Factor Influencing Outcome of Pyogenic Spondylodiscitis

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บทคัดย่อ Abstract

Background: Pyogenic spondylodicitis is a rare condition but might be devastating and fatal. Traditional treatment is surgical debridement follow by antibiotics. A retrospective study was designed to assess the effect of clinical findings and treatment methods on the outcome.

Material and Metods: 21 patients were reviewed. There were 13 men and 8 women, with age ranging from 24 to 85 years, mean age 61.9 years. 5 patients with complete cord. Pyogenic spondylodicitis found in cervical [12] thoracic [2], lumbar [4] and mutiple [3] regions. The diagnosis was defined by clinical findings, culture, histopathology, and radiological methods such as magnetic resonance imaging [MRI] and computed tomography [CT] scans. All patients received surgical debridement and follow with medication.

Results: A total of 21 patients,operative treatment was performed. Surgical debridement with or without instrumentation was done in all cases. After surgical debridement, clinical was improved. The most presenting symptom is spinal pain. All of patients have elevated ESR and CRP. The most common bacterium isolated was Staphylococcus spp. Two motality case was observed.

Conclusion: Pyogenic spondylodiscitis should be suspected in people having pain and local tenderness in the spinal region with rise in infalammatory parameters in blood. The most common bacterium was Staphylococcus species, but there were not still a greater number of patients in this study. Therefore, In case with severe neurological deficit, surgical debridement follow by antibiotic therapy is the most effective treatment. Limitation of data is lack of uncontrolled study group.

Keywords: factor influencing, pyogenic spondylodiscitis

Introduction and Epidemiology

Infection of the intervertebral disc and the adjacent vertebrae, variably referred to as pyogenic spondylodiscitis (PS), disc space infection, and vertebral osteomyelitis, all with or without associated epidural or paravertebral abscesses. PS is an infection that involves one or more of the extradural components of the spine. Its complications include epidural, paravertebral, and psoas abscess formation.[1] The incidence has been reported to be between 0.2 and 2 cases per 100,000 per annum and there is evidence suggesting that the incidence is rising, possibly re-

lated to the improved life expectancy of patients with chronic debilitating diseases.[2-4] Diagnosis, which can be difficult, is based on clinical, laboratory, and radiological features. It is often delayed or missed due to the rarity of the disease, the insidious onset of symptoms, and the high frequency of spinal pain in the general population.[5] It is important because of its potential morbidity and mortality; therefore, early diagnosis and effective antibiotherapy and surgical decompression with debridement are required.[6] The aim of this study was to evaluate the risk factors, bacteriological features, clinical, laboratory and radiological findings of PS, and treatment outcome.

Materials and Methods

This study was performed in the Neurosurgery division, department of surgery at Faculty of Medicine Siriraj Hospital. Patient who underwent treatment for pyogenic spondylodiscitis between January 2012 and October 2015. We were retrospectively evaluated. Medical records, radiological imaging, bacteriologic results, antimicrobial and surgical therapies were reviewed.

The diagnosis of PS was defined by clinical findings, blood count, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), culture, histopathology, and radiological methods such as magnetic resonance imaging (MRI) and computed tomography (CT) scans.

The diagnosis of PS was established when 1. clinical symptoms of spinal pain with inflammatory characteristic features [unrelieved by rest] or fever [temperature of 38°C],as well as neurological deficit on physical examination; 2. Imaging finding compatible with vertebral osteomyelitis[7] 3. microbiological evidence such as isolation of a microorganism from open bone biopsy specimens, cultured blood, and/or specimens from another adjacent infectious foci. Adjacent infectious foci included epidural abscesses or masses, abscesses in paravertebral or psoas or iliopsoas muscles.

We analyzed the following data: age; sex; duration of symptoms before surgical treatment; patient-related risk factors or chronic underlying diseases (e.g., diabetes mellitus, previous bacteremia or focal infections, intravenous drug used and immunodeficiency); clinical features; hematologic and biochemical features (blood count, erythrocyte sedimentation rate [ESR], and C-reactive protein[CRP] value); radiological features (from CT, and/or MRI); microbiological features; therapeutic records.

Therapeutic failure was defined as worsening symptoms after a month of specific treatment. Functional sequelae were considered to be stratifying the level of functional restriction in mobility from myelopathy, by Nurick functional scale[8] and ASIA Classification. Outcome was defined as poor if the patient had therapeutic failure.

For the statistical analysis of data we used the IBM SPSS Statistics Data Editor (version 22). Descriptive statistics was analyzed by SPSS.

The Mann-Whitney U nonparametric test or Student's t test was used for comparison of means. Fisher's exact test or Pearson's x2 test, and Wilcoxon Signed Ranks test for comparison of proportions. Differences were considered significant at a P value of <.05.

Result

Based on the established diagnosis, 21 patients were finally hospitalized in the department of neuro-

surgery. The demographic data of the patients is shown on Table I. There were 13 men and 8 women, with age ranging from 24 to 85 years, mean age 61.9 years. Of 21 patients, 7 [33%] had diabetic mellitus, 11 [52%] had hypertension, 2 [9.5%] had dyslipidemia,2 [9.5%] had cirrhosis, 1 [4.8%] had nasopharyngeal cancer, 1 [4.8%] had chronic renal failure. Six [28.6%] patients had no comorbidity.

In 7 [37.3%] patients presented cause of source of infection, most common cause was urinary tract infection [4 patients; 19%], 2 [9.5%]patients had sepsis from MSSA and Streptococcus spp.[Table I]

Among various primary symptoms distinctly observed in these patients, an episode of pain was the most frequently encountered symptom in 18[85.7%] patients, followed by fever in 10[47.6%] patients. The duration from onset of disease to first examination ranged from 4 days to 8 months. A total of 20 patients [95.2%] showed myelopathy and motor weakness. Only one patient NO: 14 showed without clinical myelopathy. Among the 21 patients in our study, there were ASIA and Nuricks Classification [Table 2]

Laboratory investigations revealed elevated CRP [>5mg/L] in 15 [71.4%] patients, elevated ESR [>15 mm/h] in 16 [76.2%] patients, and leukocytosis [leukocyte count of >10.5 x 109/L] in 11 [52.4%] pa-

Table I Demographic and clinical data

Patient No	Age	Sex	Medical history	Smoking	Alcohol Drinking	Time to diagnosis (Day)	Predisposting factor
1	64	F	HT	N	N	30	NO
2	57	M	DM,HT,CA nasopharynx	Y	Y	30	UTI
3	40	M	DM,HT	Y	Y	4	NO
4	55	F	–	N	N	60	NO
5	59	M	CA nasophaynx	Y	Y	90	NO
6	63	F	DM,HT,cirrhosis	N	N	21	Pasaspinal abscess
7	69	M	DM,GT,DLP,gout	N	N	240	UTI
8	73	M	–	N	N	14	NO
9	76	M	–	N	N	14	Sepsis
10	77	F	HT	N	N	90	NO
11	40	M	DM, cirrhosis	N	Y	14	NO
12	53	M	–	N	N	14	NO
13	47	M	–	N	N	14	NO
14	24	M	–	N	N	60	NO
15	69	F	DM, HT, CRF	N	N	14	Sepsis
16	49	M	Old CVA	N	N	60	NO
17	73	F	HT	N	N	45	NO
18	74	M	HT	N	N	14	UTI
19	75	F	HT	N	N	30	NO
20	78	M	DM, HT	N	N	10	NO
21	85	F	HT, DLP	N	N	14	UTI

Table 2 Clinical finding in case of preoperative pyogenic spondylodiscitis

Clinical finding	NO. of cases(%)
Neck pain	13 (61.9)
Back pain	8 (38.1%)
Fever	10(47.6%)
Tenderness	13 (61.9%)
Limit ROM	17 (81%)
Radiculopathy	0 (0%)
Myelopathy	20 (95.2%)
Weakness	20 (95.2%)
Bowel–bladder involvement	13 (61.9%)
ASIA Score	A: 5(23.8%) B: 4(19%) C: 9(42.9%) D: 2(9.5%) E: 1(4.8%)
Nurick's Classification	0: 1(4.8%) 2: 4(14.3%) 3: 1(4.8%) 4: 6(28.6%) 5: 10(47.6%)

Table 3 Laboratory finding in case of preoperative pyogenic spondylodiscitis

Patient No	Leukocytosis (> 10,500)	ESR (mm/hr)	CRP (mg/dl)	Hemoculture	Tissue culture
1	No	–	–	no	Strept_spp
2	Yes	98	76	no	Pseudomonas_spp
3	Yes	58	9	no	No
4	Yes	110	406	no	MSSA
5	No	–	–	no	No
6	No	92	71	Stap_spp	MSSA
7	Yes	–	–	no	E.coli
8	No	–	–	no	MSSA
9	No	94	17	Strept_spp	Strept_spp
10	No	86	148	Bacillus spp	Stap_spp
11	Yes	87	74	MSSA	MSSA
12	Yes	86	129	No	No
13	Yes	46	241	No	Strept_spp
14	No	–	–	No	No
15	Yes	117	137	MSSA	MSSA
16	No	94	57	No	Stap_spp
17	No	103	104	No	Strept_spp
18	Yes	53	17	Stap_spp	E.coli
19	No	86	148	No	Stap_spp
20	Yes	105	132	No	No
21	Yes	53	3	No	No

tients. Blood and tissue cultures were taken all of case; 6/21 [28.6%] of the blood cultures were positive; Tissue samples cultures were positive in 15 [71.4%] [Table 3].

Five microorganisms were isolated in 15 [71.4%] cases of pyogenic spondylodiscitis. The most frequent etiologic agent was Staphylococcus species[53.3%], 5 [55.5%] of 8 staphylococcus species were methicillin-sensitive-Staphylococcus aureus. Four [26.6%] patients were diagnosed as having Streptococcus species. 1 patient was infection by Psuedomonas species and 2 patients were infection by Escherichia coli. All cases of gram negative infection were related to UTI. Table 3 shows the distribution of microbiological finding isolated from operative samples.

There were no differences in leukocyte counts dependent on the presence or absence of positive blood cultures[P = 0.63], abscesses, or epidural masses [P=0.47][Table 4.1,4.2]. At diagnostic time, raised ESR (>15 mm/h) found in 100% of the 16 patients for whom it was evaluated, and 15 of 16 [95.2%] patients have raised CRP level (>5 mg/L) for whom it was evaluated. Improvement of Nurick or ASIA score showed significant decrease ESR after surgical de-

Table 4.1 Comparison of Leukocytosis condition with hemoculture report.

			Positive hemoculture		Total
			No	Yes	
leukocytosis	no	Count	7	3	10
		% within leukocytosis	70.0%	30.0%	100.0%
	yes	Count	8	3	11
		% within leukocytosis	72.7%	27.3%	100.0%
Total		Count	15	6	21
		% within leukocytosis	71.4%	28.6%	100.0%

P value 0.63

Table 4.2 Comparison of Leukocytosis condition with epidural abscess

			epidural_abscess		Total
			no	yes	
leukocytosis	no	Count	1	9	10
		%within leukocytosis	10.0%	90.0%	100.0%
	yes	Count			
		% within leukocytosis	0	11	11
			0.0%	100.0%	100.0%
	Total	Count	1	20	21
		% within leukocytosis	4.8%	95.2%	100.0%

P value 0.47

compression [P<0.05][Table 5.1] and all of patients in this study have decresed of the CRP after surgical dempression in significantly [P<0.05] [Table 5.2]

Among the 21 patients in our study, there were 11 cervical lesions, 2 thoracic lesions, 4 lumbar lesions, and 3 multiple combined lesion. Associate finding were evaluated, the 14 patients had epidural abscess, 6 had epidural and paraspinal abscess and 1 had burst fracture.

In 21 patients the initial treatment method was surgical decompression and debridement under general anesthesia. The most frequent indication were drainage of abscess, relief of compression of spinal cord and spinal stabilization. In 3 patients [patient No: 4,10,19] the percutaneous drainage of paraspinal abscess were performed under intervention. The application of metallic instrumentation to the spine [totally 16 patients. 2 patients [No:7,12] underwent to reoperation. In No:2 patient have occipital screw pull out and revised occipital screw with wiring fixation were done and No:12 patient underwent to reexplore remove screws of right L5 and laminectomy S1 with revision of L5-S1 rods. Antibiotic therapy was apply as an initial treatment medthod after surgical decompression. Antibiotic therapy was applied according to microbiology culture. All patients received minimum 2 weeks of I.V. antibiotics. [Table 6]

Follow up was completed for all patients, except 2 patient had died from cardiovascular event and upper airway obstruction. After the therapy, patient outcome was evaluated by improvement of Nurick functional scale or ASIA Classification.[8] [38.1%] patients had recovered, therapeutic failure was defined in 6 [28.6%] patients, persistent was 7 patients and 8 patients better symptoms after a month of specific treatment.

Discussion

Pyogenic spondylodiscitis is an uncommon disease. The annual incidence of disease ranges from 0.2 to 2.0 cased per 100,000 inhabitants. Although rare, pyogenic spondylodiscitis is the main manifesta-

Table 5.1 Comparative data between outcome and different value of ESR & CRP

Clinical	Different value of Mean ESR (mm/hr)	Different value of Mean CRP (mg/L)
Improvement	8.9	6.8
Not improvement	4.79	6.29
P value	.048	.876

Table 5.2 Laboratory data : Mean of ESR,CRP

	Preoperative: Mean	Postoperative :Mean	*P* value
ESR (mm/hr)	85.5	78.6	.449
CRP (mg/L)	110	52	.041

Table 6 Treatment data and level of involvement

Patient No	Location	Operative treatment	Medical treatment
1	C	corpectomy C3-4 with drainage and fixation	Ceftriaxone
2	C	ACCF C3-6 with occiput to T1 posterior fixation	Tazocin
3	C	ACCF C6-7	Cefazolin
4	T	T7-10 laminectomy and corpectomy T8-9 with posterior fixation with PCD	Cefazolin
5	C	ACCF C6	ceftazidime+vancomycin
6	C	ACCF C3-4	Cloxacillin
7	C	Transoral odentoidectomy with laminectomy C2-4 and C0-5 fixation	Cloxacillin
8	C	ACCF C3-5 with C2-6 posterior fixation	Cefotaxine
9	C	ACDF C3-7 with corpectomy C4	Ceftriaxone
10	multiple	ACCF C5 and laminectomy T6-7 T9-12 L2-5 with PCD	Ceftriaxone
11	L	Partial laminectomy L2,L5 with debridement	Ceftazidime
12	T	Laminectomy T7-9 with ACCF C5-6	Levofloxacin
13	C	Laminectomy C3,5,7	Ceftriaxone
14	L	Laminectomy L4-5	Cefazolin
15	multiple	Laminectomy C7,T3,T8-9	Cefazolin
16	L	corpectomy L4-5 with posterior fixation	Fosfomycin
17	L	Laminectomy L2-3	Cefazolin
18	C	ACCF C3-4 with ACDF C5-6	Ceftriaxone
19	multiple	ACCF C2-5 with laminectomy T6-7,9-12 L2-5 with PCD	Levofloxacin
20	C	ACCF C3-4	Cefazolin
21	C	ACCF C4-5	Meropenem

tion of hematogenous osteomyelitis in patients age over 50 years[9,10] in our series 76% of our patients were older than 50 years, mean age of nearly 62 years and represents 37.5% of patients whom older than 50 years have hematogenous source.

Most of the patients with pyogenic spondylodiscitis is associated with an disease [such as Diabetis Mellitus, Chronic renal failure,cancer, cirrhosis] or condition that suppress the immune system (e.g. alcoholism, I.V. drug abuse, trauma). DM is the most common disease as a factor in 33.3% of cases.[11] Only 28.6% of patients have no predisposing factor. We observe similar finding; 7 patients [33.3%] had DM, one patient had chronic renal failure and two patients had cirrhosis. The symptom of spondylodiscitis are non-specitic. Back or neck pain is very common, but up to 19% of patients may be pain-free. Fever is less commonly presented and occurs in only about half of patients.[12,13]

In Safak et al.'s study[14], back pain was the most common symptom, with 90.7% of patients reporting back pain. In the same study, fever was present in 28.9% of patients, and in 12.1% of patients, varying degrees of neurological deficits (weakness or mild dys-

esthesia) were seen. In our study, back pain, neck pain, fever, and neurologic abnormalities were found in 8 (38.1%), 13 (61.9%), 10 (47.6%), and 20 (95.2%) patients [Table 2], respectively. In patients whom have not clinical neck pain related with improvement outcome in significantly.[P value.046] [Table 7]

Pyogenic spondylodiscitis was more evenly distributed among lumbar, thoracic, and cervical disc spaces, although the lumbar disc spaces were still the most frequently involved.[15] The foci in the vertebral column were located in the cervical area in 22% of the patients, the thoracic area in 23%, and the lumbosacral area in 55%.16 In our study, 4 (19%) patients had pyogenic spondylodiscitis in the lumbar region, 2 [9.5%] is thoracic, 12 [57.1%] is cervical. All of cases, 25% are associated with epidural abscesses.[17] In this review, 20 [95%] patients had epidural abscesses.

A rise in ESR and CRP is seen over 90% of patients.[18-20] ESR is a sensitivity marker for infection but lacks specificity. In our study found in 100% was evaluated ESR, 95.2% patients have raised CRP level. Decrease of postoperative ESR was related with clinical improvement [P value.048]. In postoperative condition, CRP was differed from preoperative condition in significantly [P value.041].

Concerning the therapeutic strategy for spondylodiscitis, there is no clear consensus.[21,22] Antibiotics without surgery seem to be the best treatment for spondylodiscitis.[23] Surgery is reserved for decompression of neural structure, especially with associated spinal epidural abscess or compression by reactive granulation tissue. Although an emergency operation is of course necessary when the symptoms are progressing rapidly, it is desirable to evaluate the nature, that pyogenic or tuberculosis, as accurately as possible.[22,24] In our study, all of case, operative treatment is performed to eradicate the infection, definite tissue culture, restore and preserve the structure and function of the spine, and to alleviate pain.[5,14]

A detailed review of surgical management in this study. Surgery can improve clinical outcome, all of complete cord patients had improvement after surgical decompression. Although incomplete cord patient, 10[62.5%] of 16 patients were improved but were not significantly [Table 8]. All of patients in this study revealed greater improvement in with surgical decompression that showed better or persistent ASIA score after surgical decompression [Table 9]. Better ASIA

Table 7 Relation between clinical neck pain and improvement outcome.

			Improvement		Total
			no	Yes	
neck_pain	no	Count	0	8	8
		% within neck_pain	0.0%	100.0%	100.0%
	yes	Count	6	7	13
		% within neck_pain	46.2%	53.8%	100.0%
Total	Count	6	15	21	
		% within neck_pain	28.6%	71.4%	100.0%

P value.046

Table 8 Result of treatment between complete cord and incomplete cord patients.

complete_cord * improvement Crosstabulation

			improvement		Total
			no	yes	
complete_cord	incomplete	Count	6	10	16
		% within complete_cord	37.5%	62.5%	100.0%
		% within improvement	100.0%	66.7%	76.2%
		% of Total	28.6%	47.6%	76.2%
	complete	Count	0	5	5
		% within complete_cord	0.0%	100.0%	100.0%
		% within improvement	0.0%	33.3%	23.8%
		% of Total	0.0%	23.8%	23.8%
Total		Count	6	15	21
		% within complete_cord	28.6%	71.4%	100.0%
		% within improvement	100.0%	100.0%	100.0%
		% of Total	28.6%	71.4%	100.0%

P value.262

Table 9 ASIA score condition at before and after operative treatment.

		ASIA_post					Total
		A	B	C	D	E	
ASIA_pre	A	3	2	0	0	0	5
	B	0	0	3	1	0	4
	C	0	0	7	0	2	9
	D	0	0	0	1	1	2
	E	0	0	0	0	1	1
Total		3	2	10	2	4	21

Table 10 Result of treatment between complete cord and incomplete cord patients.

			Improvement		
			Total	no	Yes
instrument	No	Count	0	5	5
		% within improvement	0.0%	33.3%	23.8%
	Yes	Count	6	10	16
		% within improvement	100.0%	66.7%	76.2%
Total		Count	6	15	21
		% within improvement	100.0%	100.0%	100.0%

P value.262

score in 9 patients and persistent ASIA in 12 patients.

Debridement and instrumentations were performed in 16 cases of this study for instability due to disc and bone destruction and erosion. Instrumentation after debridement has gained wide acceptance in the setting of concomitant infection. Several retrospective studies revealed greater improvement in patients with posterior instrumentation than in those without instrumentation.[25,26] In this study patients with instrumentation was improvement better than without instrumentation for 2 times [Table 10]. In this study, however, the instrumentation did need to revised for 1 patients [No: 7]. In no:7 had occipital screw pullout and revised occipital screws wiring was performed, Fortunately the instrumentation did not contained local infection.

The overall attributable mortality varies across reports but probably stands between 2 and 11%.[19,27] Between 0 and 16% of patients experience recurrence of infection, particularly those who are immunosuppressed.[27,28]

In all cases of this series, appropriate antibiotics in reference to sensitivity were administrated, and improvement was noted. However, the death of 2 patients was due to the other severe systemic illnesses and upper airway obstruction.

Limitation of this study is less sample size and have not comparable with nonoperative treatment or conservative group

Conclusion

Pyogenic spondylodisitis remains an uncommon diagnosis. Pyogenic spondylodiscitis should be suspected in people having pain and local tenderness in the spinal region with rise in infalammatory parameters in blood. Early diagnosis is a major challenge.The most common bacterium was Staphylococcus species, but there were not still a greater number of patients in this study. Operative treatment can improve outcome and improve or persist motor function in moderate to severely neurological deficit patient. Therefore, antibiotics therapy should be start after diagnosis with surgical decompression that effective treatment, it is important to determine improvement of outcome. Limitation of data is lack of uncontrolled study.

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