Original Article

Surgical Management of Spontaneous Pyogenic Spondylodiscitis: Clinical and Radiological Outcome

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ABSTRACT

Background: Spontaneous Pyogenic Spondylodiscitis is a spectrum of diseases involving the bone, discs and or ligaments. It represents a challenge to spine surgeons due to the frequent serious sequelae resulting in acute neurological deterioration and require a combination of surgical and medical treatments. Objective: This is a prospective study analyzing the postoperative clinical and radiological outcome of nineteen patients with spontaneous pyogenic spondylodiscitis operated upon in the Neurosurgery Department, Cairo University Hospital. Patients and Methods: Patient selection: Nineteen patients with spontaneous pyogenic spondylodiscitis were operated upon and followed up clinically and radiologically for six months. Operation: surgical debridement in eight cases and debridement and stabilization with instrumentation in eleven patients. Results: Between Jan 2011 and December 2014, nineteen patients (mean age 43.8) with spontaneous pyogenic spondylodiscitis underwent surgical management. Back/neck pain (84.2% of patients), motor weakness (79% of patients) and fever (57.9%) were the most common symptoms on admission. Surgical debridement and instrumentation were performed in eleven patients (57.9%) while debridement was only done in eight patients 42.1%). Out of nineteen patients with spontaneous pyogenic spondylodiscitis, fifteen patients improved (79%), two patients (10.3%) remained stable, one patient (5.3%) worsened and one patient (5.3%) died. Outcomes were assessed as good outcome (Frankel D and E) in thirteen patients (68.4%) and poor outcome (Frankel A, B, C and dead patient) was encountered in six patients (31.6%). No recurrence or residual infection was encountered. Conclusion: Accurate diagnosis of spontaneous pyogenic spondylodiscitis patients and adequate surgical treatment with effective antibiotics in proper timing manner is critical for preventing severe neurological injury and decrease the rate of mortality.

INTRODUCTION

Spondylodiscitis is a spectrum of diseases involving the bone, discs, and or ligaments (1). It consists of a broad range of clinical entities, including discitis, osteomyelitis, and epidural abscess. Pyogenic spondylodiscitis represents approximately 2-7% of all cases of musculoskeletal infections.2,3,4

Approximately 95% of pyogenic spinal infections involve the vertebral body and or the intervertebral disc, with only 5% involving the posterior elements of the spine. The most common site of infection is the lumbar spine (45-50%), followed by the thoracic (35%), cervical (3-20%) and sacral regions.5

Pyogenic spondylodiscitis typically involves two adjacent vertebrae and the intervening disc because the segmental artery supplies the disc and lower portion of the upper vertebra and upper portion of the lower vertebra.6

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Haematogenous spread or involvements from adjacent tissue are the main contamination routes. Staphylococcus aureus and streptococcus are the predominant pathogens in spontaneous pyogenic spondylodiscitis.7

The onset of symptoms is usually insidious with back pain or neck pain (90% of cases), limb weakness, numbness and sphincteric dysfunction. Other symptoms include fever, nausea, vomiting, weight loss and confusion.8

Laboratory studies, radiological evaluation, including magnetic resonance imaging (MRI), computed tomography (CT) scans and adequate tissue sampling of the lesion for microbiological studies are important diagnostic measures.9,10

Non operative treatment including intravenous antibiotic therapy and external immobilization for spontaneous pyogenic discitis can be used alone in the early stage if neurological signs or symptoms, instability, deformity or spinal cord compression are absent or in combination with surgical management. Surgical management including debridement and/or stabilization using instrumentation is usually used in
symptomatic cases with neural compression, instability, failure of medical treatment, or uncertain diagnosis.11,12.

PATIENTS AND METHODS

This study was approved by the ethical committee of the Neurosurgery Department, Faculty of Medicine, Cairo University and performed in accordance with institutional ethics committee guidelines. Between January 2011 and December 2014, nineteen patients with spontaneous pyogenic spondylodiscitis were admitted and managed in the Neurosurgery Department, Cairo University Hospitals. The diagnosis was established on basis of clinical presentation as well as laboratory and radiological investigations.

Inclusion criteria: (a) Spontaneous (non iatrogenic) infection, (b) evidence of spinal column involvement in radiological investigation associated with neural compression, instability and/or epidural abscess, (c) Pyogenic infection (non granulomatous, not fungal or parasitic) proved by bacterial identification in samples obtained from affected tissue and microscopic diagnosis of non specific osteomyelitis (no granulomatous reaction).

Exclusion criteria (a) post surgical infection, (b) patients with granulomatous, fungal infections or parasitic infestation, (c) patients candidates for medical treatment only (without neural compression, instability or epidural abscess).

All patients underwent proper history taking including age, sex, time of presentation, coexisting medical condition e.g. diabetes mellitus, chronic immune suppression and complete neurological assessment (motor assessment, sensory examination, reflexes evaluation and autonomic dysfunction examination). Laboratory investigations such as complete blood picture (CBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), blood culture and urine analysis were done at the time of presentation, recorded and followed up.

Proper radiological assessment was done for all patients including x-ray spine, C.T. spine (thin cuts) with 3D and sagittal views to evaluate the integrity of bone and M.R.I. of the spine with and without gadolinium to evaluate the condition of the spinal cord, and degree of spinal cord compression.

Surgical management:

Surgical treatment performed in patients with spontaneous pyogenic spondylodiscitis suffering from neural compression, instability or failed medical treatment or in unproven diagnosis.

The surgical approach was posterior in the lumbar spine, postrolateral in the dorsal spine and anterior in the cervical spine.

Pathogen identification was performed in all patients by different methods including blood culture and culture of pus or tissue obtained during the surgical debridement.

Once the surgical debridement was done and tissue sample obtained, an empirical intravenous antibiotics was initiated by broad spectrum antibiotics e.g. third generation cephalosporin with vancomycin to cover the two most common pathogen staphylococcus aureus and streptococcus. The choice of antibiotics is adjusted according to the subsequent bacterial culture results.

The intravenous antibiotics should be continued until CRP became normal which usually took about two weeks and then changed to oral antibiotics for two months. Postoperatively, the patient uses neck collar or brace to minimize back or neck pain for 6 weeks.

Clinical outcome was evaluated in day 1 after surgery, at the time of discharge and at 3,6 months intervals. Postoperative flexion and extension X-ray and CT scan of spine were done in 2nd day after surgery to ensure proper placement of the screws in patients underwent stabilization, and to detect any instability in patients who underwent surgical debridement only and after 3 and 6 months intervals to document bony fusion or deformity.

The clinical pre and postoperative data included age, sex, duration of symptoms, diagnosis, comorbidites, degree of neurological impairment at presentation, site of infection operative details, duration of surgery, complications, blood loss, hospital stay and mortality.

Assessment of the severity of neurological impairment and the functional status of the patients was done using Frankel scale (Table 1).13

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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<tbody>
<tr>
<td>Grade A</td>
<td>Absent motor and sensory function.</td>
</tr>
<tr>
<td>Grade B</td>
<td>Sensation present, absent motor function.</td>
</tr>
<tr>
<td>Grade C</td>
<td>Sensation present, motor function present but not useful (Grade 2-3/5)</td>
</tr>
<tr>
<td>Grade D</td>
<td>Sensation present, motor function present and useful (Grade 4/5)</td>
</tr>
<tr>
<td>Grade E</td>
<td>Normal motor and sensory function.</td>
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All data are collected, analyzed and reviewed with the other published series in the literature.

RESULTS

From January 2011 to December 2014, twelve male patients (63.2%) and seven female patients (36.8%) with a mean age 43.8 years (range, from 25-60 years)
were admitted to Cairo University Hospitals with spontaneous pyogenic spondylodiscitis.

On admission, patients experienced symptoms for a period ranging from 3-22 days (mean 11.7 days). Pain was the most frequent symptom in sixteen patients (84.2%) and usually the first symptom followed by fever in eleven patients (57.9%) and weakness in fifteen patients (79%). One patient (5.3%) exhibited signs of meningeal involvement in the form of nuchal rigidity and headache. At least one co-morbidity was present in eleven patients (57.9%), the most common was diabetes mellitus in nine patients (47.4%), followed by heart disease in three patients (15.8%), chronic renal failure in one patient (5.3%) and one patient was a chronic steroid user (5.3%). (Table 2)

Table 2: Clinical data

<table>
<thead>
<tr>
<th>Complaint</th>
<th>NO (%)</th>
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<tbody>
<tr>
<td>Pain</td>
<td>16(84.2%)</td>
</tr>
<tr>
<td>weakness</td>
<td>15(79%)</td>
</tr>
<tr>
<td>Fever</td>
<td>11(57.9%)</td>
</tr>
<tr>
<td>Meningeal involvement</td>
<td>1(5.3%)</td>
</tr>
<tr>
<td>Co-morbidity</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>9(47.4%)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>3(15.8%)</td>
</tr>
<tr>
<td>Chronic renal failure</td>
<td>1(5.3%)</td>
</tr>
<tr>
<td>Chronic steroid user</td>
<td>1(5.3%)</td>
</tr>
</tbody>
</table>

Diagnosis was confirmed with enhanced MRI, CT and plain X-ray for nineteen patients (100%). Osteomyelitis, discitis and epidural abscess were observed in fifteen patients (79%), and osteomyelitis and discitis only in four patients (21%). Spondylodiscitis were located in dorsal spine in nine patients (47.4%), lumbar spine in seven patients (36.8%) and cervical spine in three patients (15.8%). There was a concomitant cervical and lumbar spine infection in one patient (5.3%).

Surgical indications were neurological deficit in fifteen patients (79%), epidural abscess in fifteen patients (79%) and spine instability and deformity in eleven patients (57.9%).

Posterior approach (laminectomy and debridement) was performed in seven patients (36.8%) with lumbar spondylodiscitis, postrolateral approach (transpedicular decompression) in nine patients (47.4%) with dorsal spine involvement and anterior approach in three patients (15.8%) with cervical spondylodiscitis in whom corpectomy was done. Stabilization with instrumentations was performed in eleven patients (57.9%), three patients with cervical anterior plate and screws and eight patients with transpedicular screws. Surgical debridement without instrumentation was done in eight patients (42.1%). (Fig. 1&2)

Fig.1a-e: Patient with cervical Spondylodiscitis. a &b: Preoperative MRI, c: Intraoperative X-ray, d&e: Postoperative MRI
Microbiological culture was performed in all patients using pus and tissues obtained during surgery. The causative organism was identified in fourteen patients (73.7%). In ten patients (52.6%) Staphylococcal aureus was identified, while streptococcus was identified in three patients (15.8%) and klebsiella was the causative organism in one patient (5.3%). (Fig. 3)

Pathological examination of the specimen obtained during surgery was performed in all patients and revealed non granulomatous infection in all patients (100%).

Hospital stay ranged from 14-20 days (mean 15.6 days).

At six months postoperative follow up interval, eleven out of fifteen patients having weakness improved ( five patients from Frankel score D to E, four patients from score C to D, two patients from score B to C), two patients with Frankel score A remained stationary, one patient with score B worsened to score A and one patient died. (Table 3)

Good outcome (Frankel D and E) was present in thirteen patients (68.4%) and poor outcome (Frankel A,B,C and dead patient) was encountered in six patients (31.6%).

Table 3: clinical outcome

<table>
<thead>
<tr>
<th>Clinical outcome</th>
<th>No (%)</th>
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<tbody>
<tr>
<td>Improved</td>
<td>15(79%)</td>
</tr>
<tr>
<td>Stable</td>
<td>2(10.3%)</td>
</tr>
<tr>
<td>Worsened</td>
<td>1(5.3%)</td>
</tr>
<tr>
<td>Died</td>
<td>1(5.3%)</td>
</tr>
</tbody>
</table>

Bony fusion was achieved in fourteen patients (73.7%) at 3 months follow up interval and in eighteen patients (94.7%) at 6 months postoperatively .One patient (5.3%) with progressive kyphosis was detected on radiological follow up due to inadequate fusion and was managed by stabilization via transpedicular screws fixation.

A single mortality case was encountered in patient who suffered concomitant severe pneumonia and empyema.

DISCUSSION

Spontaneous pyogenic spinal infection is an uncommon disease, consists of a broad spectrum of disorders including discitis, osteomyelitis, epidural abscess and paravertebral abscess formation. Spontaneous pyogenic spondylodiscitis should be suspected in patients having pain and local tenderness in the spinal region with a rise in inflammatory parameters in the blood. The treatments of this condition represent one of the greatest challenges to the spine surgeon. These diseases are complex and difficult to manage and often result in acute neurological deterioration and require a combination of adequate surgical and medical treatments.5,9

The aim of management was to initiate the appropriate therapy at the earliest opportunity and the
strategy must provide neural decompression, spinal stabilization and clearance of infection.

In this study we surgically treated nineteen patients (mean age 43.8) with spontaneous pyogenic spondylodiscitis. Back/neck pain (84.2% of patients), motor weakness (79% of patients) and fever (57.9%) were the most common symptoms on admission. Surgical debridement and instrumentation were performed in eleven patients (57.9%) while debridement was only done in eight patients (42.1%) and followed up clinically and radiologically for six months. Out of nineteen patients with spontaneous pyogenic spondylodiscitis, fifteen patients improved (79%), two patients (10.3%) remained stable, one patient (5.3%) worsened and one patient (5.3%) died. Outcomes were assessed as good outcome (Frankel D and E) in thirteen patients (68.4%) and poor outcome (Frankel A,B,C and mortality) was encountered in six patients (31.6%).

Pramod et al reported 42 patients (33 male and 9 females) with pyogenic lumbar spondilodiscitis with mean age 51.61 years. Debridement and posterior lumbar interbody fusion was done in all cases. The mean follow up period was 41.9months (24-63 months). Thirteen patients (30.95%) had other co morbidities. Improvement was achieved in 31 patients (73.8%), no improvement was noted in four patients (9.52%), four patients (9.5%) succumbed after operation due to their coexisting diseases. Pramod et al. had near similar results to the current study.

Julio et al. studied sixteen patients with cervical pyogenic spondylodiscitis, surgical treatment consisted of anterior corpectomy and ventral instrumentation was done in thirteen patients. Posterior decompression with fusion was performed in one case in which a multilevel vertebral osteomyelitis and epidural abscess involving multiple spinal segments. Posterior decompression alone was performed in two patients with posterior epidural abscess. More than 40% of patients had improved neurological status after surgery, 50% remained unchanged and only one patient deteriorated (7%). Four patients died during treatment. The results obtained by Julio et al. slightly differs from the current study mainly in the less rate of improvement and three more cases of mortality. This attributed to more patients presenting with cervical spondylodiscitis (16 patients) in their study. Patients with cervical involvement presented significantly with more neurological impairment and have more morbidity and mortality than other spinal segments involvement.

There are some controversies about the use of instrumentation in patients with pyogenic spondylodiscitis. Several authors concluded that the use of metallic implants after drainage of the pus and radical debridement of the infected granulation tissue, infected disc material and bone does not lead to persistence or recurrence of infection. Instrumentation after debridement has gained wide acceptance in patients with pyogenic spondylodiscitis. Several retrospective studies revealed greater improvement in patients with instrumentation than those without instrumentation. Liljenvqvist et al. studied 20 patients with thoracic and lumbar destructive osteomyelitis (17 patients with pyogenic infection and three patients with mycobacterium TB) who were surgically treated with anterior column reconstruction using an expandable titanium cage. All cages fused and infections were eradicated with no evidence of cage dislocation, migration or subsidence. Hee et al reported fifteen patients with pyogenic vertebral osteomyelitis who had spinal reconstruction with posterior instrumentation and titanium cages. All infections were successfully treated with adequate correction of sagittal and coronal alignment.

Fayazi et al. reported a series of 11 patients with pyogenic osteomyelitis of the thoracolumbar spine who underwent spinal reconstruction using titanium mesh cage. There was no evidence of recurrence or residual infection in their series. In this study, stabilization with instrumentations was performed in eleven patients (57.9%) and no recurrence or residual infection was encountered.

**CONCLUSION**

Accurate diagnosis of spontaneous pyogenic spondylodiscitis patients and adequate surgical treatment with effective antibiotics in proper timing manner is critical for preventing severe neurological injury, improving the outcome and decreasing the rate of mortality.

**Disclosure:**

The authors have no personal, financial or institutional interest in any of the drugs, materials, or devices described in this article.

**REFERENCES**