Sharan, also evaluated the efficacy of combining debridement, autograft, and instrumentation in the setting of failed medical management [27].

For patients treated nonsurgically, outcome depends on age, rate of decrease in ESR, immune state, and virulence of the infecting organism (S. aureus being particularly virulent) [28,29]. Neuroimaging evidence of successful treatment lags significantly behind clinical response and is not useful in determining response to treatment [30]. That was corresponding with the results of this study as surgically treated group shows 80% good improvement of neurological manifestation, while 64% of nonsurgical patients show good respond to conservative management.

Recurrence of infection in the presence of instrumentation is similar to that in its absence, but actually represent an incompletely treated primary infection, indicating that infection not be a contraindication for its use [5,14]. Shad, et al., recommend long-term oral antibiotic therapy after insertion of metallic instrumentation but side effects were mainly due to long-term antibiotic therapy and were sometimes severe [31].

In infected areas, titanium is superior to stainless steel based on their imaging characteristics (titanium alloy produce less artifact on MR imaging), and because the porous nature of titanium allow for delivery of adequate concentrations of antimicrobial drugs. With stainless steel implants, a pseudocapsule often forms that can harbor bacteria [22,32].

Conclusions:

Spontaneous spondylodiscitis is not an uncommon cause of low back pain in adults. It should be considered in any patient with acute or subacute
axial pain. Elevated acute-phase reactants with appropriate imaging modalities suggest the diagnosis. MRI is the radiological method of choice for the diagnosis of spontaneous spondylodiscitis especially in very early stages of the disorder. Increased alertness for spontaneous spondylodiscitis in the context of focal back pain with clinical or laboratory signs of inflammation are needed to speed up its detection. Patients with spontaneous spondylodiscitis can be successfully treated by combined debridement, spinal fixation, and autogenous interbody bone grafting can be simultaneously performed without increase incidence of complications. This allows early mobilization of the patient, decompress neural elements, regain good alignment, and improve stability of the spine. Non-surgical management considered in patients without significant neural compression, mild deformity, and non-progressive neurological deficits.

References


