

Incidence of Infective Endocarditis Due to Viridans Group Streptococci Before and After the 2007 American Heart Association's Prevention Guidelines: An Extended Evaluation of the Olmsted County, Minnesota, Population and Nationwide Inpatient Sample

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Abstract

Objective: To determine whether the incidence of infective endocarditis (IE) due to viridans group streptococci (VGS) increased after the publication of the 2007 American Heart Association (AHA) IE prevention guidelines.

Patients and Methods: We performed a population-based survey of all adults (18 years and older) residing in Olmsted County, Minnesota, from January 1, 1999, through December 31, 2013, to identify definite or possible cases of VGS-IE using the Rochester Epidemiology Project. The National (Nationwide) Inpatient Sample hospital discharge database was examined to determine the number of VGS-IE cases in the United States between 2000 and 2011.

Results: Rates of incidence (per 100,000 person-years) during the intervals of 1999-2002, 2003-2006, 2007-2010, and 2011-2013 were 3.6 (95% CI, 1.3-5.9), 2.7 (95% CI, 0.9-4.4), 0.7 (95% CI, 0.0-1.6), and 1.5 (95% CI, 0.2-2.9), respectively, reflecting an overall significant decrease ($P=.03$ from Poisson regression). Likewise, nationwide estimates of hospital discharges with a VGS-IE diagnosis trended downward during 2000-2011, with a mean number per year of 15,853 and 16,157 for 2000-2003 and 2004-2007, respectively, decreasing to 14,231 in 2008-2011 ($P=.05$ from linear regression using weighted least squares method).

Conclusion: Despite major reductions in the number of indications for antibiotic prophylaxis for invasive dental procedures espoused by the 2007 AHA IE prevention guidelines, both local and national data indicate that the incidence of VGS-IE has not increased.

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Infective endocarditis (IE) is a severe, life-threatening illness with high morbidity and mortality despite advances in diagnostics and therapeutics.^{1,2} Since 1955, the American Heart Association (AHA) has made recommendations for the prevention of IE in patients with certain cardiac conditions before invasive dental procedures.³ Controversy concerning efficacy and safety of antibiotic

prophylaxis has existed for many decades, with progressive reductions in the number of patients for whom prophylaxis is recommended, duration of antibiotic prophylaxis, and types of invasive procedures since the AHA guidelines were first published.^{3,4} In 2007, the AHA recommended restriction of antibiotic prophylaxis to only 4 groups of patients who are at the highest risk of adverse

outcomes if they develop endocarditis. This resulted in a major reduction in the number of indications for prophylaxis: if followed, these guidelines could reduce the number of patients who no longer require prophylaxis by approximately 90%.³ The recommendations were determined on an analysis of outcomes among high-risk groups if IE developed and the recognition that IE was much more likely to develop secondary to frequent bacteremia associated with daily activities (eg, toothbrushing and chewing food) than from a dental procedure.³

Recognizing the large number of people at risk of IE, there was concern among some medical and dental health care professionals that the reduction in the number of at-risk patients who were to receive antibiotic prophylaxis could result in an increase in the number of IE cases due to viridans group streptococci (VGS).¹ Data were examined during a 12-year period that included a before and after analysis of VGS-IE between 1999 and 2010 in Olmsted County, Minnesota, and there was a gradual decrease in VGS-IE incidence.¹ The number of hospital discharges due to VGS-IE using the National (Nationwide) Inpatient Sample (NIS) between 1999 and 2009 was included in our initial analysis and the number of hospital discharges due to VGS-IE appeared to have remained stable.¹

Additional investigations that examined the incidence of VGS-IE despite reductions or elimination of antibiotic prophylaxis for dental and other invasive procedures provided consistent results—no increase in VGS IE incidence was observed. Data just published, however, revealed a 25% increase in the incidence of IE and an approximately 89% reduction in antibiotic prophylaxis use for dental procedures in patients from the United Kingdom.⁵ Nevertheless, this study did not contain organism-specific incidence data, and the apparent increase in IE incidence may have been driven by an increase in *Staphylococcus aureus* IE incidence as observed in other recent studies.^{2,6,7} Despite the limitations of this study, we expect that it will generate more controversy about the updated IE prophylaxis guidelines and will create confusion for patients and physicians regarding this issue.

Therefore, we performed a temporal trend analysis of the incidence of VGS-IE in Olmsted

County, Minnesota, between 1999 and 2013, which extends our initial evaluation of VGS-IE incidence before and after the 2007 AHA IE prevention guidelines. We also formally evaluated trends in the number of hospital discharges with a primary diagnosis of VGS-IE among adult patients using the NIS database from 2000 to 2011.

METHODS

Setting

Olmsted County, Minnesota, allows population-based studies given its geographic isolation from other urban centers, as well as a unique medical records linkage system that encompasses all residents of Olmsted County.¹ Our group has previously performed 2 population-based analyses of IE incidence in Olmsted County between 1970 and 2006, in which a total of 150 cases of IE were identified, with an incidence of VGS-IE ranging from 1.7 to 3.5 cases per 100,000 person-years.^{8,9}

Data Collection

The Endocarditis Registry of the Division of Infectious Diseases at Mayo Clinic and the Rochester Epidemiology Project (REP) database were our primary resources for case ascertainment and data collection. The IE registry at Mayo Clinic has been previously described.⁸ The REP database indexes and links diagnostic and procedure information from all sources of health care in Olmsted County into a single centralized system.¹⁰ All Olmsted County residents 18 years or older with definite or possible IE caused by VGS, as defined by the modified Duke criteria, between January 1, 1999, and December 31, 2013, were identified using this system.¹

The NIS is a stratified probability sample developed as part of the Healthcare Cost and Utilization Project (HCUP) funded by the Agency for Healthcare Research and Quality.¹¹ Between 1999 and 2011, the NIS sampled approximately 20% of hospitals, and all discharges from those hospitals were collected, representing more than 95% of the US population. In 2012, the NIS was renamed the National Inpatient Sample and refined its survey design to sample 20% of discharges from all hospitals that participate in the HCUP. Despite this new sampling strategy and its apparent

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