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Major article

Surgical site infections after hip arthroplasty in Norway, 2005-2011: Influence of duration and intensity of postdischarge surveillance

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Background: Most surgical site infections (SSIs) after hip arthroplasty are detected after a patient is discharged from hospital, making postdischarge surveillance (PDS) an important component in surveillance systems. We investigated how long it was necessary to monitor hip arthroplasty patients for SSIs after hospital discharge and if passive PDS through readmissions could replace active PDS by patient questionnaire in detecting SSIs.

Methods: We used data from the Norwegian surveillance system from 2005-2011, which has active 1-year PDS, to investigate proportions of SSIs found at different time intervals after surgery and whether these SSIs could have been detected through passive PDS by investigating the proportion of patients with SSIs that were readmitted.

Results: We found that 79% of all SSIs and 82% of deep SSIs were detected after hospital discharge. 95% of deep SSIs were detected within 90 days after surgery. 14% of the deep SSIs were detected beyond 30 days after surgery, and all of these patients were readmitted because of their SSI and thus could have been detected by passive PDS.

Conclusions: Our data suggest that most deep SSIs are detected within 90 days and that passive PDS beyond 30 days after surgery may replace active PDS without reducing sensitivity.

Many countries have successfully implemented comprehensive surveillance systems for surgical site infections (SSI) in past decades. With a continuing trend toward a shorter length of hospital stay, postdischarge surveillance (PDS) is increasingly important to get a more comprehensive picture of the SSI burden.

PDS methods differ in both intensity of case finding and duration of follow-up.[1] The intensity of case finding is often described as either active or passive PDS. Active PDS is resource-demanding because the hospital must contact all patients after discharge. Passive PDS entails the hospital only getting information about SSI status among readmitted patients, and thus there is a risk of missing cases treated by other health care providers. The intensity of case-finding has varied between studies and surveillance systems and active PDS is performed in a multitude of ways. The norm for PDS duration has until now been 1 year following implant surgery and 30 days following other kinds of surgery as defined by the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN)[2] and the European Centre for Disease Prevention and Control (ECDC).[3] From 2014 NHSN reduced the PDS duration from 1 year to 90 days after hip arthroplasty.

With the introduction of electronic health records, it is alluring to rely on data that already exist in the hospital information system.[4-7] The balance between the wish for high quality data and the resource demands of diligent PDS is the focus of this study. Using data from the Norwegian Surveillance System for Antibiotic Consumption and Healthcare-Associated Infections (NOIS), we try to answer 2 questions: For how long is it necessary to follow-up hip arthroplasty patients for SSIs after surgery? and, Can passive PDS be used in lieu of active PDS to detect SSIs?

METHODS

The NOIS SSI module was established in 2005 by regulation[8] and we have earlier reported in detail on the rationale and

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functioning of the system.[9,10] NOIS is based on the ECDC surveillance protocol[3] and the American NHSN methodology and definitions,[2,11] and is unique in that it is a mandatory system, relies heavily on automated data collection, and has active PDS. Although participation in NOIS is mandatory, the hospitals choose which procedures to report on from a prioritized list. Hip arthroplasty has third priority behind coronary artery bypass graft and cesarean section. Hospitals may submit more data than the minimum requirement of the 2 highest-priority procedures, and many do. Data are collected for September-November each year.

There are many methods with different merits for detecting and classifying SSIs that manifest after hospital discharge. PDS is generally defined as active if the hospital makes an effort to ascertain a patient's infection status independently of information that is already available in the hospital records. With passive PDS the hospital relies on in-hospital sources, such as readmission information, to detect infections after discharge. In our study we compared 1 year of active PDS by patient questionnaire confirmed by a physician, with passive PDS through readmissions as methods for detection of SSIs after hospital discharge. Patients were contacted by a questionnaire sent from the hospital 30 days after surgery and an additional questionnaire sent after 1 year. Nonresponders are sent reminders and receive telephone follow-up. SSIs for nonhospitalized patients are confirmed and classified by a physician, either the patient's general practitioner or at an outpatient clinic. A modified version of the SSI definitions is printed on the reverse side of the patient questionnaire for classification purposes. A patient's self-diagnosed infections are not included in this study. Data on SSI status are recorded at 3 postoperative intervals: discharge, 30 days, and 1 year after implant surgery.

NOIS applies the epidemiologic definitions from CDC/ECDC.[2,3] In our study we categorized SSIs as either superficial or deep (ie, includes deep incisions and organ/space involvement). Only data on deep SSIs are collected beyond 30 days. In NOIS, we additionally register whether a patient has been readmitted (with or without a reoperation) due to an SSI within 30 days and within 1 year of surgery. A readmission due to SSI is defined by the NOIS protocol as the surgical procedure under surveillance leading to an SSI that requires readmission. Whether the readmission is due to the SSI in question is determined by a physician. This provides us with the opportunity to investigate whether an SSI could have been detected solely by the patient being readmitted to hospital (ie, passive PDS).

In our study, we included data on all primary total hip arthroplasties and hemiarthroplasties of the hip as defined by the Nordic Medico-Statistical Committee's Classification of Surgical Procedures[12] from hospitals that have submitted 1-year follow-up data to NOIS for the years 2005-2011. We calculated SSI rates and the proportion of SSIs detected before and after hospital discharge and at different postoperative time intervals. We also calculated sensitivity with 95% confidence intervals (CIs) (adjusted Wald) with active and passive PDS at different postoperative time intervals. By SSI rate we mean the cumulative proportion of patients who develop an SSI within a given time interval after surgery. Sensitivity was estimated by dividing SSIs detected using different PDS strategies by SSIs detected with active PDS for 1 year by patient questionnaire. Only deep SSIs are included when calculating sensitivity because superficial SSIs are not included beyond 30 days.

The NOIS regulations govern the collection, collation, storage, and use of data; the submission of data to the Norwegian Institute of Public Health; as well as the responsibilities and duties of the hospital trusts and various authorities. Because NOIS is a national health register governed by a separate act, patient consent is not required.[8]

RESULTS

The NOIS national database includes 12,928 primary hip arthroplasties from 54 hospitals for the years 2005-2011. We included data from the 29 hospitals that submitted 1-year follow-up data. Twenty-eight hospitals submitted data on total hip arthroplasties and 22 submitted data on hemiarthroplasties of the hip. We excluded 10 nonclassifiable records, leaving 6,528 hip arthroplasties, 4,893 total hip arthroplasties, and 1,635 hemiarthroplasties of the hip. Follow-up was complete for 96% of patients at 30 days and 87% at 1 year according to our definition.[9] SSIs were identified in 233 patients, for whom 15 had missing infection dates. Of 15 SSIs with missing infection dates—12 superficial and 3 deep—were detected after hospital discharge and were reported at the 30-day follow-up. Of 218 SSIs with valid infection dates 131 (60%) were deep, and 113 (86%) of these were detected within 30 days of surgery and 18 (14%) between 31 days and 1 year.

Figure 1 shows the number and percentage of superficial and deep SSIs detected at different postoperative time intervals for total hip arthroplasties and hemiarthroplasties of the hip. The SSIs following total hip arthroplasty peak earlier than following hemiarthroplasty of the hip. Ninety-two percent of all SSIs were detected within 30 days and 95% were detected within 90 days after surgery. The proportion of deep SSIs is larger for hemiarthroplasty of the hip (73%) than for total hip arthroplasty (46%). The median time to infection was 16 days for all SSIs, and 17 days for deep SSIs. The median postoperative length of stay was 6 days for total hip arthroplasty and 7 for hemiarthroplasty of the hip. We observed a reduction in the median postoperative length of stay from 7 (2005-2008) to 5 (2009-2011) days for total hip arthroplasty and from 8-6 days for hemiarthroplasty of the hip.

Table 1 shows the number of SSIs and the SSI rate during inpatient stay and after discharge and the number and percent of the SSIs detected by passive PDS (ie, because of readmission). The overall SSI rate was 3.6%. The rate was higher among hemiarthroplasties of the hip than total hip arthroplasties for deep SSIs. Seventy-nine percent of all SSIs were detected after hospital discharge, and 82% of the deep SSIs were detected after discharge. The proportion of deep SSIs detected after discharge increased from 79% in 2005-2008 to 85% in 2009-2011. Ninety-four (85%) of the deep and 9 (12%) of the superficial SSIs after hospital discharge could have been detected by passive PDS. The SSI rate for deep SSIs that could have been detected with passive PDS was 1.0% for total hip arthroplasties and 2.8% for hemiarthroplasties of the hip.

Table 2 shows the SSI rates and sensitivity of different case finding strategies for deep SSIs compared with active PDS by patient questionnaire for 1 year. The sensitivity varies from 0.18 by inpatient surveillance only to 1.00 by a combination of active and passive PDS. The sensitivity of passive PDS for 1 year is 0.85 compared with active PDS for 1 year. Of the SSIs that were detected within 30 days of surgery, 94 (83%) were readmitted due to SSI and could have been detected by passive PDS. All 18 deep SSIs that were detected between 31 days and 1 year were readmitted, 11 of these within 90 days. In total, 124 (95%) of the deep SSIs were detected within 90 days of surgery.

DISCUSSION

In our study of SSIs after primary hip arthroplasty in Norway, we found that 79% of all SSIs and 82% of deep SSIs were detected after hospital discharge. Almost all SSIs were detected within 90 days after surgery. Only 14% of the deep SSIs were detected beyond 30 days, and all of these patients were readmitted because of their SSI and thus could have been detected by passive PDS. Active PDS for the first 30 days and passive PDS thereafter achieved the same