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Invasive Procedures Associated With the Development of Infective Endocarditis

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ABSTRACT

BACKGROUND Various invasive medical procedures might induce bacteremia and, hence, act as triggers for infective endocarditis. However, empirical data in humans on the potential dangers of invasive medical procedures in this regard are very sparse. Due to lack of sufficient data, it is currently debated whether the risk for endocarditis with medical procedures is substantial or rather negligible.

OBJECTIVES The purpose of this nationwide case-crossover study was to quantify the excess risk for infective endocarditis in association with invasive medical and surgical procedures.

METHODS The authors identified all adult patients treated for endocarditis in hospitals in Sweden between January 1, 1998, and December 31, 2011. The authors applied a case-crossover design and compared the occurrence of invasive medical procedures 12 weeks before endocarditis with a corresponding 12-week time period exactly 1 year earlier. The authors considered all invasive nondental medical procedures except for those that are likely to be undertaken due to endocarditis or sepsis or due to infections that could possibly lead to endocarditis.

RESULTS The authors identified 7,013 cases of infective endocarditis during the study period. Among others, several cardiovascular procedures, especially coronary artery bypass grafting; procedures of the skin and management of wounds; transfusion; dialysis; bone marrow puncture; and some endoscopies, particularly bronchoscopy, were strongly associated with an increased risk for infective endocarditis.

CONCLUSIONS This study suggests that several invasive nondental medical procedures are associated with a markedly increased risk for infective endocarditis. (J Am Coll Cardiol 2018;71:2744–52) © 2018 by the American College of Cardiology Foundation.

Infective endocarditis is a relatively rare but life-threatening condition with high mortality and a high incidence of devastating complications among survivors (1,2). Prevention of infective endocarditis is clearly imperative, and therefore, there is a need for identification of possible risk factors.

Various invasive medical procedures might induce bacteremia and, hence, act as triggers for this condition. In animal studies, it is well documented that experimentally induced bacteremia can cause infective endocarditis and that it can be prevented by antibiotic prophylaxis (3,4). However, empirical data in humans on the potential dangers of medical procedures regarding infective endocarditis are very sparse. Evidence is mainly limited to a large number of poorly documented case reports showing a temporal relationship between procedures and infective endocarditis and to a few small case-control studies, which were largely confined to dental procedures (5). Due to lack of sufficient data, it is currently debated

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whether the risk for endocarditis with medical procedures is substantial or rather negligible (5,6). Consequently, the once widespread use of antibiotic prophylaxis before dental and other invasive medical procedures to prevent infective endocarditis has been questioned by recent guidelines (7–11). However, neither these recent nor previous guidelines were based on strong evidence (1).

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As randomized controlled trials are not likely to be performed (10), there is a clear need for large population-based studies to quantify the risk of endocarditis after invasive medical procedures, which could lead to a more evidence-based recommendation on preventive measures such as antibiotic prophylaxis. For example, the American Heart Association called for large case-control studies to better assess the possible risk of infective endocarditis after invasive procedures (9). However, because many conditions could predispose for both medical procedures and endocarditis, and these factors might not be all captured and controlled, the results from such a case-control study are likely to be substantially confounded (9).

In the present study, we analyzed all infective endocarditis cases diagnosed in Sweden over 14 years and assessed the risk of endocarditis in relation to nondental invasive medical procedures. By using a case-crossover design (12), where each patient served as his or her own control, we minimized the risk for unmeasured confounding. Furthermore, by utilizing mandatory registration of hospital admissions and invasive procedures, we also eliminated the possibility of bias due to self-selection or biased recall.

METHODS

RESEARCH DESIGN. We applied a case-crossover design (12,13), which includes only cases of a disease and applies self-matching by comparing exposure before the disease onset with a sample of disease free time in the past as control information to assess relative risks. The case-crossover design is a special case of the traditional matched case-control design, and it also shares features with crossover trials. Today, it is largely considered a standard method to study acute or so-called triggering effects of transient exposures. For example, much of our knowledge on triggering factors for acute myocardial infarction has come from case-crossover studies (14–16).

The main advantage of the design is that due to the within-person comparisons, stable characteristics cannot confound the observed associations in case-crossover studies. For example, several chronic cardiac conditions or lifestyle related factors such as diabetes might predispose individuals for infective endocarditis, and these conditions are also associated with the probability of undergoing an invasive medical procedure (17,18). However, in the case-crossover approach, due to self-matching, such factors are unlikely to confound the association between procedures and risk for infective endocarditis.

ABBREVIATIONS AND ACRONYMS

ICD = International Classification of Diseases

NOMESCO = Nordic Medico-Statistical Committee

STUDY POPULATION. We used the Swedish National Patient Register to identify patients treated at hospital for infective endocarditis. All patients >20 years of age with a primary discharge diagnosis with International Classification of Diseases-10th Revision codes I33, I38, or I39 occurring between January 1, 1998, and December 31, 2011, in Sweden were included. Generally, in Sweden, modified Duke criteria are used for the diagnosis of endocarditis (19,20). For each individual, only the first episode of infective endocarditis was included in the analyses during this period. Exact date for the onset of the disease was not available. We used admission date as a proxy.

INVASIVE MEDICAL PROCEDURES. Both inpatient and outpatient medical procedures performed at hospitals and outpatient clinics are registered in Sweden in the National Patient Register, and linkage is possible to the same individual's previous and subsequent patient records using the Swedish personal identification number.

The National Patient Register has covered the whole country since 1987, but it adopted the NOMESCO (Nordic Medico-Statistical Committee) classification for coding of medical procedures (21), which was used in the present study, on January 1, 1997. For some nonsurgical procedures, the coding system of the Swedish National Board of Health and Welfare was used. Outpatient procedures were available from January 1, 2001.

To avoid reverse causation, we have not investigated procedures, which are more likely to be undertaken due to endocarditis or sepsis than without these conditions. Similarly, to avoid interpretation problems, we have not considered procedures, which are likely to be performed due to infections potentially leading to endocarditis. Procedures not investigated in this study are listed in the Online Appendix. Because only a small fraction of dental procedures in Sweden are performed in hospitals and outpatient clinics and hence recorded in the National Patient Register, these were not investigated. Otherwise, all invasive procedures were the focus of interest in the present study and were included in our analyses.