Epidemiology of acute vertebral osteomyelitis in Denmark

137 cases in Denmark 1978–1982, compared to cases reported to the National Patient Register 1991–1993

Michael R Krogsgaard[1], Peter Wagn[2] and Jørgen Bengtsson[3]

We studied the epidemiology of acute, non-tuberculous, hematogenous vertebral osteomyelitis in Denmark during 1978–1982. 137 patients fulfilled the criteria for acute vertebral osteomyelitis. The incidence was 5/mill/year. There were no cases in the age group 20–29 years. The highest incidence was between 60–69 years (18/mill/year). The prevalence was 15 cases. The mean duration of the disease was 7 months. The lumbar spine was affected in 59%, the thoracic spine in 33% and the cervical spine in 8% of the cases. Insulin-dependent diabetes and treatment with systemic corticosteroids seemed to be significant risk factors, but not rheumatoid arthritis and abuse of alcohol or intravenous drugs. We found no demographic variables of importance for the incidence. In 46%, a primary focus was identified, urinary tract infection being the commonest. According to the National Patient Register 1991–1993, the relative number of reported patients with vertebral osteomyelitis had increased in the age group 20–49 years, compared to 1978–1982, but the incidence was highest in the group aged 60–79 years.

Departments of [1]Orthopaedic Surgery M, Bispebjerg Hospital, Bispebjerg Bakke 23, DK-2400 Copenhagen NV, Denmark. Tel +45 35 31-2440. Fax -39 56; [2]Orthopaedic Surgery, Copenhagen University Hvidovre Hospital, Copenhagen, Denmark, [3]Internal Medicine, The Deaconess House Saint Luke's Foundation's Hospital, Hellerup, Denmark
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There are several reported series of patients with non-tuberculous, hematogenic vertebral osteomyelitis (Stone and Bonfiglio 1963, Bonfiglio et al. 1973, Sneppen et al. 1976, Wedge et al. 1977, Digby and Kersley 1979, Osenbach et al. 1990, Liebergall et al. 1991, Malawski and Lukawski 1991), but the epidemiology of acute vertebral osteomyelitis has been described only once. In a series of 30 cases from England, the incidence was calculated at 4 cases/mill/year (Digby and Kersley 1979).

We investigated the epidemiology of acute vertebral osteomyelitis, diagnosed in Denmark (not including the Faeroe Islands and Greenland) and factors which might predispose to the disease.

Patients and methods

The National Patient Register in the Danish Board of Health was established in 1977. By 1978, all hospitals reported routinely to the register the diagnosis of patients who had been discharged. All those discharged during the 5-year period 1978–82 with the diagnosis of osteomyelitis of the vertebral column (WHO's classification codes 720.01 and 720.11, 8th revision) were identified from the National Patient Register. The hospital records of every patient were studied. Postoperative discitis and tuberculous vertebral osteomyelitis, coded separately, according to WHO's classification, were not included.

The diagnosis of vertebral osteomyelitis was based on the finding of destruction of the vertebral bodies (Digby and Kersley 1979), when malignancy could be excluded, either by biopsy or from the clinical course, with arrest of destruction and gibbus formation.

183 patients were discharged with the diagnosis. In 2 patients we could not obtain access to the hospital files, and one patient was not living in Denmark. Of the remaining 180 cases, 43 did not fulfil the criteria for the diagnosis of acute vertebral osteomyelitis. 10 had postoperative discitis, 9 had chronic vertebral osteomyelitis, and 7 had osteomyelitis in other bones. 17 were miscoded or excluded for other reasons. 137 patients were left for the epidemiologic study.

Information about the following factors, often said to predispose to vertebral osteomyelitis (Wedge 1977, Miskew et al. 1983, Osenbach et al. 1990), was found in the hospital records: corticosteroid treatment, rheumatoid arthritis, diabetes, intravenous drug abuse and alcoholism. Information about operations within 3 months before the admission for vertebral osteomy-

Table 1. Age- and sex-specific incidence per year and age-specific prevalence of acute vertebral osteomyelitis in Denmark 1978–82

Age (years)	Number		Incidence per million			Mean disease duration (year)	Prevalence (cases)
	M	F	Total	M	F		
0–9	10	5	4.4	5.7	3.0	0.3	1.0
10–19	4	6	2.5	2.0	3.1	0.4	0.9
20–29	0	0	0	0	0	0	0
30–39	2	2	1.0	1.0	1.1	0.3	0.3
40–49	7	4	3.9	4.9	2.8	0.7	1.5
50–59	12	11	8.2	8.7	7.6	0.6	2.6
60–69	27	17	18	23	13	0.6	5.2
70–79	10	13	13	14	13	0.6	2.8
80–89	3	3	9.4	13	7.3	0.9	0.9
> 90	0	1	14	0	21	0.5	1.1
Total	75	62	0.53	0.59	0.48	0.6	15

elitis and about the primary focus—if known—was also recorded.

Information about the population was obtained from the Statistical Yearbook for 1980. The incidence of acute vertebral osteomyelitis was calculated as a mean of 5 years. For each patient, the disease-period was defined as the time from the appearance of the symptoms until the treatment (antibiotic therapy and/or immobilization) was completed. The prevalence (i. e., the number of patients in Denmark with acute vertebral osteomyelitis at a given time) was calculated for each age-group as the number of cases per year × disease-period.

In each of the 16 counties in Denmark the expected number of cases was calculated on the basis of information about age- and sex-distributions of the inhabitants and the age and sex specific incidence of acute vertebral osteomyelitis in Denmark. The relative risk in each county was calculated as the observed number of cases (i. e., number of patients with home address in the county) divided by the expected number of cases. The relative risk for each risk factor was calculated in the same way.

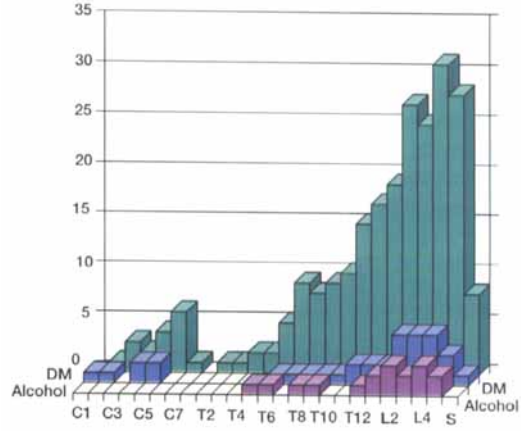
Information about age and sex of patients with the diagnosis of osteomyelitis of the vertebral column was also obtained from the National Patient Register for 1991–93. The hospital files of these patients were not examined.

Results

In 1978–1982, the incidence was not significantly higher for men than women ($p > 0.1$). The age-specific incidence was biphasic, with no cases among the 20–29 year olds. The prevalence in relation to age was also biphasic, which reflected changes in incidence and the fact that the duration of the disease increased with age (Table 1).

In 2 counties, the relative risk of acute vertebral osteomyelitis was significantly reduced, i.e., 0.35 (95% CI: 0.18–0.68) in Vejle county and 0.50 (95% CI: 0.31–0.79) in Fuen county. The number of expected and observed cases during 1978–82 in the 4 largest cities in Denmark (with more than 100,000 inhabitants) were 53 and 57, respectively, and the relative risk of acute vertebral osteomyelitis in the cities was not significantly increased (mean 1.09, 95% CI: 0.83–1.42).

The location of the infection was 59% in the lumbar, in 33% in the thoracic and 8% in the cervical spine. There was no difference in the distribution between age groups 0–19, 30–59 and > 60 years (chi^2, $p > 0.4$) or in subgroups of diabetics or alcoholics (chi^2, $p > 0.1$) (Figure).



The anatomic distribution of infected vertebral bodies in 137 patients with acute vertebral osteomyelitis, divided into 3 groups: patients without diabetes or alcoholism (green bars), patients with diabetes (DM) and patients who were alcoholics. Y-axis number of vertebral bodies affected and X-axis anatomic distribution.

Table 2. Frequency of possible predisposing factors among 137 patients with acute vertebral osteomyelitis. The expected number of patients was calculated from information in the literature. 5 patients had 2 predisposing factors

Predisposing factor	Number of patients	Expected number [a]	RR [b] (CI 95%)
Corticosteroid treatment	10	?	?
Rheumatoid arthritis	4	1.1	3.7 (0.6–24)
Diabetes	17		
Insulin-dependent [c]	8	1.4	5.7 (1.1–30)
Noninsulin-dependent	9	6.9	1.3 (0.6–2.7)
Intravenous drug addiction	0		
Alcoholism	9	4.5	2.0 (0.8–5.0)
Patients with predisposing factors	35		

[a] The expected frequency of insulin-dependent diabetes can be estimated at about 1% (Östman et al. 1986) and of noninsulin-dependent diabetes at about 5% (Bengtsson et al. 1992). In a population with the age- and sex-distribution of the patients in this investigation, the expected number of alcoholics can be estimated at 4.5 (Hardt and Vilstrup 1992), and the expected number of persons with rheumatoid arthritis at 1.1 (McIntosh 1996). The prevalence of patients on corticosteroid treatment is not known.
[b] Relative risk with 95% confidence intervals.
[c] Only insulin-dependent diabetes was found to be a significant risk factor.

Patients with insulin-dependent diabetes ran an increased risk, whereas there was no increased risk in patients with rheumatoid arthritis and alcoholism (Table 2). In 46%, a possible primary focus was found, urinary tract infection being the commonest one (Table 3).

18 patients (of whom 10 had a primary focus identified in the urinary tract) had instrumentation or operation on the urinary tract during the 3 months prior to the osteomyelitis (5 cystoscopy, 3 permanent catheterization, 3 transient catheterization, 6 transurethral prostate resection and 1 operation for phimosis). In these patients, no cervical vertebral bodies were affected, and the most proximal vertebral body infected was the 8th thoracic, but this distribution was not different from the rest of the patients (chi^2, $p > 0.1$)

252 persons were reported to the National Patient Register with the diagnosis acute osteomyelitis of the vertebral column 1991–1993: 79 cases in 1991, 74 in 1992 and 99 in 1993. By January 1, 1994, the 10th revision of WHO's diagnosis classification was introduced in Denmark, and all patients who were in hospital on December 31, 1993 were coded on that day according to the 8th revision (the 9th revision has never been used in Denmark), as well as after the 10th revision, when they were discharged later. Therefore some patients registered in 1993 were actually discharged in 1994.

In 1991–1993, 58% of the patients were men ($p < 0.05$), and the age-distribution was not biphasic.

Table 3. The primary focus in 137 patients with acute vertebral osteomyelitis

Primary focus	Number of patients (%)
No focus found	74 (54)
Urinary tract infection	24 (18)
Subcutanous abscess	10 (7)
Lung infection	9 (7)
Infected operation wound	4 (3)
Gall bladder infection	3 (2)
Endocarditis	3 (2)
Other	10 (7)

Table 4. Expected and observed age distributions among patients with acute vertebral osteomyelitis in 1991–1993.

Age group years	Expected percentage 1992	Observed percentage 1991–1993
0–9	9.0	4.7
10–19	6.6	3.1
20–29	0	3.5
30–39	2.8	6.7
40–49	11	15
50–59	16	15
60–69	30	23
70–79	18	23
80–89	5.7	5.9
> 90	1.4	0

The expected age distribution was calculated from the age- and sex-specific incidence rates from 1978–1982 and information about the age and sex distribution in the population by January 1, 1992 (taken from the Statistical Yearbook, 1992)

The 20–49-year-olds seemed to run an increased risk of acute vertebral osteomyelitis in 1991–1993, compared to 1978–1982 (Table 4).

Discussion

The National Patient Register in Denmark covers all patients discharged from public hospitals in Denmark. All hospitalized patients with the diagnosis of acute vertebral osteomyelitis were reported to the register. Some patients reported were miscoded and did not have acute vertebral osteomyelitis and, similarly, some patients with vertebral osteomyelitis could have been miscoded, i.e., as spondylosis. Most of the patients were treated in several departments during the course, and they were reported to the register after every discharge, thus the risk of missing cases because of mistakes in coding must have been minimal.

The incidence of acute vertebral osteomyelitis in Denmark 1978–82 (5/mill/year) was slightly higher than that reported from England (4/mill/year) (Digby and Kersley 1979), which in part can be explained by

exclusion of patients younger than 11 years in the English series. The age-specific incidence was biphasic in 1978–82, with the highest incidence in persons between 60 and 69 years of age. The same age pattern as ours has been observed in several other series (Sneppen et al. 1976, Frederickson et al. 1978, Digby and Kersley 1979, Eismont et al. 1983, Liebergall et al. 1991). In a series of 442 patients (Malawski and Lukawski 1991), the cases were more evenly distributed over the age-groups, but the material also included cases of chronic vertebral osteomyelitis. In our material from 1991–93, the incidence was not biphasic.

Most authors (Bonfiglio et al. 1973, Osenbach et al. 1990, Liebergall et al. 1991, Malawski and Lukawski 1991) report a male predominance, which we found in 1991–93 but not in 1978–82. Predisposing factors, found in up to 50% of the patients in some series (Wedge et al. 1977, Sapico and Montgomerie 1979, Osenbach et al. 1990), were identified in one quarter of our cases, but only insulin-dependent diabetes was found to be a significant predisposing factor. Diabetes has been observed in up to 20% of patients in other series (Bonfiglio et al. 1973, Cooppan et al. 1976, Sapico and Montgomerie 1979, Osenbach et al. 1990, Carragee 1997).

Whether alcoholism is a predisposing factor has been debated. Abnormal immune response makes alcoholics more susceptible to infections (MacGregor 1986). It is a long tradition in Denmark always to include information about alcohol consumption in patient files. Self-reported alcohol consumption has been found to be sufficient to rank patients' intake (Midanik 1982, Longnecker et al. 1992, Grønbæk and Heitmann 1997). Our study indicates that alcoholism is not a strong predisposing factor.

Pathogenetic factors for vertebral osteomyelitis included hematogenic spread via arterial blood or by paravertebral veins (Bonfiglio et al 1973, Digby and Kersley 1979, Carragee 1997). Urinary tract infections in the gall bladder and the lungs can spread via the paravertebral veins, and were found as a primary focus in 27% of our patients. Spread via the paravertebral veins can also occur during instrumentation of the urinary tract, which was performed in an additional 6% of the patients. The high percentage of lumbar vertebral bodies affected supports the view that spread via the paravertebral veins is an important pathogenetic factor.

It is surprising that there was not even one intravenous drug addict in the 1978–82 material, since intravenous drug abuse has been called a major risk factor (Holtzman and Bishko 1971, Wiesserman et al. 1973, Messer and Litvinoff 1976, Sapico and Montgomerie 1979, Carragee 1997). The estimated number of drug addicts in Denmark has been constant for 20 years (between 6,000 and 10,000 persons) (Hovedbestyrelsen 1994). Heroin did not come to Denmark until the early 1970s, so perhaps the general condition and the immune system of drug abusers in Denmark was better in 1978–82 than in USA. The increased percentage of patients in the age group 20–49 years in 1991–93 could be caused by a worsening in the general condition of drug addicts in Denmark. Drug addiction was not a major cause of vertebral osteomyelitis in Denmark, however.

The prevalence was only 15 cases. Acute vertebral osteomyelitis is a rare disease, and this is probably the reason why the diagnosis was often made late, Back pain is common, and an expectant attitude is usually adopted.

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