Clinical features of spinal infection in individuals older than eighty years

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Abstract

Purpose Japan has one of the most rapidly increasing numbers of elderly individuals; therefore, future trends in spinal infections in the elderly in other countries may be predicted by studying such characteristics in Japan. The purposes of this study were to identify whether the incidence of spinal infection in individuals more than 80 years old is increasing and to define its clinical characteristics.

Methods We retrospectively reviewed the medical records of 98 patients treated in our hospital for spinal infection between 1999 and 2008. Patients were divided into two groups: those admitted to our hospital during the initial five year period, and those admitted during the latter five year period. We evaluated changes in the percentage of individuals over the age of 80 years. To define the clinical characteristics of spinal infection, patients were also divided into another set of two groups: those over 80 years and those around the age of 80 years.

Results The percentage of patients over 80 years with spinal infection was significantly increasing. There was no significant difference in the gender distribution, prevalence of immunocompromised hosts, common involved levels, or mortality rate between the two age groups. The pathogenic organism was isolated in 78.6%, and of these, the rate of methicillin-resistant *Staphylococcus aureus* or *epidermidis* was 2.46 times higher in the elderly group than in the younger group.

Conclusions The number of patients over 80 years with spinal infection is expected to rapidly increase in aging societies. This advanced age group is more susceptible to infection with drug-resistant organisms, which makes infection management more difficult.

Introduction

Spinal infection is a relatively rare condition and accounts for 2–16.7% of all cases of osteomyelitis [7, 10, 14, 26]. In developed countries, improved public hygiene has facilitated control of spinal infections since the 1970s; however, several papers [1, 4, 8, 22, 26] warn that spinal infections have been rising recently with the increase of immunocompromised hosts, human immunodeficiency virus (HIV) infection and immigrants from developing countries. Moreover, spinal infections are being reported in aging patients in developed countries [22]. There are few case reports regarding spinal infections in the elderly [30, 16–18], and to our knowledge, there are no reports focusing on or describing the clinical features of spinal infection in individuals over 80 years. Japan has one of the most rapidly increasing aging populations; life expectancy in 2009 was 79.59 and 86.44 years for men and women, respectively [28], and the longevity of Japanese women is ranked number one in the world. Therefore, future trends in spinal infections in the elderly in other countries may be predicted by studying the characteristics of spinal infections in Japanese elderly. In this study, we investigated the incidence of spinal infections in individuals over 80 years and attempted to determine whether factors such as gender, immunocompromised hosts, involved levels, mortality and infecting pathogens differed from patients aged about 80 years in our population.

Materials & methods

This study assessed patients from Tottori University Hospital, a 697-bed hospital providing primary, secondary and tertiary medical care, which covers an area with a population of approximately 300,000. The ethics committee of our

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institution approved this study. After searching the inpatient database, we retrospectively reviewed the medical charts of 98 consecutive patients with spinal infection between 1999 and 2008. Patients with surgical-site infection or iatrogenic infection, such as that associated with epidural block, were excluded.

Study 1

Changes in the proportion of patients older than 80 years to the overall patient population with spinal infection

Patients were divided into two groups: those admitted during the initial five year period (group 1), and those admitted during the latter five year period (group 2). We evaluated changes in the prevalence of patients aged over 80 years.

Study 2

Characteristics of spinal infection in patients older than 80 years

Patients were divided into another set of two groups: those over 80 years (group A) and those around 80 years (group B). We evaluated differences in gender distribution, prevalence of immunocompromised hosts, involved levels, mortality rates and infecting pathogens between groups.

Diagnosis

Patients with severe neck, back or lumbar back pain were suspected of having spinal infection if their erythrocyte sedimentation rate (ESR), leucocyte count, and/or C-reactive protein (CRP) were increased. Magnetic resonance images (MRI) were immediately obtained to determine the involved level, and specimens were then collected using computed tomography (CT)-guided needle biopsy or needle biopsy under fluoroscopy in addition to blood collection for culture. If an organism was detected from the specimen, it was easy to diagnose a patient as having spinal infection. However, some patients had received antibiotics from their local doctor before organisms could be determined. Therefore, there were no detectable organisms from most specimens obtained five to seven days after antibiotic cessation just after referred to our hospital. Patients without detectable organisms were diagnosed as having spinal infection based on clinical findings, laboratory data and imaging studies. When end-plate erosion, destructive change or sclerotic reactive bone formation was observed on plain films, the patient was diagnosed as having pyogenic spondylitis [27]. CT or MRI frequently showed widening of the retropharyngeal space, enlargement of the paravertebral shadow or changes in the psoas shadow in patients with

spinal infection [6]. In patients with tuberculosis (TB), sclerotic reactive bone formation on plain films is seen much later in the course and is less marked than in those with pyogenic spondylitis [11]. On MRI, the intervertebral disc often shows normal height and signal in patients with TB spondylitis [6].

Statistical analysis

The difference in involved levels between two groups was statistically analysed using one-way analysis of variance. The remaining differences were tested using Student's *t* test. A probability value <0.05 was considered significant. All statistical analysis was performed on SPSS.

Results

Study 1

There were 37 patients in group 1 and 61 in group 2. There were no patients over 80 years in group 1, but there were 16 (26.2%) in group 2, showing a significant difference ($p<0.001$, Fig. 1). Excluding patients infected with *Mycobacterium* spp., there were 27 patients in group 1 and 50 in group 2. In group 2, there were 13 patients (26%) over 80 years, showing a significant difference ($p=0.002$).

Study 2

There were 16 patients in group A and 82 in group B. Average ages were 85.4 (range 81–90) and 64.6 (range 22–79) years in groups A and B, respectively. There was no significant difference in gender distribution ($p=0.306$), prevalence of immunocompromised hosts ($p=0.851$) or

Fig. 1 Changes in total patients and those >80 years with spinal infection. The incidence of spinal infection in those >80 years significantly increased ($p<0.001$). y.o. years old

commonly involved levels ($p=0.533$) between groups (Tables 1 and 2, Fig. 2). The pathogenic organism was isolated in 78.6% of all patients, and of these, methicillin-resistant *S. aureus* or *epidermidis* was detected in 69.2% and 28.1% in groups A and B, respectively, with a significant difference ($p=0.004$, Table 3). There was no significant difference in mortality rates between groups ($p=0.494$, Table 1). All of those who died were immunocompromised hosts who died of multiple organ failure or underlying diseases, such as cancer.

Excluding the patients infected with *Mycobacterium* spp., there were 13 patients in group A and 64 in group B. There was no significant difference in gender distribution ($p=0.613$), prevalence of immunocompromised hosts ($p=0.725$), commonly involved levels ($p=0.633$), or mortality rate ($p=0.517$) between groups A and B (Table 4). The pathogenic organism was isolated in 72.7%, and, of these, methicillin-resistant *S. aureus* or *epidermidis* was detected in 90.0% and 39.1% in groups A and B, respectively, with a significant difference ($p=0.006$). There were three patients (23.1%) with previous infection in group A and eight (12.5%) in group B ($p=0.304$). Previous infections included pyelonephritis, cholecystitis and cholangitis in one patient each in group A, and pyelonephritis in two, endocarditis in two and pneumonia, hepatic abscess and diverticulitis in one each in group B.

There were no HIV-positive patients or intravenous drug abusers in this series, and all patients were Japanese.

Discussion

Several authors have reported that the number of spinal infections is rising [1, 4, 8, 22, 26] and that in developed countries, spinal infections are increasing among the elderly [22]. There have been some reports on the characteristics of spinal infection in the elderly [2, 12, 29]; however, there have been no reports on spinal infection in people over 80 years. Japan has one of the most rapidly increasing elderly populations, and the longevity of Japanese women is ranked number one in the world. Therefore, future trends in spinal infections among the elderly worldwide may be

Table 2 Immunocompromised hosts

	Group A	Group B
DM	4	19
Cancer	0	11
Steroid use	2	6
Hepatic dysfunction	1	6
DIC	1	4
Malignant lymphoma	0	4
Renal dysfunction	0	3
Immediate postoperative ^a	1	1

Numbers indicate the number of the patients. Some patients had two conditions

DM diabetes mellitus, DIC disseminated intravascular coagulation

^a Within 1 month after the date of surgery

predicted by studying the characteristics of spinal infections in Japan.

Our study has two limitations. Firstly, we retrospectively reviewed only patients admitted to our hospital. Our data reflected the incidence in only a small area in Japan. In this area, almost all patients with spinal infection are referred to our hospital; however, there is a possibility that some patients consulted or were referred to another hospital. Secondly, there is a possibility that some patients were diagnosed incorrectly. The organism detection rate was 78.6% in this series. When organisms could not be detected, patients were diagnosed as having spinal infection based on clinical findings, laboratory test and imaging studies only; therefore, there is a possibility that some of these patients did not actually have spinal infection.

Despite improved public hygiene, the incidence of patients with spinal infection has increased [1, 4, 8]. This is probably the result of an increasing aging population, easy access to better diagnostic methods such as MRI and an increase in the prevalence of immunocompromised hosts [1, 17]. In our previous study [22] conducted in the same area as the study reported here, spinal infection had been decreasing until 1995; however, it has subsequently been increasing. Furthermore, the ages of patients with spinal infection gradually advanced, and the percentage of immunocompromised hosts dramatically increased to >50% between 1996 and 2005.

There have been some reports on the characteristics of spinal infection in the elderly; however, the definitions of the term varied in patients over 60 years [2] and those over 65 years [12, 29]. To our knowledge, this is the first report focusing on spinal infection in an advanced age group: >80 years. Moreover, there is no report even on osteomyelitis at other sites in this advanced age group. However, several papers describe the characteristics of pneumonia in the advanced age group. A large Finnish study of 46,979 patients with community-acquired

Table 1 Demographic Patient Data

Category	Group A (N=16)	Group B (N=82)	P value
Male:female	9:7	57:25	0.306
Immunocompromised hosts	9 (56.3%)	44 (53.7%)	0.851
Mortality	2 (12.5%)	6 (7.3%)	0.494

Fig. 2 Involved levels in patients >80 years (group A) and ≤80 years (group B). The most common site of spinal infection was the lumbar spine in group A and between the thoracolumbar and lumbosacral spine in group B; however, there was no significant difference ($p=0.533$). Multiple levels were involved in some patients

pneumonia found differences between age groups concerning the incidence of pneumonia per 1,000 person per year: 6.0 in people 15–59 years of age and 34.2 in the elderly ≥75 years of age [15]. Furthermore, Jackson et al. demonstrated that one of 20 individuals around 85 years age developed pneumonia each year in the United States [13]. As a result of the increasing number in the aging population and especially the increase in

people over 80 years, there is a possibility that the incidence of spinal infection in the advanced age group will increase, which our findings have confirmed meaning that physicians will more frequently encounter spinal infection in patients aged over 80 years.

To our knowledge, this is the first report demonstrating that the elderly are highly susceptible to spinal infection with drug-resistant pathogens. In our series, methicillin-resistant *S. aureus* or *epidermidis* was detected approximately 2.5 times more frequently in patients over 80 years than in the group aged 80 years or less. Initially, we were concerned that this result might be affected by the difference of periods, because patients over 80 years were completely concentrated in the latter five year period of the study. We further investigated whether there was a difference in the incidence of drug-resistant pathogens in the age group 80 or less between the initial and latter five year periods. However, there was no significant difference (29.6% vs. 27.8%; $p=0.875$). Another concern was that this result might be affected by a difference in detection rate between the two groups; however, the difference was not significant (81.3% vs. 78.0%; $p=0.778$). Regarding pneumonia, patient age around 65 years was reported as one risk factor for drug-resistant *Streptococcus pneumonia* [3, 9, 23]. From our results and the reports on

Table 3 Causative Organisms

Causative organism	Group A	Group B
<i>Staphylococcus aureus</i> (methicillin resistant)	6 (6)	27 (18)
<i>Staphylococcus epidermidis</i> (methicillin resistant)	3 (3)	2 (0)
<i>Staphylococcus schleiferi</i>	1	0
<i>Escherichia coli</i>	0	3
<i>Pseudomonas aeruginosa</i>	0	2
<i>Klebsiella pneumoniae</i>	0	2
<i>Enterococcus faecalis</i>	0	1
<i>Enterococcus species</i>	0	1
<i>Enterobacter cloacae</i>	0	1
<i>Streptococcus pneumoniae</i>	0	1
<i>Streptococcus agalactiae</i>	0	1
<i>Streptococcus species</i>	0	1
<i>Streptococcus milleri</i> group	0	1
<i>Citobacter amalonaticus</i>	0	1
<i>Viridans streptococcus</i>	0	1
<i>Bacteroides species</i>	0	1
<i>Mycobacterium tuberculosis</i>	2	11
<i>Mycobacterium intercellulare</i>	1	13
<i>Mycobacterium avium</i>	0	1
Unknown	3	18

Two organisms were detected in some patients

Table 4 Demographic Patient Data (Excluding *Mycobacterium* spp.)

Category	Group A (N=13)	Group B (N=64)	P value
Male:female	8:5	44:20	0.613
Immunocompromised hosts	8 (61.5%)	36 (56.5%)	0.725
Mortality	2 (15.4%)	6 (9.3%)	0.517

pneumonia cited above, the advanced age group was more susceptible to infection with drug-resistant pathogens, even in the spine.

Mortality rates in patients with pneumonia are reported to be significantly higher in the elderly [21, 24, 25], and Mirzanejad et al reported that in individuals over 80 years, the rate was 43% compared with approximately 24% for patients aged between 70 and 79 years [21]. Conte et al [5] demonstrated that risk factors for mortality in 2,356 patients over 65 years with pneumonia were age 85 years or more, presence of comorbidity, impaired motor response, vital sign abnormality and creatinine levels 1.5 mg/dl or more. Conversely, our study showed no difference in mortality rates. This discrepancy could be attributed to the focus of infection. Some patients with pneumonia died of respiratory failure, as age-associated decline in lung function could contribute to this increased risk in the elderly [19, 20]. In our series, however, multiple organ failure or underlying diseases such as cancer were the main causes of death in patients with spinal infection. As there was no age-related difference in the percentage of immunocompromised hosts in this series, this could have contributed to the lack of a difference in the mortality rate between the group over 80 years and that 80 years or less with spinal infection.

In conclusion, the number of patients over 80 years will increase rapidly in societies with a rapidly increasing number of elderly. Drug-resistant strains of bacteria were detected approximately 2.5 times more frequently in patients over 80 years, which makes infection management more difficult in this age group.

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