Misdiagnosis in Vertebral Osteomyelitis : Problems and Factors

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Abstract

One hundred and one cases diagnosed with vertebral osteomyelitis were evaluated for misdiagnosis and both factors and outcomes of misdiagnosis were assessed. There were 67 patients with tuberculous spondylitis and 34 patients with pyogenic vertebral osteomyelitis. Misdiagnosis occurred in 33.7 per cent of the cases. The average delayed diagnosis time was 2.6 months (range, 0.2 to 12). Age between 60 to 70 years was the most frequent group for misdiagnosis, while the most frequent area of misdiagnosis was the lumbar spine. Metastatic carcinoma, spinal stenosis, herniated nucleus palposus and back strain were common initial misdiagnoses. The factors, age group, absence of fever and positive straight leg raising test (SLRT) were associated with misdiagnosis in univariate analysis and multivariate analysis (odds ratio 3.40 (95%CI:1.07-11.94), 3.47 (95%CI:1.20-10.05), and 24.47 (95%CI:2.18-274.28), respectively) Misdiagnosis was statistically significantly associated with the result of treatment. This paper emphasizes that the elderly age group, absence of fever and positive SLRT are the independent factors which increase the risk of misdiagnosis of vertebral osteomyelitis.

Key word : Misdiagnosis, Vertebral Osteomyelitis

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Vertebral osteomyelitis is a debilitating disease[1,2], which can be pyogenic, granulomatous or parasitic[3,4]. The presentation and clinical course are characterized by acute, subacute or chronic syndrome[5]. Despite an uncommon incidence compared to other causes of back pain, spinal infection can cause significant morbidity and mortality[3-6]. Neurological compromise is a serious complication of this infection, which has been reported to vary from 20 to 81.8 per cent depending on site, type, causative organism and diagnosis time[1,5-10]. Due to the nonspecific clinical presentation, misdiagnosis frequently occurs at initial visit[4,5,8,11,12]. Misdiagnosis may result in delayed treatment, increased risk of disease progression or being sued. Misdiagnosis can be caused by factors such as the doctor, disease or clinical presentation of the patients. There are no previous reports showing the problems or factors of misdiagnosis in vertebral osteomyelitis. The aims of the study were to identify the problems and factors affecting misdiagnosis of spinal osteomyelitis and determine the result of misdiagnosis.

MATERIAL AND METHOD

The records of 101 patients diagnosed as either tuberculous spondylitis or pyogenic osteomyelitis of the spine at the authors' institution during the study period (1989-1999) were included for analyses. All patients had been followed for at least 1 year. The diagnoses were based on a combination of factors including clinical, laboratory, culture and response to treatment. Demographic data such as age, sex, underlying disease, associated infections, location, amount of spinal involvement and misdiagnosis were collected. Clinical data including duration of symptoms, fever, associated symptoms such as nausea, vomiting, and weight loss, neurological deficit, range of motion of the spine, tenderness of the spine, kyphotic deformity of the spine, sinus tract formation, subcutaneous abscess formation and straight leg raising test (SLRT) were determined. Laboratory investigation included complete blood count, erythrocyte sedimentation rate (ESR), and pathologic examination. Radiographic data were also examined. Misdiagnosis was analyzed with respect to the variables, frequency, doctor who misdiagnosed, the delayed diagnosis time and clinical and laboratory variables. The effect of misdiagnosis such as neurological deficit, kyphotic deformity of the spine, surgical need and result of treatment were also evaluated. Result of treatment was classified as good, fair, or poor at the last visit. Good result was determined by full recovery of neurological deficit, no pain or limitation of daily activity and no kyphotic deformity. Fair result meant partial recovery of neurological deficit, mild pain or minimal limitation of daily activity and some kyphotic deformity. Poor result described no neurological recovery, moderate to severe pain with marked limitation of activity and severe kyphotic change of the spine.

Statistical Analysis

All descriptive demographic and clinical variables were summarized. Univariate analysis using either Chi-square or Fisher's exact test was used to determine the association of demographic and clinical variables with misdiagnosis. Misdiagnosis was also tested for association with severity of disease and result of treatment. Multivariate analysis using logistic regression was used to identify factors independently associated with misdiagnosis.

RESULTS

There were 67 cases of tuberculous spondylitis and 34 cases of pyogenic vertebral osteomyelitis. There were more males (58%). The average age was 50.8 years (range 1-81). The most common location of involvement was the lumbar area (62.7%). Underlying disease predisposing to infection was found in 21 patients (21.2%). Urinary tract infection was the most common infection associated with pyogenic infection, while accompanying pulmonary tuberculosis occurred in 23 (35.4%) tuberculous spondylitic patients. The average duration of symptoms was 5.6 months. Fever was determined in only one-fourth of the patients. Neurological deficit was revealed in 65 per cent of cases at the initial visit with 23 per cent of the patients having bowel-bladder dysfunction. Most cases had limited back motion and back tenderness on physical examination. A small number of the patients revealed subcutaneous abscess formation, sinus tract formation and positive root tension sign. Laboratory Investigations showed leucocytosis in only 24.2 per cent, while elevated ESR was found in 73.3 per cent of the patients. Thirty-three patients (33.7%) were misdiagnosed at the initial visit. The average delayed diagnosis time was 2.6 months (range, 0.2-12) (Table 1).

The most common causative organisms in pyogenic vertebral osteomyelitis was gram-positive bacteria (35%), especially *S. aureus* (23.5%). Gram-

Table 1. Clinical and laboratory baseline data.

Characteristic	
Tuberculous spondylitis	66.3%
Pyogenic vertebral osteomyelitis	34.7%
Age (mean, SD)	50.8 (17.1) yrs
Sex (Male %)	58%
Location	
Lumbar	62.7%
Thoracic	29.4%
Other	7.8%
Number of involved spinal-motion segment	1 (range, 1-5)
Underlying disease	21.2%
Associated infections	26.3%
Misdiagnosis	33.7%
Delayed diagnosis time	2.6 mos (range, 0.2-12)
Duration (mean, SD)	5.6 (7.2) mos
Fever	27%
Associated symptoms	21.8%
Neurological deficit	65.3%
Bowel-bladder involvement	22.7%
Back tenderness	76.2%
Kyphotic deformity	41.6%
Subcutaneous abscess- formation	5.9%
Sinus tract formation	2.0%
SLRT positive	8.9%
Leucocytosis	24.2%
ESR (mean, SD)	78.3 (33.1) mm/h

SLRT = Straight Leg Raising Test, ESR = Erythrocyte Sedimentation Rate

Table 2. Distribution of misdiagnoses at initial visit.

Misdiagnosis	Number of patients	%
Metastatic carcinoma	9	26.4
Spinal stenosis	7	20.6
Herniated nucleus palposus	7	20.6
Back strain	7	20.6
Spondylolisthesis	2	5.9
Osteoporosis	2	5.9
Others	5	16.7

negative bacteria accounted for 30.3 per cent of the cases, while 34.7 per cent of the patients had negative tissue culture.

Most patients who were misdiagnosed were elderly. The age group between 60 to 70 years was the most frequent age of involvement. Lumbar spine was the most frequent location for misdiagnosis (55.4%), followed by the thoracic region (38.6%). Metastatic carcinoma, spinal stenosis, herniated nucleus palposus and back strain were the common diagnoses at the initial visit (Table 2). Five patients (14.3%) were misdiagnosed more than one time. Among the doctors who initially misdiagnosed spinal infections as other conditions, orthopaedists were responsible for 58.8 per cent, neurosurgeons 11 per cent, internists 18.2 per cent and general practitioners 11 per cent.

In the univariate analysis, the factors, age group, absence of fever and positive SLRT were significantly associated with misdiagnosis of spinal infections (Tables 3, 4.).All three factors were shown to be independent factors affecting misdiagnosis (Table 5). Poor and fair results of treatment were significantly more common in patients who were misdiagnosed (Table 6).

DISCUSSION

We found that 34 patients (33.7%) diagnosed as vertebral osteomyelitis were initially misdiagnosed. Most patients were aged between 60 to 70 years. The lumbar spinal region was the most frequent area of misdiagnosis. The factors, age group, positive SLRT (straight leg raising test) and

Table 3. Relationship between demographic variables and misdiagnosis of vertebral osteomyelitis. Univariate analysis.

Variable	Number of patients	Percentage of patients with misdiagnosis	P-value+
Age			0.048*,0
≤ 40 yrs	30	22.2	
41-60 yrs	36	30.6	
> 60 yrs	35	48.6	
Sex			0.2070
Male	59	39.0	
Female	42	26.8	
Associated infections			0.779
Yes	26	30.8	
No	74	33.8	
Underlying disease			0.627
Yes	22	28.6	
No	79	34.2	
Involved area			0.882
Lumbar	64	35.9	
Thoracic	30	33.3	
Other	7	33.3	
Number of involved spinal-motion segment			0.274
≤ 1	81	38.2	
> 1	20	25.0	
Disease			0.1250
Tuberculous spondylitis	67	28.8	
Pyogenic vertebral osteomyelitis	34	44.1	

+ From Chi-Square analysis, 0 = Included for multivariate analysis, * = Statistically significant

absence of fever were independently associated with misdiagnosis. Result of treatment was also associated with misdiagnosis.

The proportion of patients misdiagnosed as other conditions (one-third) was relatively high. However, the average delayed diagnosis time in the present study was shorter than that reported in the study by Kemp et al[13]. The cause of misdiagnosis can involve several factors, such as doctor, disease or clinical manifestations. Doctor factors such as unawareness, inexperience, inadequate history taking and physical examination and inappropriate investigation can be implicated. In the present study, doctors who most frequently made misdiagnosis were orthopaedists. This might be because patients with back pain usually visit an orthopaedic doctor more often than other physicians in our country. However, the orthopaedist should pay more attention, especially in elderly patients with chronic back pain having no fever. Elderly patients (age > 60 years) have an increased risk for misdiagnosis compared to the younger age group. The explanation could be the insidious onset and unobvious clinical presentation of the patients. Absence of fever is another independent factor associated with misdiagnosis. Patients with spinal infection having no fever had 3.4 times the odds of misdiagnosis compared to those with fever.

The frequency of causative organisms of spinal infection differed among misdiagnosed and correctly diagnosed patients. Patients with pyogenic vertebral osteomyelitis were misdiagnosed more commonly than those with tuberculous spondylitis. The reason could be associated with the relatively infrequent incidence and more lumbar involvement compared to tuberculous spondylitis, however, the difference was not statistically significant. Lumbar spine being the most common area of misdiagnosis might be due to the clinical manifestation of spinal infection being difficult to differentiate from other more common causes of low back pain such as spinal stenosis and herniated nucleus palposus. Most cases misdiagnosed as spinal metastasis had multiple levels of involvement or resulted from multiple bony uptake from bone scan, which is frequently due to degenerative change in elderly patients.

Table 4. Relationship between clinical and laboratory variables affecting misdiagnosis of vertebral osteomyelitis. Univariate analysis.

Variable	Number of patients	Percentage of patients with misdiagnosis	P-value $_1$	P-value $_2$
Duration of symptoms			0.183^0	
≤ 3 mos	53	39.6		
> 3 mos	48	27.1		
Absence of fever			0.001*,^{0}	
Yes	74	59.3		
No	27	24.3		
Associated symptoms			0.807	
Yes	22	31.8		
No	79	34.6		
Back tenderness			0.969	
Yes	77	33.8		
No	24	33.3		
Kyphotic deformity			0.584	
Yes	42	31.0		
No	59	36.2		
Sinus tract formation#				0.547
Yes	2	0.0		
No	98	34.5		
Subcutaneous abscess formation				0.402
Yes	6	50.0		
No	95	32.6		
SLRT positive				0.001*,^{0}
Yes	9	88.9		
No	92	28.3		
Neurological deficit			0.288	
Yes	66	32.4		
No	35	37.6		
Bowel-bladder involvement			0.709	
Yes	23	30.4		
No	78	34.6		
Leucocytosis#			0.619	
Yes	24	29.1		
No	76	34.7		
Elevated ESR (mm/h)#				0.089^0
≤ 30	27	85.7		
> 30	72	63.9		

* = Statistically significant, ^{0} = Included for multivariate analysis, # = Data partially missing.
P-value $_1$ from Chi-Square test, P-value $_2$ from Fisher's-exact test

Clinical manifestations of spinal infection depend on the location of spine, type of causative organisms and host response(2,3,14). Back pain is the most frequent symptom of the patients. Fever and associated symptoms such as nausea, vomiting and weight loss occurred in only a small proportion of the patients(5,7,10,11,15). Neurological compromise of the patients in the study was high compared to other studies(5,10,16-18). This might be associated with the severity of the disease and the duration before treatment. Tenderness along the involved area and limited back motion were the consistent physical findings found in most cases; however, It is necessary to differentiate infection from other causes of back pain. Kyphotic change of the spine was found in about 42 per cent of the patients, which showed the severity of involvement. Positive straight leg raising test (SLRT) can also be found in spinal infection, especially in lumbar involvement, which was frequently misdiagnosed as herniated nucleus palposus. The age of the patients in this study was comparable to that in other studies (1,12,17,19-21). Lumbar spine involvement being the most frequent area was the same as most other

Table 5. Multivariate model of patients with misdiagnosis.

Factor	Odds ratio of patients with misdiagnosis	95%CI	P-value[0]
Age			0.050*
≤ 40 yrs	1	-	
41-60 yrs	1.44	0.39-5.22	
> 60 yrs	3.44	1.07-11.94	
Sex			0.124
Male	1	-	
Female	0.45	0.16-1.24	
Duration of symptoms			0.618
≤ 3 mos	1	-	
> 3 mos	0.77	0.28-2.12	
Disease			0.156
Tuberculous spondylitis	1	-	
Pyogenic vertebral osteomyelitis	2.16	0.74-6.27	
Absence of fever			0.022*
No	1	-	
Yes	3.47	1.20-10.05	
SLRT positive			0.009*
No	1	-	
Yes	24.47	2.18-274.28	
Elevated ESR (>30 mm/h)			0.074
No	1	-	
Yes	0.06	0.00-1.30	

* = Statistically significant, [0] = From likelihood ratio test

Table 6. Relationship between misdiagnosis and result of diseases.

Variable	Number of patients	%	P-value [1]	P-value [2]
Neurological deficit			0.805	
Misdiagnosis	12	35.3		
Corrected diagnosis	22	34.4		
Bowel-bladder involvement			0.709	
Misdiagnosis	7	20.6		
Corrected diagnosis	16	25.0		
Kyphotic deformity			0.584	
Misdiagnosis	13	38.2		
Corrected diagnosis	29	45.3		
Surgical need			0.490	
Misdiagnosis	27	79.4		
Corrected diagnosis	49	76.6		
Fair and poor result				0.040*
Misdiagnosis	16	44.1		
Corrected diagnosis	14	21.9		

* = Statistically significant
P value [1] from Chi-square analysis, P value [2] from Fisher's-exact test analysis

studies[5,10,15,18]. Accompanying infection such as pulmonary tuberculosis as well as the underlying compromised host in the present study was lower than previously reported[2,10,20].

Prevention of misdiagnosis in vertebral osteomyelitis is necessary. Complete history taking and thorough physical examination are mandatory. Patients with chronic back pain who have risks for

infection such as the elderly, immunocompromised host, those having associated infection with or without fever should be ruled out for vertebral osteomyelitis, especially those who have tenderness along the involved area and limited back motion. There are no consensus guidelines for the management of patients who are suspected of having vertebral osteomyelitis. Screening test using ESR is usually useful because most cases of this infection show elevation, however, it can not differentiate from other causes of back pain eg, metastatic spine. Bone scan is also helpful for localization of the lesion, but can be misleading owing to the degenerative change in elderly patients. Plain radiograph should be used in patients suspected with vertebral osteomyelitis. Bony destruction, disc space narrowing, and end plate irregularity are the radiographic findings in late detected cases. Magnetic resonance imaging (MRI) is the most accurate modality in detecting vertebral osteomyelitis(22-25). MRI can detect location and severity of involvement including abscess formation, especially epidural involvement, which is usually associated with neurological deficit. However, it cannot differentiate the causative organisms of spinal infection and involves a relatively high cost compared to other investigations.

In conclusion, we have shown that one-third of the patients with vertebral osteomyelitis were initially misdiagnosed. We emphasize that orthopaedic doctors should be aware of this condition, especially in elderly patients who have back pain with an absence of fever or have a positive root tension sign.

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ปัญหาและปัจจัยการวินิจฉัยผิดพลาดในโรคกระดูกสันหลังติดเชื้อ

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แฟ้มประวัติผู้ป่วยโรคกระดูกสันหลังติดเชื้อจำนวน 101 คน ได้รับการประเมินเรื่องการวินิจฉัยผิดพลาด ทั้งปัญหาและปัจจัยรวมถึงผลกระทบ โดยมีผู้ป่วย 67 ราย เกิดจากเชื้อวัณโรค และ 34 รายเกิดจากเชื้อหนอง ผู้ป่วยร้อยละ 33.7 ได้รับการวินิจฉัยผิดพลาดในการตรวจครั้งแรก ระยะเวลาเฉลี่ยก่อนได้รับการวินิจฉัยที่ถูกต้อง 2.6 เดือน (0.2 ถึง 12) ผู้ป่วยอายุระหว่าง 60 ถึง 70 ปี เป็นกลุ่มอายุที่ได้รับการวินิจฉัยผิดพลาดบ่อยที่สุด โดยเฉพาะตำแหน่งกระดูกสันหลังส่วนเอว โรคที่ได้รับการวินิจฉัยผิดพลาดช่วงแรก (initially misdiagnosis) ได้แก่ metastatic carcinoma, spinal stenosis, herniated nucleus palposus และ back strain ปัจจัยที่มีความสัมพันธ์อย่างมีนัยสำคัญกับการวินิจฉัยผิดพลาด คือ กลุ่มผู้ป่วยสูงอายุ ภาวะไม่มีไข้ (absence of fever) และผลบวกการตรวจ straight leg raising test (SLRT) (odds ratio 3.4 (95%CI : 1.07–11.94), 3.47 (95%CI: 1.20–10.05) และ 24.47 (95%CI : 2.18–274.28) ตามลำดับ การวินิจฉัยผิดพลาดมีความสัมพันธ์อย่างมีนัยสำคัญกับผลการรักษาโรค งานวิจัยนี้บ่งชี้ว่าแพทย์ควรคิดถึง และวินิจฉัยแยกโรคกระดูกสันหลังติดเชื้อโดยเฉพาะในผู้ป่วยอาการปวดหลังที่สูงอายุ ไม่มีไข้ หรือให้ผลบวกจากการตรวจ SLRT

คำสำคัญ : การวินิจฉัยผิดพลาด, โรคกระดูกสันหลังติดเชื้อ, ปัจจัยและปัญหา

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