

SPINE SECTION

Research

The Incidence of Spontaneous Epidural Abscess in Olmsted County from 1990 Through 2000: A Rare Cause of Spinal Pain

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ABSTRACT

Objective. The primary objective of this study is to determine the population-based incidence of spontaneous epidural abscess. The secondary objective is to characterize the clinical course of patients with this rare infectious disease.

Design. The records-linkage system of the Rochester Epidemiology Project was used to identify incident cases of spontaneous epidural abscess in residents of Olmsted County, Minnesota, USA, from 1990 through 2000.

Setting. Tertiary referral medical center.

Patients. All patients were residents of Olmsted County and had spontaneous epidural abscesses that were radiographically or surgically confirmed.

Results. Eight patients, including six women, were identified and the mean age was 56 years (range, 40–80). The incidence of epidural abscess was 0.88 cases per 100,000 person-years (95% confidence interval, 0.27–1.48). The median time from symptom onset to diagnosis was 18 days (interquartile range, 4–30 days). Six patients presented with spinal pain and one presented with focal neurological deficits. Risk factors were identified in all patients, including concomitant infections, diabetes mellitus, immunosuppression, and intravenous substance abuse. *Staphylococcus aureus* was cultured in six patients and streptococcal species were cultured in two patients. Three patients were treated surgically and five received medical treatment. One patient treated surgically and one patient treated medically had residual neurological deficits. One patient, who was immunosuppressed and received medical treatment died of pneumonia.

Conclusions. This is the first published report of the population-based incidence of spontaneous epidural abscess. These findings could serve as a reference point for further epidemiological research related to this uncommon infection.

Key Words. Spontaneous Epidural Abscess; Population-Based Incidence; Pain

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Introduction

The incidence of spontaneous epidural abscess in hospital populations has been estimated at 0.33–1.96 abscesses per 10,000 hospital admissions per year [1]. Following use of an indwelling

epidural catheter for operative anesthesia or post-operative analgesia, the odds of developing a peri-operative epidural abscess vary from 0 to 1:1,930 [2,3]. Epidural abscess is also a rarely reported but serious complication of epidural corticosteroid injections for treatment of back pain [4,5].

Whereas the incidence of iatrogenic epidural abscess has been determined in specialized patient groups, the incidence of spontaneous epidural abscess in the general population remains undetermined. The primary objective of this study was to determine the population-based incidence of spontaneous epidural abscess. The secondary objective was to characterize the clinical presentation, treatment and outcomes of patients with this rare infection.

Materials and Methods

The records-linkage system of the Rochester Epidemiology Project was used to identify incident cases of spontaneously occurring epidural abscesses in Olmsted County, Minnesota, USA, from 1976 through 2000. Mayo Clinic and Olmsted Medical Center are located in Rochester, Minnesota, and are the major health care providers for individuals who live in Olmsted County. Additional health care providers in Olmsted County also participate in the Rochester Epidemiology Project, which has previously been described [6,7]. Briefly, all medical diagnoses and surgical procedures are routinely abstracted from medical records and coded using the International Classification of Diseases-adapted code for hospitals (H-ICDA) [8]. The coded medical information is then entered into the Rochester Epidemiology Project computerized database.

The Rochester Epidemiology Project database was searched using 45 H-ICDA codes of diseases or other spine disorders indicative of epidural abscess. The research protocol was approved by the Institutional Review Boards of Mayo Clinic and Olmsted Medical Center and was limited to residents of Olmsted County who had previously authorized use of their medical records for research purposes. The electronic search identified 195 individual medical records that were hand-reviewed by a physician abstractor. Inclusion criteria included all patients 18 years of age or older with a spontaneous epidural abscess verified by magnetic resonance (MR) imaging, computerized tomography, myelogram, or surgery. Patients who had other spinal infections with secondary involvement of the epidural space were excluded,

as were patients with intracranial abscesses. Other exclusion criteria included spine surgery and penetrating trauma within 6 months preceding the diagnosis of an epidural abscess. Presenting clinical symptoms were characterized, including the onset of spinal or radicular pain, focal sensory or motor deficits, and systemic signs of infection. Historical factors, including previous infections, spine-related pain, and disease processes or medications that impair immune function were abstracted from the medical record. Radiographic and pathological results were reviewed, and culture results were collected. Finally, treatment and clinical outcomes were assessed, including the need for surgical decompression, residual neurological deficits, persistent spine-related pain, and duration of hospital stay.

The incidence rate was calculated assuming that all residents 18 years of age or older in Olmsted County, Minnesota, during 1976–2000 were at risk. The denominator for this period was estimated using decennial census data. Rates were age- and sex-adjusted to the population structure of the United States in 1990. Ninety-five percent confidence intervals were constructed about the rates assuming a Poisson error distribution [9].

Results

Eleven residents of Olmsted County were identified with an epidural abscess. One patient developed an epidural abscess within 6 months of undergoing spine surgery and was excluded. The clinical diagnosis of epidural abscess was not radiographically or surgically confirmed in one patient who was subsequently excluded. The study cohort, at this juncture, contained nine patients (six women) with spontaneous epidural abscesses. A preliminary examination of the data revealed that one patient (patient number 1 in Table 1) had been diagnosed with an epidural abscess during the 14-year period from 1976 through 1989, while eight patients were diagnosed during the 11-year period from 1990 through 2000. The epidural abscess that occurred during the earlier time period in 1983 was diagnosed by myelogram. All epidural abscesses that occurred in the later time period from 1990 through 2000 were diagnosed with MR imaging. Increased utilization and technological advances in MR imaging were postulated as an explanation for the increased number of epidural abscesses diagnosed during the 1990–2000 time period compared with the 1976–89 time period. At our

Table 1 Clinical features of patients with spontaneous epidural abscesses in Olmsted County from 1990 through 2000, including one patient from 1983

No.	Age (Sex)	Year	Site of Abscess	Past Medical History	Presenting Signs and Symptoms	Symptom Duration	Radiographic Findings	Surgical Treatment	Culture Results	Outcome
1*	62 (M)	1983*	Lumbar	Transient global amnesia 4 months prior. Neuralgia paresthetica 6 years prior	LBP, fever, rapidly progressing LE weakness. Temp 38.9, ESR 87, WBC 16.5	8 days	Myelogram showed complete block of contrast flow at T7	Laminectomy T6–L5	Pus culture, Gram-positive cocci resembling staphylococcus	LE weakness, sensory deficit, bladder dysfunction
2	40 (M)	1990	Lumbar	Sacral myelomeningocele, repaired. Nephrectomy and cystectomy for chronic infections; prostatitis; ulcers on sacrum, heels, and buttocks. Herpes zoster	Skin infection in area of myelomeningocele, severe headache, nuchal rigidity, delirium, required intubation. HR 115, WBC 15.8	1 day	MRI showed lumbosacral epidural abscess	None	CSF culture, Group B beta-hemolytic streptococcus	Concomitant meningitis, decreased hearing acuity
3	80 (F)	1990	Lumbar	Diabetes, peripheral vascular disease with toe ulcer	Right hip pain, chills, rigors. Temp 39.1; HR 112, WBC 11	25 days	MRI showed epidural abscess at L4–S1	None	Blood culture, <i>S. aureus</i>	No neurological deficits, myocardial infarction, baseline health status at hospital dismissal
4	60 (F)	1992	Thoracic	Rheumatoid arthritis, taking steroids, peripheral neuropathy and vasculitic leg ulcers	Back pain, shoulder pain, diaphoresis. Temp 38.8; ESR 55, WBC 13	30 days	MRI showed T6–7 epidural abscess	None, patient deferred surgery	Blood culture, <i>S. aureus</i>	Died from pneumonia 1 month after diagnosis
5	69 (F)	1993	Cervical	Parkinson's disease, left C6 radiculopathy	Increased pain in left neck, shoulder, arm, and leg. Temp 36.8; ESR 62, WBC 10.5	18 days	MRI showed C5–7 epidural abscess with compression deformity cervical cord	Anterior cervical corpectomy of C6, fusion C5–7	Pus culture, <i>S. aureus</i>	Left hemiparesis, confined to nursing facility
6	51 (F)	1994	Thoraco-lumbar	Staphylococcal abscess left shoulder prior to presentation	LBP, RLE weakness and pain. WBC 14.7	135 days	MRI showed T12–L2 epidural abscess, compression of conus and cauda equina	Right hemilaminectomy L1–2	Pus culture, <i>S. aureus</i>	Developed paravertebral abscess, residual LBP
7	52 (M)	1995	Lumbar	Pott's disease. On steroids for tuberculosis with meningeal and ophthalmic involvement	Back pain. ESR 28, WBC 14.6	Symptoms due to Pott's disease	MRI showed inflammatory mass in epidural space producing moderate compression	Corpectomy L2 through L4, posterior fusion	Pus culture, acid-fast positive on smear, <i>S. aureus</i> in broth	No neurological deficits
8	48 (F)	1996	Lumbo-sacral	Diabetes, strep G bacteremia, infected uterine leiomyoma 2 weeks prior	Fever, chills, vomiting, LBP. Temp 39.4; HR 120	14 days	MRI showed L4 epidural abscess compressing cauda equina	None	Blood culture, streptococcus G	No neurological deficits
9	44 (F)	2000	Lumbo-sacral	Hemilaminectomy L4–S1 2 years prior. Hepatitis B, C, intravenous drug abuse	LBP, diaphoresis, chills, agitation. WBC 26.8	4 days	MRI showed L3–S1 epidural abscess	None	Blood culture, <i>S. aureus</i>	Residual LBP, LE sensory deficit

* Patient data excluded from all analyses.

No. = number; M = male; F = female; LBP = low back pain; LE = lower extremity; temp = temperature; ESR = erythrocyte sedimentation rate, reference range 0–22 mm/h; WBC = white blood cell count, reference range, 3.5×10^3 – 10.5×10^3 /L; HR = heart rate (beats per minute); MRI = magnetic resonance image; CSF = cerebrospinal fluid; RLE = right lower extremity.

institution, the first 1.5 Tesla MR scanner and use of gadolinium contrast were introduced in 1987. Phased array spine coils and gradient-echo pulse sequencing were introduced during the 1990–1991 time period. These technological advances improved the ability to identify epidural abscesses. The research team determined that including the time period prior to these advances may give a falsely low estimate of incidence, as some epidural abscesses may not have been diagnosed. Therefore, in order to improve the accuracy of the incidence calculation, only patients diagnosed with an epidural abscess during the 11-year time period from 1990 to 2000 were included in the study sample.

The final study cohort contained eight patients (six women) and the mean age was 56 years (range, 40–80 years). The clinical characteristics of the patient who was diagnosed with an epidural abscess in 1983 have been included in Table 1, but all data pertaining to this patient were excluded from further analyses.

The age- and sex-adjusted incidence was 0.88 per 100,000 person-years (95% confidence interval, 0.27–1.48) (Table 2). Although the incidence of epidural abscess in women was slightly higher, the confidence intervals of the incidences in women and men overlap and therefore the difference is not statistically significant.

Six patients had epidural abscesses involving the lumbar region. One patient had a cervical epidural abscess and one had a thoracic epidural abscess (Table 1). Spinal pain was a presenting symptom in six of eight patients. One patient, who did not have spinal pain, presented with hip pain. Three patients presented with neurological deficits or mental status changes, including one with lower extremity weakness, one with delirium, and one with agitation. Fever or tachycardia was a presenting sign in four of eight patients.

One patient had symptoms from chronic tuberculous infection of the spine, and was found to have developed a concurrent epidural abscess dur-

ing surgery. The onset of this patient's symptoms could not be accurately differentiated from symptoms related to the previously diagnosed tuberculous spine infection. Excluding this patient, the median time from symptom onset to diagnosis was 18 days (interquartile range, 4–30 days). The time from symptom onset and diagnosis in one patient was 135 days. This particular patient was receiving long-term antibiotic therapy for a staphylococcal shoulder infection. The erythrocyte sedimentation rate (ESR) was obtained in three of seven patients where two had elevations greater than 50 mm/h (reference range, 0–22 mm/h). The total leukocyte count on admission was determined in seven of eight patients, of whom six had a total count greater than $10.5 \times 10^9/L$ (reference range, 3.5×10^9 – $10.5 \times 10^9/L$).

Two patients had past histories of spinal surgery, including one with a myelomeningocele involving the sacral region (Table 1). This particular patient had a history of recurrent infections and was diagnosed with concomitant meningitis. Three patients had medical conditions or were taking medications that could impair immune function, including two with diabetes mellitus and one who was maintained on chronic oral steroids for rheumatoid arthritis. Three patients had been recently treated for localized infections prior to developing an epidural abscess including one with a shoulder infection, one with a skin infection near a sacral myelomeningocele, and one who had an infected uterine leiomyoma. Three patients, two with a history of diabetes and one with rheumatoid arthritis who was taking steroids, had lower extremity ulcerations. Finally, one patient had a history of intravenous drug abuse.

The epidural abscess was identified by spinal MR in all patients. However, it was not definitively determined by MR that the inflammatory mass in the epidural space of the patient with spinal tuberculosis was an epidural abscess. Blood cultures grew *Staphylococcus aureus* in three patients. Blood cultures from the patient with an infected uterine leiomyoma showed growth of streptococcus G. The cerebral spinal fluid culture obtained from the patient with the meningomyelocele and concomitant meningitis grew group B beta-hemolytic streptococcus. Culture of purulent material obtained at the time of surgery in three patients grew *S. aureus*.

Three patients underwent surgery and five were treated medically (Table 1). One of the three patients treated surgically had neurological deficits at the time of presentation. None of the patients

Table 2 The incidence per 100,000 person-years of epidural abscess in Olmsted County from 1990 through 2000

	Number	Population	Incidence*	95% CI
Female	6	476,100	1.26	0.25–2.27
Male	2	431,480	0.46	0.00–1.11
Total (age- and sex-adjusted)	8	907,580	0.88	0.27–1.48

* Per 100,000 person-years.
CI = confidence interval.

Table 3 The prevalence of particular presenting features and risk factors for spontaneous epidural abscess as found in the present study, the emergency medicine study of Davis et al. [10], and the neurosurgery study of Curry et al. [11]

	Present Study		Emergency Medicine		Neurosurgery	
	Number	Proportion	Number	Proportion	Number	Proportion
Sample size	8		63		48	
Presenting features						
Spinal pain	6	0.75	60	0.95	17	0.35
Neurological deficits	1	0.13	26	0.41	27	0.57
Risk factors						
Concurrent infection	3	0.38	9	0.14	10	0.21
Diabetes mellitus	2	0.25	8	0.13	8	0.17
Immune compromise	1	0.13	38	0.21	1	0.02
Intravenous drug use	1	0.13	13	0.63	13	0.27

treated medically had neurological deficits at presentation. One of the three patients treated surgically and one of the five patients treated medically had residual neurological deficits. Surgery was recommended but deferred by one patient in the medical treatment group. This particular patient had a history of chronic steroid use and died from pneumonia 1 month after the epidural abscess was diagnosed.

Discussion

Certain limitations affect the present study. The study sample was drawn from a small geographic area populated predominantly by Caucasians. This could limit the validity of generalizing the findings to other geographic regions and populations. Additionally, the diagnosis of spontaneous epidural abscess was established by retrospective review of the medical record. Errors in coding or retrieval might have reduced the number of cases found. Nevertheless, the data obtained provide the best estimate currently available of the incidence of spinal epidural abscess. The age-corrected and sex-corrected incidence in the general population was found to be 0.88 cases per 100,000 person-years.

The clinical features and potential risk factors identified in the present study can be compared with those reported recently in two, large, retrospective series, in which the study samples were drawn from emergency medicine [10] and neurosurgery [11] populations. As the three samples were drawn from different social and medical populations, and were subject to possible referral bias, the prevalence of various features differs in each of the samples. This precludes deriving what the typical prevalence of any particular clinical feature or risk factor should be for spontaneous epidural abscess. However, it does not preclude identifying

the cardinal presenting features and risk factors that should alert clinicians to the possibility of an epidural abscess.

As shown in Table 3, the cardinal presenting features, common to all the studies, are spinal pain and neurological deficits. The higher prevalence of neurological deficits in the neurosurgery sample is understandable, given the nature of the source population, but the prevalence of neurological deficits in each of the other two samples happens not to be significantly different statistically from that in the neurosurgery sample. The 95% confidence intervals of the proportions overlap.

The cardinal risk factors are concurrent infection, diabetes mellitus, compromised immunity, and intravenous drug abuse (Table 3). The disproportionately higher prevalence of drug abuse in the emergency medicine sample probably reflects its conduct in an urban setting. A meta-analysis of 915 patients with epidural abscess identified diabetes mellitus as the single, most common risk factor [12]. Although diabetes mellitus was identified in this and the two other studies, it was not as common as the meta-analysis suggests it should be. This might be attributed to differences in source populations, and to differences between spontaneous and iatrogenic epidural abscesses.

Spontaneous epidural abscess is a rare cause of spinal pain and neurological deficits.

Suspicion of the diagnosis should be prompted by the identification of risk factors for possible infection. Magnetic resonance imaging constitutes the best means of establishing the diagnosis.

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