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Thirteen years of surgical site infection surveillance in Swiss hospitals

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SUMMARY

Background: Surveillance is an essential element of surgical site infection (SSI) prevention. Few studies have evaluated the long-term effect of these programmes.
Aim: To present data from a 13-year multicentre SSI surveillance programme from western and southern Switzerland.
Methods: Surveillance with post-discharge follow-up was performed according to the US National Nosocomial Infections Surveillance (NNIS) system methods. SSI rates were calculated for each surveyed type of surgery, overall and by year of participation in the programme. Risk factors for SSI and the effect of surveillance time on SSI rates were analysed by multiple logistic regression.
Findings: Overall SSI rates were 18.2% after 7411 colectomies, 6.4% after 6383 appendicectomies, 2.3% after 7411 cholecystectomies, 1.7% after 9933 herniorrhaphies, 1.6% after 6341 hip arthroplasties, and 1.3% after 3667 knee arthroplasties. The frequency of SSI detected after discharge varied between 21% for colectomy and 94% for knee arthroplasty. Independent risk factors for SSI differed between operations. The NNIS risk index was predictive of SSI in gastrointestinal surgery only. Laparoscopic technique was protective overall, but associated with higher rates of organ-space infections after appendicectomy. The duration of participation in the surveillance programme was not associated with a decreased SSI rate for any of the included procedure.
Conclusion: These data confirm the effect of post-discharge surveillance on SSI rates and the protective effect of laparoscopy. There is a need to establish alternative case-mix adjustment methods. In contrast to other European programmes, no positive impact of surveillance duration on SSI rates was observed.

Introduction

Surgical site infection (SSI) constitutes a major complication after surgery. According to the type of surgical procedure, it may affect from <1% to >20% of operated patients.[1–3] Overall,

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it corresponds to one of the most frequent healthcare-associated infections (HCAIs), ranking first, when asymptomatic urinary tract infection is not taken into account.[4] SSI is associated with prolonged hospital stay, enhanced costs and death.[5,6] Following the US landmark study on the efficacy of nosocomial infection control (SENIC study), surveillance has become an essential part of SSI prevention.[6–9] During the past three decades various European countries have initiated surveillance programmes for SSI control, aiming at lowering infection rates by providing reliable estimates to hospitals and surgeons. Some of these programmes published encouraging results, showing trends towards decreased SSI rates over time, at least for some operations.[10–13]

From 1998 to 2010, a network of hospitals in western and southern Switzerland participated in a surveillance programme for SSI, before joining in 2011 a new nationwide programme developed by the Swissnoso consortium (www.swisnosso.ch). This study presents data from this first Swiss multicentre programme, including SSI rates by procedure and their temporal trends during a 13-year period.

Methods

Participants and data collection

In March 1998, six Swiss public hospitals initiated a surveillance programme for SSI based on voluntary participation. In December 2010, they had been progressively joined by others and the programme totalled 23 hospitals, including two university hospitals that had joined in 1998 and 2008, respectively. Each participating hospital could choose among four gastrointestinal surgical procedures (appendicectomy, cholecystectomy, herniorrhaphy, colon surgery) and, since 2002, two orthopaedic procedures (first elective hip and knee arthroplasties). The programme was developed according to the principles of the US National Nosocomial Infections Surveillance (NNIS) system, currently known as the National Healthcare Safety Network (NHSN).[14,15]

Demographic and clinical data were prospectively collected in each hospital by trained infection control nurses during hospital stays and post discharge by means of standardized telephone interviews at one month, and at one year for hip and knee arthroplasty. Treating physicians were contacted for complementary information in case of suspicion of SSI. Any suspected or unclear case was discussed with infectious disease physicians for confirmation of SSI according to the Centers for Disease Control and Prevention (CDC) definitions.[16,17]

Data were entered in each hospital into the Epi-Info software (World Health Organization, Geneva, Switzerland, and CDC, Atlanta, GA, USA) and sent annually to a data centre where statistical analyses were performed with the SAS software (SAS Institute, Cary, NC, USA). Yearly reports on each surgical procedure, including crude rates and inter-hospital comparisons by relative risks and adjusted odds ratios for the NNIS risk index, were sent within nine to 12 months to the persons in charge of the surveillance programme in every hospital. The reports were discussed in hospitals with infection control committees and surgeons. The necessity to implement or reinforce preventive measures was left to the hospitals' discretion. These measures were not registered in the surveillance system.

Statistical analyses

Annual and cumulative SSI rates were calculated for each surgical procedure. Cumulative rates were stratified by type of SSI (superficial incisional, deep incisional, and organ/space) and by NNIS index categories.[15]

Risk factors for SSI were identified in univariate analyses by using the whole dataset for each surveyed procedure and by using Fisher's exact test, χ^2-test, *t*-test, or Wilcoxon test as appropriate. They included patients' characteristics [sex, age, American Society of Anesthesiologists (ASA) score, delay from admission to operation] and characteristics of the procedure (contamination class, duration of the intervention compared with the time 'T' as defined in the NNIS system, emergency procedure, antibiotic prophylaxis <1 h before incision, laparoscope use, multiple procedures during the intervention, re-intervention within the follow-up period for non-infectious complications).[15] Adjustment for confounding factors was done by entering all variables with $P \leq 0.2$ as covariates in logistic regression models developed for each surgical procedure.

In order to estimate the effect of surveillance time on SSI rates, the duration of participation in the surveillance programme for every procedure was determined for each hospital, as in the study by Manniën *et al.*[11] The surveillance time from the first year of participation to the registered operation was then stratified in one-year periods. The association between surveillance duration and SSI was estimated by using logistic regression models developed for each surveyed procedure and adjusting for all variables with $P \leq 0.2$ in univariate analysis.

Analyses were performed using SAS System, Version 9.2 (SAS Institute, Cary, NC, USA). $P \leq 0.05$ was considered significant. All tests were two-tailed.

Results

Table I shows the characteristics of the study population, by surgical procedures. The cumulative SSI rates varied from 1.3% after knee arthroplasty to 18.2% after colectomy. With the exception of appendicectomy, most of these SSIs were superficial incisional. There was a clear increase in SSI rates across the NNIS index risk categories in gastrointestinal surgery, but not in hip and knee arthroplasties. The follow-up at one month for gastrointestinal surgery, and at one year for arthroplasties, had been completed for $\geq$95% of the patients. In all interventions but colectomy, most SSIs were detected after discharge.

Table II shows the independent risk factors for SSI. Irrespective of other risk factors, the laparoscopic technique constituted a protective factor for SSI in the four gastrointestinal surgery procedures, as the administration of antibiotic prophylaxis within 1 h before incision for cholecystectomy, colectomy, and herniorrhaphy. Laparoscopy was nevertheless significantly associated with organ/space SSIs after appendicectomy (adjusted odds ratio: 1.372; 95% confidence interval: 1.002–1.879). Antibiotic prophylaxis was administered within 1 h before incision in 53% of laparoscopic cholecystectomies; it was associated with a lower rate of SSI after these interventions (SSI rate: 45/4277, 1.1% vs 91/3804, 2.4%; $P < 0.0001$). Thirty-eight percent of patients undergoing hernia repairs without mesh received antibiotic prophylaxis, but