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Incidence of Healthcare Associated Infections After Lower Extremity Revascularization Using Antibiotic Treatment as a Marker

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WHAT THIS PAPER ADDS

Infrainguinal open vascular procedures are known to be particularly prone to surgical site infections. The ambulatory nature of endovascular procedures poses difficulties in the surveillance of post-operative infections. The present study used antibiotic prescription as a surrogate marker for identifying post-operative infections by cross-matching the national vascular and prescribed drug registers. This is the first large scale study that has looked at healthcare associated infections after both open and endovascular infrainguinal revascularization using antibiotic prescriptions as a surrogate marker for post-discharge infectious complications.

Objective/Background: This register based study aimed to investigate the rate and pattern of healthcare associated infections (HCAI) in patients treated for lower extremity arterial disease, using antibiotic prescription as a surrogate for post-operative HCAI.

Methods: A retrospective analysis of prospectively registered data on all patients treated with primary elective, open or endovascular, surgery for lower extremity arterial disease in Sweden between 2005 and 2010, was carried out. Antibiotic prescriptions were determined for three time periods (6 months pre-operative; 30 day post-operative, and 5 months extended post-operative).

Results: The cohort ($n = 9894$) included patients with claudication (27%, $n = 2659$), critical limb ischemia (rest pain without ulceration; 17%, $n = 1681$), and ulceration/gangrene (56%, $n = 5552$). Fifty-nine percent ($n = 5865$) of the procedures were endovascular interventions. The incidence of 30 day post-operative antibiotic prescriptions was 33% ($n = 3294$). These were comprised of antibiotics for skin and soft tissue infections (67%, $n = 2199$); urinary tract infections (UTIs; 21%, $n = 703$); and respiratory tract infections (12%, $n = 383$). There was a 92% increase in the antibiotic prescription incidence rate for the 1 month post-operative period compared with the pre-operative period ($p < .001$). In the endovascular group, UTI antibiotics dominated the 30 day post-operative period for patients with claudication ($p < .001$).

Conclusion: Antibiotic treatment can be a useful marker for post-discharge surveillance of HCAI in patients with lower extremity arterial disease. The incidence of post-operative HCAI after lower extremity revascularization may have previously been underestimated.

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INTRODUCTION

Post-operative infections in vascular surgery represent a substantial burden of disease and have consequences for both the individual and the community.[1–3] These healthcare associated infections (HCAI) include surgical site infections (SSI) of varying degrees (Szylagyi grade I–III), urinary tract infections (UTI) and respiratory tract infections (RTI), causing considerable morbidity and prolonged hospital stay.[1] Groin incisions and the preponderance of diabetes in patients undergoing infrainguinal vascular procedures make this group particularly susceptible to the development of HCAI.[2,4,5] Percutaneous endovascular procedures have largely eliminated the risk of SSI.[6] However, the ambulatory nature of endovascular procedures poses difficulties in the surveillance of post-operative infections. Furthermore, some infectious complications after open procedures are diagnosed and treated after discharge from hospital. A substantial fraction of these HCAI are diagnosed and treated on an outpatient basis, often by general practitioners and therefore not always recorded in vascular registries. The feasibility and validity of antibiotic prescriptions as a surrogate marker for the incidence of post-operative infections in a population has been demonstrated previously.[7–9]

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The aim of the present study was to investigate the rate and pattern of HCAI and related risk factors in patients treated for lower extremity arterial disease on a national basis using antibiotic prescription as a surrogate marker for post-operative HCAI.

METHODS

Study population

All patients who underwent non-emergent primary infrainguinal surgery, open or endovascular, for lower extremity arterial disease, on a national basis between 2005 and 2010, were included in the study. Only the first procedure for each patient was included in the analysis. Events with incomplete date of surgery or hybrid events with combined endovascular and open surgery were excluded.

The study was approved by the local ethics committee.

Data sources

National quality registries, including the Swedish National Registry for Vascular Surgery (Swedvasc), the Swedish National Patient Register (NPR), and the Prescribed Drug Register (PDR), were used as data sources to collect information about patients who have undergone lower extremity revascularization, as well as to collect data on demographics, infections, and prescribed antibiotics during the study period. The subjects' Civic Registration Numbers (CRN), which are registered at every contact with the health authorities, facilitated the cross-matching of data between different databases. Since 1994, when the Swedvasc registry was established on a national basis, it has been continuously updated and improved to include all vascular procedures. Owing to the increasing number of endovascular interventions the registry underwent a major revision in May 2008 and became known as Swedvasc 2.0. A total of 34 hospitals, ranging from smaller county hospitals to university hospitals, covering all major population centers have contributed to the database. The external validity of Swedvasc has been shown to be >90%.[10] All contacts with healthcare providers, whether hospitals or community care providers, are registered in the NPR. According to a recent report, the rate of missing main diagnosis codes was 0.9% for hospital admissions and 10% for primary care contacts.[11]

In Sweden, antibiotics can only be obtained through a medical prescription at certified pharmacies. Starting in 2005, the PDR contains data (type, dose, total amount, and time) on all dispensed prescriptions, on an outpatient basis, and is linked to the CRN, providing basic demographic data such as age and sex. Drugs prescribed and administered in hospital are not included in the register.

Study data

Data regarding demographics, presenting symptoms, comorbidities, types of procedure, and follow up visits at 30 days and 1 year were collected from Swedvasc. These data were subsequently cross-matched with the PDR to determine the type and number of antibiotic prescriptions per patient during the study period.

Data regarding antibiotic prescriptions were collected from the PDR for a 6 month period leading up to the index operation and a 6 month period after the operation for each patient. The post-operative prescription data were further divided into two groups; the first pertaining to the 1 month period after the operation and the second to the remaining 5 months.

The antibiotics were classified into three categories based on their main therapeutic indications. This classification was aided using the Anatomical Therapeutic Chemical Classification (ATC, 2006). The three groups were as follows: antibiotics used primarily for treatment of skin and soft tissue infections (β-lactamase-resistant penicillins and lincosamides; ATC codes J01CF and J01FF, respectively); antibiotics used primarily for UTI (pivmeccillinam, sulfonamides and trimethoprim, flouroquinolones, and nitrofurantoin derivatives; ATC codes J01CA 08, J01E, J01MA and J01XE, respectively); and those used primarily for RTI (antibacterial glycopeptides and methenamine; ATC codes J0X1A, J01X and J01XX05, respectively).

Patient comorbidities included diabetes mellitus (all types), hypertension, renal insufficiency (serum creatinine $>$ 150 µmol/L), cerebrovascular disease (history of stroke, transient ischemic attack or major neurological deficit), heart disease (history of myocardial infarction, angina pectoris, heart failure, or previous coronary intervention), lung disease (chronic obstructive pulmonary disease), and smoking (history of smoking within 5 years of index procedure). The only discrepancy between Swedvasc 1.0 and 2.0 concerning the definitions of the above risk factors was the omission in Swedvasc 2.0 of atrial fibrillation from heart disease.[6]

The patients were divided into three diagnostic categories based on the severity of lower extremity symptoms: claudication, critical limb ischemia (CLI; rest pain without wound/gangrene) and gangrene.

The operative methods comprised open surgical and endovascular procedures. The open surgical methods included groin thrombo-endarterectomy (TEA), encompassing the common femoral, deep femoral, and proximal superficial femoral arteries, and bypass surgery using autogenous vein or synthetic grafts. The endovascular interventions included percutaneous transluminal angioplasty, subintimal angioplasty, and implantation of stents/stent grafts. The guidelines for administration of prophylactic antibiotics in open procedures nationwide range, in general, from one to three doses of cloxacillin (2 g intravenously [IV]) and in case of penicillin allergy, clindamycin (600 mg IV three times). As there are no national guidelines pertaining to the administration of prophylactic antibiotics for endovascular procedures, the use of such prophylaxis remains discretionary.

Statistical analysis

Groups were compared based on time period, indication for treatment, operative method, and absence/presence of risk