Computer-enhanced surveillance of surgical site infections: early assessment of a generalizable method for French hospitals

B. Leclère[1], C. Lasserre[1], C. Bourigault[1], ME. Juvin[1], MP. Chaillet[2], M. Hanf[3], J. Caillon[1,4], D. Lepelletier[1,4]
[1] Bacteriology and Hygiene Department, [2] Medical Information Department, [3]Clinical Investigation Center, Nantes University Hospital, France, [4]University of Nantes, EA 3826, Medical School, Nantes, France
didier.lepelletier@chu-nantes.fr

UNIVERSITÉ DE NANTES

CENTRE HOSPITALIER UNIVERSITAIRE DE NANTES

eP024

Introduction

Standard data from hospital information systems are easily available and their management can be rapidly completed by the significant progress in computer technology in the last decades. **This allows many aspects of routine surveillance of health care-associated infections to be enhanced or automatized**, including cluster detection, quality assessment and risk factor identification.

Infection control professionals may therefore spend their time more efficiently, focusing on prevention and education. The aim of the present study was to **evaluate the performance of a generally applicable method for surgical site infection detection** using different databases available routinely in the medical information system of the Nantes University hospital during a two-year period 2010-2011.

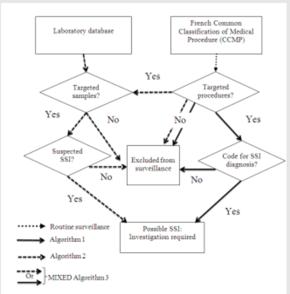
Materials and Methods

Surgical procedures were identified by the French Common Classification of Medical Procedure (CCMP) codes that are recorded in the hospital's medical activity database. The list of patients was monthly transmitted to the infection control team by the Medical Information Department. Then, infection control nurses or practitioners systematically reviewed the computerized medical records to monthly detect SSIs (operative report, medical discharge letter, bacteriological results, post-discharge consultation letter, *etc.).*

Table 1. International Classification of Diseases (ICD-10) codes used for surgical site infection detection according to the targeted procedures.

Surgery procedure	ICD-10 codes	
Cesarean section	T81.4	Infection following a procedure
	O86.0	Infection of obstetric surgical wound
Neurostimulator implantation	T81.4	Infection following a procedure
	T85.7	Infection and inflammatory reaction due to other internal prosthetic devices, implants and grafts
Urinary sphincters implantation and kidney transplantation	T81.4	Infection following a procedure
	T83.5	Infection and inflammatory reaction due to prosthetic device, implant and graft in urinary system
Coronary artery bypass grafting and valve replacement	T81.4	Infection following a procedure
	T81.38	Disruption of operation wound
	T82.7	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts
	T82.6	Infection and inflammatory reaction due to cardiac valve prosthesis
Colectomy	T81.4	Infection following a procedure
	K65.0	Acute peritonitis
	K65.8	Other peritonitis
	K65.9	Peritonitis, unspecified
Primary total knee or hip arthroplasty	T81.4	Infection following a procedure
	T81.38	Disruption of operation wound
	T84.5	Infection and inflammatory reaction due to internal joint prosthesis
	T84.7	Infection and inflammatory reaction due to other internal orthopedic prosthetic devices, implants and grafts

Each suspicion of SSI needed to be confirmed by the infection control practitioners or surgeons who operated the patient**.** We considered this prospective routine surveillance as the reference method (gold standard) to **assess the performance tests of electronic surveillance algorithms using two electronic data sources: microbiological results and medical activity**. Post-hospital surveillance was performed to detect SSI within 30 days or one year using standard definition.



Three algorithms were tested to retrospectively identify SSIs in patients with surgical procedures. Algorithm 1 relied solely on the PMSI database. According to the surgical procedures, relevant ICD-10 codes were selected to detect SSI cases (Table 1). Algorithm 2 was performed using the laboratory database. All cultures (negative and positive) from superficial or deep samples and blood cultures were used to detect SSIs within one month or one year (for surgical procedures with implants or invasive devices) after surgical procedures, respectively. Algorithm 3 was performed combining data from algorithms 1 and 2. The three algorithms are summarized in the figure on the left.

Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated with the corresponding 95% confidence interval for each of the three algorithms. Specific statistics and results were also estimated and stratified according to the SSIs depth.

Results

Table 2. Number of surgical site infections detected by the routine surveillance and number of possible infections using two different databases.

Surgical procedures		Routine surveillance (Gold standard)		Algorithms		
Type	Number	Superficial SSIs	Deep SSIs	1	2	3
CABG and valve replacement	2259	0	27	47	270	294
Colectomy*	196	3	9	33	28	29
PTHA	506	0	11	8	48	49
PTKA	278	0	4	4	17	17
Kidney transplantation	293	4	26	13	57	63
Urinary sphincter implantation	179	2	3	1	9	10
Neurostimulator implantation	149	6	3	0	11	11
C-section	540	14	0	4	11	11
TOTAL	4400	29	83	113	451	484

* Colectomy with immediate reestablishment of the digestive continuity, excluding emergency situations. C-section: cesarean section; CABG: Coronary artery bypass grafting; PTHA: primary total hip arthroplasty; PTKA: primary total knee arthroplasty. Algorithm 1 was performed by matching the data collected with the 10th revision of the International Classification of Diseases (ICD-10) codes and the CCMP codes; Algorithm 2 was performed by matching the data collected by the laboratory database and the CCMP codes; Algorithm 3 was performed by combining algorithms 1 and 2.

Table 3. Performance analysis for electronic surveillance of surgical site infections according to the data sources and infection depth, Nantes University Hospital (2010-2011).

Algorithm	SSI depth	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
1	Superficial	24.1 [8.6 - 39.7]	97.6 [97.1 - 98]	6.2 [1.8 - 10.6]	99.5 [99.3 - 99.7]
	Deep	25.3 [15.9 - 34.7]	97.9 [97.4 - 98.3]	18.6 [11.4 - 25.8]	98.6 [98.2 - 98.9]
	All	25 [17.0 – 33.0]	98 [97.6 – 98.4]	24.8 [16.8 – 32.7]	98 [97.6 – 98.5]
2	Superficial	58.6 [40.7 - 76.5]	90.1 [89.2 – 91.0]	3.8 [2.0 - 5.5]	99.7 [99.5 - 99.9]
	Deep	96.4 [92.4 - 100.4]	91.4 [90.6 - 92.2]	17.7 [14.2 - 21.3]	99.9 [99.8 - 100]
	All	86.6 [80.3 - 92.9]	91.7 [90.9 - 92.6]	21.5 [17.7 - 25.3]	99.6 [99.4 - 99.8]
3	Superficial	65.5 [48.2 - 82.8]	89.4 [88.4 - 90.3]	3.9 [2.2 - 5.7]	99.7 [99.6 - 99.9]
	Deep	98.8 [96.4 - 101.1]	90.7 [89.8 - 91.6]	16.9 [13.6 - 20.3]	100 [99.9 - 100]
	All	90.2 [84.7 - 95.7]	91.1 [90.2 - 91.9]	20.9 [17.2 - 24.5]	99.7 [99.6 - 99.9]

Conclusions

The surveillance system based on common hospital data appeared to be sufficiently accurate for routine SSI detection, and its use could allow reducing by 90% the number of medical files to be revised by infection control practitioners. However, the results of our study may be interpreted with caution as the strategy of wound culturing in routine may varied in diagnosing superficial or deep SSI between surgeons and hospitals.

A larger multicenter study should however be undertaken to assess the applicability of this system in other institutions, and to study performance variations between surgical specialties and procedures.

References

1. Freeman R, Moore LSP, García Álvarez L, et al. Advances in electronic surveillance for healthcare-associated infections in the 21st Century: a systematic review. *J Hosp Infect* 2013;84:106–19.
2. Gerbier-Colomban S, Bourjault M, Cêtre JC, et al. Evaluation study of different strategies for detecting SSI using the hospital information system at Lyon University Hospital, France. *Ann Surg* 2012;255:896-900.