CLINICAL RESEARCH STUDY

THE AMERICAN JOURNAL of MEDICINE®

Errors in Diagnosis of Spinal Epidural Abscesses in the Era of Electronic Health Records

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ABSTRACT

PURPOSE: With this study, we set out to identify missed opportunities in diagnosis of spinal epidural abscesses to outline areas for process improvement.

METHODS: Using a large national clinical data repository, we identified all patients with a new diagnosis of spinal epidural abscess in the Department of Veterans Affairs (VA) during 2013. Two physicians independently conducted retrospective chart reviews on 250 randomly selected patients and evaluated their records for red flags (eg, unexplained weight loss, neurological deficits, and fever) 90 days prior to diagnosis. Diagnostic errors were defined as missed opportunities to evaluate red flags in a timely or appropriate manner. Reviewers gathered information about process breakdowns related to patient factors, the patient−provider encounter, test performance and interpretation, test follow-up and tracking, and the referral process. Reviewers also determined harm and time lag between red flags and definitive diagnoses.

RESULTS: Of 250 patients, 119 had a new diagnosis of spinal epidural abscess, 66 (55.5%) of which experienced diagnostic error. Median time to diagnosis in error cases was 12 days, compared with 4 days in cases without error ($P < .01$). Red flags that were frequently not evaluated in error cases included unexplained fever (n = 57; 86.4%), focal neurological deficits with progressive or disabling symptoms (n = 54; 81.8%), and active infection (n = 54; 81.8%). Most errors involved breakdowns during the patient−provider encounter (n = 60; 90.1%), including failures in information gathering/integration, and were associated with temporary harm (n = 43; 65.2%).

CONCLUSION: Despite wide availability of clinical data, errors in diagnosis of spinal epidural abscesses are common and involve inadequate history, physical examination, and test ordering. Solutions should include renewed attention to basic clinical skills.

Published by Elsevier Inc. • The American Journal of Medicine (2017) ■, ■-■

KEYWORDS: Back pain; Diagnostic delays; Diagnostic errors; Red flags; Spinal epidural abscess

Funding: This project is supported with resources and the use of facilities at the Houston VA Health Services Research and Development Center of Excellence (HFP90-020) at the Michael E. DeBakey VA Medical Center, Houston, Texas. Murphy is additionally funded by an Agency for Healthcare Research & Quality Mentored Career Development Award (K08-HS022901) and Singh is supported by the VA Health Services Research and Development Service (CRE12-033; Presidential Early Career Award for Scientists and Engineers USA 14-274), the VA National Center for Patient Safety and the Agency for HealthCare Research and Quality (R01HS022087 and R21HS023602). This work is supported in part by the Houston VA HSR&D Center for Innovations in Quality, Effectiveness and Safety (CIN13-413). These funding sources had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; and preparation, review, or approval of the manuscript.

Conflict of Interest: The authors have no financial disclosures to report.

Authorship: All authors had access to the data and a role in writing the manuscript. VB and DRM had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

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0002-9343/$ -see front matter Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.amjmed.2017.03.009

Diagnostic evaluation of back pain in the outpatient setting can be challenging, as evaluation needs to rule out rare but serious etiologies, such as spinal epidural abscess, among the vast majority of benign causes.[1-5] Although very few patients presenting with back pain to a primary care setting eventually have epidural abscesses,[1,6,7] a missed or delayed diagnosis of spinal epidural abscess can lead to significant morbidity, such as permanent neurological damage with long-term disability.[8-11] While advanced imaging tests can confirm a spinal epidural abscess diagnosis, they are costly and offer little benefit for patients where signs and symptoms clearly indicate benign causes.[12-14] Thus, maintaining an appropriate balance between ordering imaging tests when signs and symptoms suggest serious causes while avoiding unnecessary imaging when they do not, is critical in preventing misdiagnoses of spinal epidural abscess.

CLINICAL SIGNIFICANCE

- In a retrospective evaluation of a national sample with 119 patients, we identified diagnostic errors that occurred in 66 patients (55.5%).
- Contributing factors included information gathering during history and physical examination and inadequate ordering of diagnostic tests to evaluate red flags during diagnostic evaluation.
- Our findings highlight the need for renewed attention to basic clinical skills.

The American College of Radiology offers guidelines based on the presence of "red flags" to determine which imaging tests to pursue.[15,16] Despite the widespread availability of such guidelines, instances of missed spinal epidural abscess diagnoses continue to occur, even when documentation of initial symptoms suggest a need for further work-up.[6,17-19] Previous estimates from a single institution retrospective chart review study suggest that most patients (75%-84%) with spinal epidural abscess experienced diagnostic delays after initial assessments in the emergency department.[17,20] However, factors responsible for such delays in diagnostic assessment have not been discussed in detail and are not well understood.[4,20,21] Unrecognized red flag signs and symptoms during diagnostic evaluation, failure to consider spinal epidural abscess in the differential diagnosis, and atypical and subtle presentations of back pain (vs classic presentations) have been suggested as potential reasons.[22-27] Advancing the understanding of contributory factors for misdiagnosis of spinal epidural abscess can enable the development of interventions to prevent patient harm from delays in care.

A recent Institute of Medicine report, *Improving Diagnosis in Healthcare*,[28] calls for better approaches to understand and measure diagnostic errors. However, most systems lack availability of longitudinal clinical patient data to enable accurate assessment of the diagnostic process.[29] In integrated systems, such as the Department of Veterans Affairs (VA), that use comprehensive electronic health records (EHRs), accessibility of large amounts of diagnostic data (such as visit notes, lab tests, imaging tests, pathology, and procedures) makes it possible to understand the patient's diagnostic process as it evolves over time. Our study objective was to evaluate the diagnostic process in patients presenting with back pain who were subsequently diagnosed with spinal epidural abscess. We used predefined criteria to identify missed opportunities in the diagnostic process in order to understand factors contributing to the diagnostic errors.

METHODS

Study Setting

To identify patients with spinal epidural abscess diagnosis, we accessed a VA database that contains clinical EHR data from over 1700 VA outpatient and inpatient facilities, serving over 8 million veterans across the US annually. The local institutional review board approved the study.

Design

We used an electronic query to identify all instances of spinal epidural abscess diagnosis during any outpatient or inpatient visit between January 1 and December 31, 2013 in the national database. The query was based on the presence of the International Classification of Diseases, Ninth Revision code 324.1. From this cohort, 2 physicians independently reviewed 250 randomly selected records to identify instances of errors in diagnostic assessment of spinal epidural abscess. Because our primary objective was to understand details of the evolving diagnostic process, we excluded patients with spinal epidural abscess diagnosed outside the VA system (ie, patients who transferred care to the VA only once treatment was needed). We defined diagnostic errors as "missed opportunities to make the correct or timely diagnosis of spinal epidural abscess based on available evidence regardless of whether the patients experienced harm." This definition is similar to what we have used in our previous work.[30,31] To operationalize this definition, reviewers first identified whether red flag signs or symptoms were documented in any outpatient clinic or emergency department visit note during the 90 days prior to the new spinal epidural abscess diagnoses (ie, the date the International Classification of Diseases, Ninth Revision code was identified). We chose the 90-day period based on expert input in order to capture all diagnosis-related activity during the evolution and progress of spinal epidural abscess.

Red flags were based on signs and symptoms from the American College of Radiology's Appropriateness Criteria for patients presenting with chronic back pain[15,16]. All documentation in the chart, including notes from other providers, such as nursing and triage notes, was reviewed for the presence of red flags. Reviewers then assessed whether providers took subsequent action to evaluate documented red flag signs or symptoms (eg, appropriate