Spinal Epidural Abscess: In Search of Reasons for an Increased Incidence

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ABSTRACT: **Background:** Spinal epidural abscess (SEA) is a rare disease with a potentially devastating outcome, and a reported incidence traditionally estimated at 0.2–2 cases/10,000 hospital admissions. Since the implementation in October 2007 of a program to increase medical personnel's awareness of SEA, we have documented a sharp increase in the incidence of SEA at our medical center

Objectives: To investigate the cause of the increased incidence of SEA.

Methods: All cases diagnosed with SEA during the period 1998–2010 were retrospectively reviewed. Cases diagnosed before 2007 were compared with those diagnosed thereafter.

Results: From January 1998 to October 2007 SEA was diagnosed in 22 patients (group A), giving an annual incidence of 0.14–0.6 cases per 10,000 admissions. During the period November 2007 to April 2010, 26 additional patients were diagnosed (group B), yielding an incidence of 0.81–1.7 cases per 10,000 admissions ($P < 0.01$). The two groups did not differ significantly in epidemiological, clinical or laboratory characteristics, or in the causative bacteria isolated.

Conclusions: The threefold rise in the incidence of SEA observed at a tertiary medical center in Tel Aviv since November 2007 was not explained by different host characteristics or by more virulent bacterial isolates. We suggest that heightened awareness of the clinical presentation and timely utilization of MR imaging has resulted in more cases being identified.

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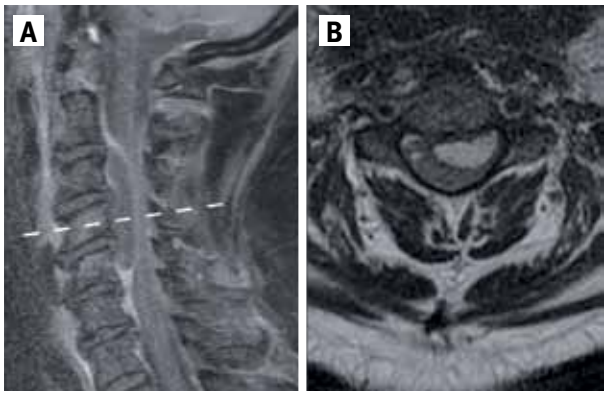
KEY WORDS: spinal epidural abscess (SEA), magnetic resonance imaging, epidemiology, increased incidence

Spinal epidural abscess is defined as a localized collection of pus between the dura mater and bony vertebral canal [Figure 1]. It is a rare entity with a reported incidence of 0.2–2 cases per 10,000 hospital admissions [1-4]. SEA constitutes a medical emergency since irreversible neurological damage can develop rapidly and mortality may occur in some cases. Despite advances in imaging techniques, the diagnosis of SEA remains a challenging clinical problem necessitating a high index of suspicion. The classic clinical "triad" – neck/back pain, fever, neurological deficit – is present in only a minority of patients, making the diagnosis difficult and elusive [2,3].

Figure 1. Cervical MRI demonstrating an anterior spinal epidural abscess at C3-5 compressing the spinal cord. **[A]** Sagital T1 with gadolinium, **[B]** Axial T2



A recent review reports that the incidence of SEA has doubled over the past two decades [3], corroborating our own experience. Theoretically, the sharp rise in incidence may be attributed to varied risk factors such as increasing use of spinal instrumentation and vascular access, abundance of injection-drug use, and overall, a more immunocompromised and aged population [1,5-7]. In October 2007 an educational program was initiated aimed at familiarizing emergency medicine personnel, neurosurgeons, orthopedic surgeons and internists with this entity. In addition, new regulations were issued to facilitate the availability of magnetic resonance imaging if SEA is suspected. We then noticed an abrupt rise in the incidence of SEA at our medical center.

The aim of the present study was to identify all patients with SEA diagnosed at our institution since 1998, and to characterize and compare their clinical features over time in an attempt to identify factors that may explain the steep rise in SEA over this period.

*** The first two authors contributed equally to the manuscript**

SEA = spinal epidural abscess

PATIENTS AND METHODS

We retrospectively reviewed the medical records of adult patients (> 18 years old) diagnosed with SEA according to ICD-9 definitions (324.1, 324.9) at our medical center, a tertiary referral hospital of 1100 beds, during the 12 year period January 1998 to April 2010. We identified 48 cases of SEA. The criteria for inclusion were: a) a clinical presentation consistent with SEA, b) diagnosis of spinal epidural collection on a computed tomography scan and/or an MRI, and c) visible infection in the spinal epidural space during surgery yielding a positive culture or associated with a positive blood culture. Data pertaining to epidemiologic characteristics, clinical manifestations, laboratory and imaging findings, bacteriologic results, medical treatment, surgical procedures, and patient's outcome were collected. Cases were divided into an early group (group A – diagnosed at or before 31 October 2007) and a late group (group B – diagnosed at or after 1 November 2007). Clinical, laboratory and imaging findings were compared between the two groups.

HOSPITAL MANAGEMENT-GUIDED INTERVENTION

In 2007 a patient developed acute quadriplegia after admission to our hospital for a cervical epidural abscess. Interventions directed by the hospital management during October-November 2007 were aimed at raising medical staff awareness of the potential diagnosis of SEA.

As a first step a multidisciplinary morbidity conference was held for all medical personnel, including the medical, orthopedic, spine surgery, and neurosurgery services as well as the infectious diseases unit and the imaging department, to identify pitfalls in diagnosis and management of the patient. As a second step, the conclusions drawn from this conference were presented at a hospital staff meeting to increase the awareness of SEA among medical personnel with little experience of this rare disease. Special emphasis was given to emergency room personnel. It was concluded that the infectious disease unit and a surgeon experienced in spine surgery should be consulted at an early stage as part of the evaluation of any patient suspected of having SEA. In addition, the hospital management issued new regulations to facilitate the availability of MRI when SEA is suspected.

STATISTICAL ANALYSIS

Continuous variables were compared using Student's *t*-test or the Mann-Whitney test, as appropriate. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. *P* values < 0.05 were considered statistically significant.

RESULTS

Twenty-two cases of SEA were diagnosed during the early period from January 1998 to October 2007 (group A), averaging 0.37 cases/10,000 hospital admissions. The annual incidence of SEA did not vary significantly over the period and ranged between 0.14 and 0.6 cases per 10,000 admissions. During the later period, from November 2007 to April 2010, 26 new cases of SEA were identified (group B), representing a statistically significant increase in incidence to an average of 1.36 cases/10,000 admissions (range 0.81–1.7, $P < 0.01$) [Figure 2].

Table I summarizes the epidemiological and clinical characteristics, the laboratory data and the outcome in the two groups. Pain was a major complaint on admission in both groups of patients. However, the classical "clinical triad" of pain, fever and a neurological deficit was present in a mere 18% and 23% of patients in group A and B, respectively. Epidemiological and clinical characteristics, including the incidence of neurological

Figure 2. [A] Incidence of SEA diagnosis per 10,000 admissions during the period 1998–2010. Red dashed line indicates hospital management-initiated interventions in October 2007. **[B]** Box plots of averaged pooled incidence in group A vs. group B (the borders of the box indicate the 25th–75th percentiles, the line inside the box marks the median, and error bars above and below the box indicate the 90th and 10th percentiles, respectively).

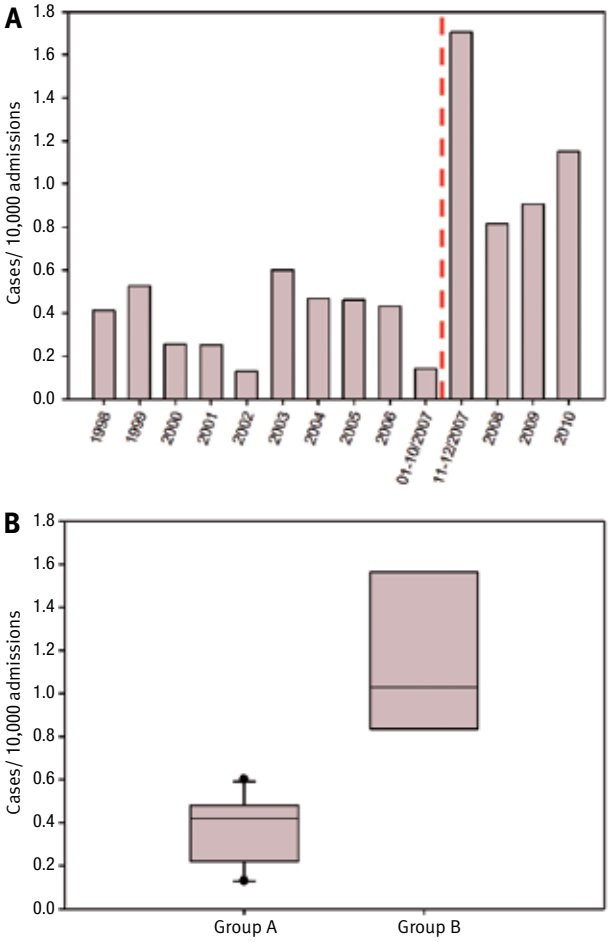


Table 1. Characteristics of patients diagnosed with spinal epidural abscess before and after steps to increase awareness (group A and B respectively)

	Group A	Group B	*P* value
No. of patients	22	26	
Mean age (yrs) (range)	60.5 (19–86)	64 (25–89)	0.48
Male	59%	69%	0.46
Etiology			0.07
Idiopathic	6 (27%)	16 (62%)	
Procedure-related*	9 (41%)	7 (27%)	
Secondary to distant infect**	7 (32%)	3 (11%)	
Immune-suppressed conditions			0.91
Malignancy, steroid use, HIV	5 (23%)	6 (24%)	
Chronic medical illnesses	9 (40%)	6 (24%)	0.21
Diabetes mellitus	7	2	
Chronic renal failure	2	2	
Chronic lung disease	1	2	
Clinical presentation			
Pain	22 (100%)	24 (92%)	0.32
Fever	7 (32%)	12 (46%)	0.26
Neurological deficits	10 (45%)	13 (50%)	0.45
Pain + fever + neuro deficit	4 (18%)	6 (23%)	0.73
Diagnosis by MRI	18 (82%)	22 (85%)	0.69
Median time intervals (days)			
Admission-to-diagnosis (range)	3 (0–32)	1 (0–8)	0.007
Admission-to-surgery (range)	5 (1–32)	2 (1–9)	0.012
Laboratory (mean values)			
WBC/mm³	13,427 ± 5047	14,034 ± 6240	0.72
CRP (normal < 5 mg/L)	162 ± 118	175.5 ± 95	0.71
Cases with *S. aureus*	11 (50%)	13 (50%)	0.77
Outcome			0.59
Mortality	2 (9%)	4 (15)	
Neurological deficit at discharge	11 (50%)	11 (4%2)	

*Procedure related = spinal epidural abscess that developed after spinal surgery or spinal anesthesia

**Endocarditis, bacteremia, skin and soft tissue infection

deficit, were not significantly different between the two groups. White blood cell count and C-reactive protein levels were proportionately high in both groups. Importantly, the frequency of positive bacteriological cultures, including *Staphylococcus aureus* and methicillin-resistant *S. aureus* (MRSA) positive cultures was the same in both groups. Also, the rate of chronic medical illnesses known to be associated with an increased infection rate such as diabetes mellitus, chronic renal failure and chronic lung disease as well as other immune compromised states (human immunodeficiency virus, malignancy, steroid use) did not differ significantly between the two groups.

MRI confirmed the diagnosis in 82% and 85% of patients in group A and B, respectively, while a CT scan showed definite findings in only 18% and 15% of respective groups.

The median time interval from admission to diagnosis and from admission to surgery shortened considerably between the two periods [Table 1]. Only one patient in group A was diagnosed immediately upon hospital admission, compared to seven patients in group B. All-cause mortality and the incidence of neurological sequelae at discharge did not differ significantly between the two groups ($P = 0.58$). Two patients in group A (9%) and 4 in group B (15%) died during their hospitalization; 11 patients in group A (50%) and 11 in group B (42%) had neurological impairment at discharge. Neurological sequelae were more likely to occur in patients with neurological deficit at presentation ($P < 0.01$).

DISCUSSION

Spinal epidural abscess is infrequently encountered in daily clinical practice, varying in incidence between 0.2 and 2 cases per 10,000 hospital admissions [1–3]. Nonetheless, we documented a threefold rise in annual incidence rates at our center since 2007, compared to the preceding decade. Importantly, this steep rise in SEA diagnosis was not due to a change in clinical presentation, diagnostic breakthroughs or increasing virulence of causative organisms. Rather, the rising incidence rates are attributed to increased awareness and appropriate diagnosis of SEA. Indeed, improved diagnosis was not coincidental, but rather should be ascribed to an educational program that we implemented at our hospital in October 2007 with the aim of familiarizing emergency medicine personnel, neurosurgeons, orthopedic surgeons and internists with this entity. The significantly shorter time from presentation to diagnosis in the latter period supports this argument. As is usually the case, our educational agenda was sparked by an unfortunate episode earlier that year of a cervical epidural abscess that resulted in complete quadriplegia due to tardy diagnosis. Again, the lack of identifiable epidemiological, clinical or laboratory differences among patients diagnosed in the first as compared to the second time period on the one hand, and the significantly shorter time to diagnosis and surgery on the other, indicates that the newly implemented increased awareness-motivated clinical approach was responsible for the increased rates of SAE.

Lamentably, despite a timely diagnosis, prompt institution of antibiotic therapy and surgical intervention, when indicated, during the period of the SEA educational program in the hospital, outcome did not improve and rates of mortality and neurological sequelae remained high. While this may be surprising, especially since the incidence of medical illnesses associated with increased risk for infections was not significantly different between the two groups, it is in accordance with a recently published meta-analysis [2] showing that mortality rates from SEA have not changed significantly over the past 25 years.

The classic clinical triad – fever, neck or back pain and neurological impairment – proved, as in earlier reports, to be an infrequent presentation of SEA [5,8-10]. Indeed, since physicians inexperienced in the diagnosis and management of SEA frequently recognize this entity only in the context

of the classical triad, the search for the complete triad may delay the correct diagnosis. Previous studies have emphasized the crucial significance of early diagnosis and prompt surgical intervention in the management of patients with SEA [1,2,10]. Presently, our findings reiterate that neurological status prior to surgery is the single most important predictor of the final neurological outcome [1,3,10–12]. Therefore, the constellation of back pain and elevated inflammatory markers should prompt immediate investigation for SEA, ideally before neurological deficit sets in.

In the quest for a speedy diagnosis, it should be recognized that MR is the imaging modality of choice. Although this has been stated previously [2,4,8,13,14], a CT scan is often chosen first due to considerations of availability and cost. Our study reinforces the low yield of the CT scan in the diagnosis of SEA. Indeed, increased utilization of MRI during the second period of our study, as a result of the new guidelines we had instituted, greatly contributed to shortening the diagnostic interval.

Staphylococcus aureus was the main offending pathogen retrieved in both periods of the study. This was expected since it accounts for 60–90% of cases of SEA in the literature [2,8,9]. Moreover, MRSA infection is of particular concern, especially when SEA develops post-spinal instrumentation, accounting for up to 40% of Staphylococcal infections [3]. We found neither a difference in the incidence of MRSA between the two periods of the study nor an increase in the frequency of SEA post-spinal instrumentation.

In conclusion, we have documented a threefold rise in the diagnosis of SEA over a 12 year period, due primarily to heightened vigilance rather than a true rise in incidence. This was established via the institution of a hospital-based intervention program aimed at increasing awareness of SEA in conjunction with basing the presumptive diagnosis on the combination of back pain with increased inflammatory markers instead of on the classical triad of fever, pain and neurological deficit, which develops at a later often irreversible stage of the disease and in only a minority of patients, as well as on the utilization of MRI as the primary diagnostic modality in suspected cases of SEA. Importantly, no change in host or pathogen characteristics was found during this period which may explain, in part, our inability to demonstrate a better outcome with earlier diagnosis. Moreover, the relatively small size of the sample may have weakened its power to detect meaningful differences between the groups, as well as the fact that most of the patients were diagnosed before developing neurological deficit, whereas subtler clinical complications may have been overlooked in our retrospective study.

MRSA = methicillin-resistant *S. aureus*

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"Vocations which we wanted to pursue, but didn't, bleed, like colors, on the whole of our existence"

Honore de Balzac (1799-1850), French novelist and playwright. Considered one of the founders of realism in European literature, he is renowned for his multifaceted characters, who are morally ambiguous. His writing influenced many subsequent novelists such as Marcel Proust, Émile Zola, Charles Dickens, Edgar Allan Poe, Fyodor Dostoyevsky and others, and philosophers such as Friedrich Engels and Karl Marx. Many of Balzac's works have been made into or have inspired films, and they are a continuing source of inspiration for writers, filmmakers and critics