



Characteristics, length of stay, and hospital bills associated with severe odontogenic infections in Houston, TX

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Despite medical advances, odontogenic infections are increasing in frequency in the United States.¹ From 2008 through 2010, dental-related conditions were responsible for 4,049,361 emergency department (ED) visits in the United States, or approximately 1% of all ED visits.² Admissions for severe odontogenic infections were less than 1% of all hospital admissions at the 3 hospitals in this study. Prevention and treatment of early odontogenic infections are often straightforward and relatively inexpensive, often consisting of dental restorations, scaling and root planing, incision and drainage of localized infections, endodontic treatment, or dental extractions. However, delayed treatment comes with considerable expense and can have serious consequences, including prolonged hospitalizations, intensive care unit (ICU) stays, airway compromise, spread of infection to the mediastinum, thrombosis of the internal jugular vein, cavernous sinus thrombosis, blindness, and even death.³

For the purposes of this study, we defined severe odontogenic infections as those for which patients required hospitalization and incision and drainage in the operating room (OR). Although investigators in several previous studies analyzed variables associated with an

ABSTRACT

Background. There were 2 main purposes of this retrospective chart review study. The first was to describe the demographic, social, and financial characteristics of patients with severe odontogenic infections. The second was to assess the relationships among several demographic, social, and treatment variables and length of stay (LOS) in the hospital and hospital bill (charges).

Methods. The authors conducted a retrospective chart review for patients admitted to the hospital and taken to the operating room for treatment of severe odontogenic infections at 3 hospitals in Houston, TX (Ben Taub, Memorial Hermann Hospital, and Lyndon B. Johnson) from January 2010 through January 2015.

Results. The authors included data from severe odontogenic infections in 298 patients (55% male; mean age, 38.9 years) in this study. In this population, 45% required admission to the intensive care unit, and the mean LOS was 5.5 days. Most patients (66.6%) were uninsured. The average cost of hospitalization for this patient population was \$13,058, and the average hospital bill was \$48,351. At multivariable analysis, age ($P = .011$), preadmission antibiotic use ($P = .012$), diabetes mellitus ($P = .004$), and higher odontogenic infection severity score ($P < .001$) were associated with increased LOS. Higher odontogenic infection severity score, diabetes mellitus, and an American Society of Anesthesiologists score of 3 or more were associated with an increased charge of hospitalization.

Conclusions. Severe odontogenic infections were associated with substantial morbidity and cost in this largely unsponsored patient population. The authors identified variables associated with increased LOS and charge of hospitalization.

Practical Implications. Clinicians should consider these findings in their decision-making processes and prioritize early treatment of odontogenic infections potentially to decrease the number of patients admitted to the hospital, LOS, and overall costs of treatment for these infections.

Key Words. Infection; hospital dentistry; dental care use; oral health; public health and community dentistry.

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increased length of stay (LOS),⁴⁻⁷ few presented detailed cost information or cost analysis for the treatment of severe odontogenic infections. Severe odontogenic infections can be a considerable financial burden on hospitals.^{8,9} In an era of budget cuts, physicians and hospitals must strive constantly to provide the highest level of patient care while minimizing costs. Meeting this goal requires objective data regarding patient demographic characteristics, variables that may prolong hospitalization, and variables associated with increased costs of hospitalization. The purpose of this retrospective chart review study was to describe the demographic, social, and financial characteristics of patients with severe odontogenic infections and to identify factors associated with increased LOS or hospital bills.

METHODS

Institutional review board approval. We obtained institutional review board approval from The University of Texas system and all 3 hospitals involved in our study.

Inclusion and exclusion criteria. We performed a retrospective chart review of patients with severe odontogenic infections treated at 3 hospitals in Houston, TX, from January 2010 through January 2015. Ben Taub (BT) and Lyndon B. Johnson (LBJ) hospitals are 2 county hospitals that provide low-cost or charity care to underserved patients of Harris County. Memorial Hermann Hospital (MHH) is a privately owned level 1 trauma center and the primary teaching hospital for The University of Texas Medical School at Houston. We used procedure logs maintained by the Department of Oral and Maxillofacial Surgery at The University of Texas Medical School at Houston to identify patients. Inclusion criteria were surgical treatment under general anesthesia and admission to the hospital for an odontogenic infection. Exclusion criteria included infection not of odontogenic origin, treatment provided outside of the OR, or an incomplete medical record. We included 298 patient records in our analysis.

Variables. We extracted several demographic and treatment variables from the patients' records, deidentified them, and arranged them in an electronic spreadsheet (Excel, Microsoft). The independent variables extracted included age, American Society of Anesthesiologists (ASA) score (as determined from the anesthesiologist's documentation from the preoperative evaluation), tobacco use, history of diabetes, whether the patient sought treatment for his or her infection previously, whether the patient received preadmission antibiotics, number and location of infected spaces, number of computed tomographic (CT) scans per admission, number of trips to the OR, admission to the ICU, length of ICU stay, total LOS, microbiology culture results, and antibiotic sensitivities. We generated the outcome (dependent) variables in this study from LOS and the hospital bill.

The ASA score is a reflection of a patient's overall health and is divided into 5 groups. The lower the score,

the healthier the patient. For example, a patient designated ASA class 1 is essentially healthy, whereas a patient designated ASA class 4 has a severe systemic disease that is a threat to life (for example, a patient with symptomatic chronic obstructive pulmonary disease or unstable angina). Based on a study by Shewale and colleagues,¹⁰ we categorized patients into 2 broader and clinically meaningful groups based on ASA score for statistical analysis: those with a score of 2 or less and those with a score of 3 or more.

We obtained the total costs and charges for each patient's hospitalization from all 3 hospitals. In this study, we considered costs to be the expense the hospital incurred in treating these patients (overhead), and we considered charges to be the amount billed to the patient.

According to previous work by Flynn and colleagues,^{5,6} we assigned an odontogenic infection severity score to each patient's infection. We used documentation from the patient's electronic medical record and CT imaging to determine which fascial spaces were involved. We scored each fascial space on the basis of its proximity to the airway, likelihood of preventing access to the airway, or proximity to vital structures.⁵ Low-severity spaces (1 point) were vestibular, subperiosteal, infraorbital, and buccal. Moderate-severity spaces (2 points) were submandibular, submental, sublingual, pterygomandibular, submasseteric, superficial temporal, and deep temporal. High-severity spaces (3 points) were lateral pharyngeal, retropharyngeal, pretracheal, mediastinal, and intracranial. The odontogenic infection severity score for each patient was the sum of the scores of all infected spaces. For example, a patient with a lateral pharyngeal space and submandibular space infection would have an odontogenic infection severity score of 5, whereas a patient with a sublingual and submandibular space infection would have an odontogenic infection severity score of 4.

All patients included in this study were taken to the OR for incision and drainage under general anesthesia. Microbiology specimens were obtained in the OR after sterile preparation and draping of the surgical site. The decision to keep a patient intubated postoperatively was made with consideration of the risk of developing airway loss and hemodynamic stability.

Statistical analysis. We used Pearson χ^2 and Fisher exact tests to analyze differences between categorical variables, and we used *t* tests and Mann-Whitney *U* tests to analyze differences between continuous variables as

ABBREVIATION KEY. **Abx:** Antibiotics. **ASA:** American Society of Anesthesiologists. **BT:** Ben Taub. **CT:** Computed tomographic. **ED:** Emergency department. **ET:** Endodontic therapy. **Ext:** Extraction. **ICU:** Intensive care unit. **LBJ:** Lyndon B. Johnson. **LOS:** Length of stay. **MHH:** Memorial Hermann Hospital. **NA:** Not applicable. **OR:** Operating room. **PCP:** Primary care physician. **RCT:** Endodontic therapy.

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