ORIGINAL ARTICLE

Impact of a surgical site infection (SSI) surveillance program in orthopedics and traumatology

C. Mabit a,∗, P.S. Marcheix a, M. Mounier b, P. Dijoux a, N. Pestourie b, P. Bonnevalle c, F. Bonnomet d, The French Society of Orthopaedic Surgery, Traumatology (SOFCOT)1

a Department of Orthopaedic Surgery and Traumatology, Dupuytren Teaching Hospital Center, 42, avenue Martin-Luther-King, 87042 Limoges, France
b Hospital Hygiene Unit, Dupuytren Teaching Hospital Center, 42, avenue Martin-Luther-King, 87042 Limoges, France
c Toulouse Teaching Hospital Center Musculoskeletal Institute, Purpan Traumatology Unit, place Baylac, 31052 Toulouse cedex, France
d Department of Orthopaedic Surgery and Traumatology, Strasbourg University Hospital, Hautepierre Hospital, avenue Molière, 67098 Strasbourg cedex, France

Accepted: 22 June 2012

KEYWORDS
Surgical site infection; Infection control; Nosocomial infections

Summary Surveillance of surgical site infections (SSI) is a priority. One of the fundamental principles for the surveillance of SSI is based on receiving effective field feedback (retro-information). The aim of this study was to report the results of a program of SSI surveillance and validate the hypothesis that there is a correlation between creating a SSI surveillance program and a reduction in SSI.

Materials and methods: The protocol was based on the weekly collection of surveillance data obtained directly from the different information systems in different departments. A delay of 3 months was established before extraction and analysis of data and information from the surgical teams. The NNIS index (National Nosocomial Infections Surveillance System) developed by the American surveillance system and the reduction of length of hospital stay index Journées d’hospitalisation évitées (JHE).

Results: Since the end of 2009, 7156 surgical procedures were evaluated (rate of inclusion 97.3%), and 84 SSI were registered with a significant decrease over time from 1.86% to 0.66%. A total of 418 days of hospitalization have been saved since the beginning of the surveillance system.

This study was presented at the 86th SOFCOT meeting in Paris, November 2011.

∗ Corresponding author.
E-mail address: ch-mabit@unilim.fr (C. Mabit).
1 SoFCOT, 56, rue Boissonade, 75014 Paris, France.

1877-0568/$ - see front matter © 2012 Elsevier Masson SAS. All rights reserved.
doi:10.1016/j.otsr.2012.08.001
Introduction

Surveillance of surgical site infections (SSI) is a national priority (section L.711-1 of France’s Public Health Code) for the fight against nosocomial infections (NI). These complications can have serious consequences on morbidity and mortality while also increasing costs. Based on the studies by Condon et al. [1] and Haley et al. [2], one of the fundamental principles for the surveillance of SSI involves receiving effective feedback (retro-information) when infections develop, in particular SSI.

The aim of this study was to review the structural bases of SSI surveillance and report the experience at the Dupuytren University Hospital Center (CHU Dupuytren) which began a SSI surveillance program in 2002 managed by the Hospital Hygiene Unit, and to validate the hypothesis that there is a correlation between creating a SSI surveillance program and a reduction in SSI.

Materials and methods

A "registry of nosocomial infections" was created in accordance with a ministerial decree dated 6th February, 2006. The goal was to encourage all healthcare establishments to measure their actions and results in the fight against nosocomial infections, which are now called healthcare associated infections because transmission can occur outside the hospital setting [3]. Assessment indicators had to be defined for this approach: the first was "the global indicator of activities in the fight against nosocomial infections" (French acronym: ICALIN); followed by "the indicator for the volume of psychoalcoholic products consumed" (French acronym: ICSHA), then the "indicator for SSI surveillance" (French acronym: SURVISO, Fig. 1) which is a reference to determine the implementation of activities and not results, and finally the "global index of the correct use of antibiotics" (French acronym: ICATB).

To facilitate analysis of this registry based on these four indicators, a "total score" of 100 was created. The relative weight of each indicator was set as follows: ICALIN 40%; ICSHA 30%; ICATB 20%; SURVISO 10%. The healthcare facility is classified (from A to E) depending upon the result of this total score, and can be compared to other facilities in its category.

The methodology used for the surveillance of SSI at the CHU Dupuytren was based on that proposed by the Network for the Warning, Investigation and Surveillance of Nosocomial Infections (Réseau d’alerte, d’investigation et de surveillance des infections nosocomiales [RAISIN]) which compiles data from interregional surveillance networks (CCLIN) [4]. This approach, which was initiated and managed by the Hospital Hygiene Unit (Unité d’hygiène hospitalière [UHH]) received the support of all the surgical teams: in 2002, it was first implemented in several "pilot" programs and it has been operational in the department of orthopedics and traumatology for more than 2 years [5].

The protocol is based on the weekly collection of surveillance data by the UHH, (age, gender, entry/release date, CCAM code, class, ASA score, duration of surgery, urgency, multiple procedure, biological samples, germ, antibiogram) obtained directly from the different information systems in our hospital (administration, operating room, bacteriological laboratory). At first, data was collected 3 weeks after surgery, because according to RAISIN data three out of four infections are identified within 15 days after surgery. However, this delay is 3 months for orthopedics-traumatology which corresponds to the mean postoperative follow-up evaluation date (in particular for planned surgery). Thus, each surgeon received the list of surgical procedures he/she had performed 3 months before for validation: this list included any existing microbiological data related to SSI for information purposes. Data were then exploited using Epilinfo® (version 6.04df) software. Every semester global results were sent to all surgeons and the specific results for each unit were only sent to the surgeons from that unit; a surgeon could obtain an individual report of his/her operations upon request (or they could be obtained for the purposes of the study).

The data in the surgical file could be applied to each specialization. For the SOFCOT symposium, we integrated the traumatology codes so that these SSI could be extracted from the global activity. We also integrated the National Nosocomial Infections Surveillance System (NNIS) index developed by the American surveillance system [6,7] and the reduction in hospital days index Journées d’hospitalisation évitées (JHE) [5].

The NNIS index is an indicator of severity based on the classification of surgical procedures by Altemeier et al. [8], the ASA score and the length of surgery. In our practice, surgical procedures were usually classified as type I and the length of the procedure was based on a simplified score (0 for less than 2 hours; 1 for more than 2 hours).

The JHE index is based on the hypothesis that without surveillance the SSI rate in year (n) will be the same as that of the year before (n-1): to obtain this figure the number of SSI that were prevented must be known [number of surgical procedures/year (n) × rate of SSI/year (n-1) – number of SSI/year (n)] and the increase in the mean length of hospital stay (DMS) [mean DMS with SSI (n) – mean DMS without SSI/year (n)]. Thus, calculations were based on the formula:

**Discussion:** Our surveillance system has three strong points: follow-up is continuous, specifically adapted to orthopedic traumatology and nearly exhaustive. The extraction of data directly from hospital information systems effectively improves the collection of data on surgical procedures. The implementation of a SSI surveillance protocol reduces SSI.

**Level of evidence:** Level III. Prospective study.

© 2012 Elsevier Masson SAS. All rights reserved.
Figure 1  Organization of SSI surveillance.

Figure 2  Progression of the percentage of SSI: global results in orthopedics and traumatology.

Figure 3  Progression of SSI: traumatology results (based on criteria from the 2011 Sofcot symposium).
Surgical site infection surveillance program

Figure 4  Correlation between NNIS index and SSI.

JHE = number of SSI prevented × increase in DMS. The extra cost created by SSI could thus be evaluated.

Results

Since surveillance of orthopedic traumatology began at the end of 2009, 7156 surgical procedures have been evaluated. The inclusion rate is 97.3%.

Patient data

Between 2009 and 2011 the mean age of patients has not changed (55.4 years old; median 56) and (55.8 years; median 56) respectively; the gender ratio was 1.13.

SSI Data

Eighty-four SSI have been registered in 2 years, with a significant decrease over time from 1.86% to 0.66% (Figs. 2–4). The mean age of infected patients was 58 years old, and they were mostly men (gender ratio 1.6). The SSI rate was strongly correlated to the NNIS severity score.

Hospital stay data

Most hospital stays were conventional hospitalizations (for the moment the study does not include day surgery; the DMS was 6.6d (median: 3d) with a significant increase in the DMS when a SSI occurred. The JHE went from 164d in 2010 to 254d
for the first 9 months of 2011 (Fig. 5). A total of 418 days of hospitalization were saved since the surveillance system has begun.

Bacteriological data

_Staphylococcus aureus_ (41.7%) was the most frequent germ (Fig. 6).

Receiving retro-information

Receiving retro-information was systematically correlated to a downturn in the curve for the occurrence of SSI (Fig. 7).

Discussion

Since the princeps studies by Condon et al. [1] and Haley et al. [6], it is now accepted that creating a SSI surveillance system effectively reduces the incidence of SSI. These programs have been implemented in France [4,9] and Europe [10–13] since 1998. Very few studies have specifically evaluated orthopedics and traumatology and in France, the Hospital Cochin is the only team to have proposed a SSI surveillance protocol in 2007 based on a 2-year study [14].

Our surveillance system has three strong points: follow-up is continuous and non-sequential as suggested by RAISIN (over 3–6 months or based on at least 100 procedures) and it is nearly exhaustive as well as being specifically adapted to orthopedic traumatology. The extraction of data directly from hospital information systems effectively improves the collection of data on surgical procedures. Theoretically, a SSI could be missed due to a lost to follow-up patient or a late declaration: in this case, a secondary declaration by the surgeon can be validated and the SSI can be "recovered".

The global decrease in the rate of SSI in orthopedics-traumatology in our institution is fairly comparable to that of other surgical specializations (evaluated since 2002) and that reported by Rioux et al. who observed a decrease of 3.8% to 1.7% in 6 years [9].

The bacteriological warning was correlated to the SSI in 78.6% of cases, but in 18 cases (4.5%) the SSI was reported without a bacteriological warning.

The DMS is increased in patients with an SSI: in a statistical model, Graves et al. estimated that the DMS was multiplied by 2.5 [15]. This parameter is a key factor to determine the cost increases associated with SSI [15–17]. We included this item to evaluate the number of JHE, which we felt was better adapted to clinical reality than simply calculating costs.

Although the collection of clinical or technical data can be refined and developed (new parameters can be introduced into the study...), this list should remain simple to use so that surgical teams will continue to endorse it.

The implementation of a SSI surveillance system must now be included in the arsenal of "technical means" that are usually used to study surgical site parameters (washing hands, surgical environment...) [18–20]. The weight of the system of surveillance in the total score including all the indicators in the register of healthcare associated infections seems highly under-evaluated (10%) in relation to its efficacy and compared to the ICSHA indicator (30%).

![Microbiological data](image1.png)

Figure 6 Microbiological data.

![Progression of SSI according to seasons and feedback information (FBI).](image2.png)

Figure 7 Progression of SSI according to seasons and feedback information (FBI).
Conclusion

The implementation of a SSI surveillance protocol reduces SSI and is a tool that is available to hospital units: it is an essential element when organizing the follow-up of patients (RMM) with SSI in relation to the evaluation of professional practices (EPP). Organization of a SSI surveillance protocol makes it possible to participate in the national surveillance network (RAISIN) and does not require any extra work.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References