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Original article

Incidence of surgical site infections and accompanying risk factors in Algerian patients

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Introduction

Surgical site infections (SSIs) are the most common nosocomial infection (NI) in surgical patients, accounting for 38% of all NI, and are a significant source of postoperative morbidity resulting in increased hospital length of stay and increased costs[1,2].

There are no published studies on incidence and risk factors of SSIs in Algeria hospitals. The aim of this study was to determine the incidence and to analyse the risk factors for SSIs at the university hospital in Blida, Algeria. This large hospital has 654 beds including 202 surgical beds.

Patients and Methods

From January through December of 2006, there were 1094 surgical patients and all were included in this study. Data were collected on a standardized, precoded form for each surgical patient including demographics, risk factors and antibiotic usage. Additional data were collected for patients who developed SSIs. Patients were followed daily until discharge and were asked to return to the hospital for re-examination one month post-op and until their wounds were fully healed, as per routine postoperative protocol. Post-discharge surveillance was continued over a 30-day period. Centers for Disease Control and prevention (CDC) definitions for wound classification, timing and classification of SSI were used[3]. SSIs were classified as being superficial, deep incisional or organ/space. Data were entered and analysed using Epi Info v6.04 (CDC, Atlanta, USA) and SPSS v11.5 (SPSS-Corp., Chicago, USA).

The characteristics of the patients were studied including the age and sex distribution. The means and standard deviation (SD) for quantitative variables and the distribution of frequencies of qualitative variables was determined. The cumulative incidence of SSIs in global form and in specific form was estimated according to the NNIS risk index[4].

Univariate analysis of the categorical outcome (development of SSI) and each individual associated factor was carried out using chi-squared test or Fisher's exact test. Odds ratios (ORs) and 95% confidence intervals (95% CI) were calculated. Multiple logistic regression was used to predict risk factors for SSIs by adding predictors in a stepwise manner to examine if the factor was associated with the development of infection while adjusting for potential confounders and effect modifiers. Variables were eligible for inclusion at $p \leq 0.05$ and removed at $p \geq 0.10$. Age, timing of surgery (with a cut-off time of 120 minutes), pre-operative length of stay, wound class, American Society of Anaesthesiologists (ASA) score and emergency procedures were the hypothesized risk factors for SSIs that were examined in the models.

Results

The mean (SD) age of our surgical patients was 35.6 (22.7) years, and 676 (61.8%) were male. Most of the patients required emergency surgery (N=676; 54.4%).

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There were 49 (4.5%) deaths in the study population. The mean (SD) of pre-operative length of stay days was 3.2 (6) days and the duration of surgery was 120 minutes or longer in 221 (20.2%) cases.

All the patients were classified according of ASA score, wound class and NNIS index (Table 1). Antibiotic prophylaxis was used in 582 (72.4%) patients with clean wounds; the most common antibiotics were penicillins (77.1%) and third-generation cephalosporins (12%).

Table 1: ASA score, wound class and NNIS index of surgery patients

		N (%)
ASA score	1	716 (65.4)
	2	244 (22.3)
	3	70 (6.4)
	4	64 (5.9)
Wound class	Clean	318 (29.1)
	Clean-contaminated	485 (44.3)
	Contaminated	168 (15,4)
	Dirty	123 (11,2)
NNIS index	0	505 (46.2)
	1	470 (43)
	2	114 (10.4)
	3	5 (0.5)

A total of 41 patients developed SSIs; thus, the SSI cumulative incidence rate was 3.7% (41 of 1094). Of these, 32 developed an in-hospital SSI and 9 developed an SSI that was detected after discharge. Infections were classified as superficial incisional (N=21; 51.2%), deep incisional (N=14; 34.1%), or organ/space (N=6; 14.6%). The incidence of incisional SSI was 1.9%, deep incisional SSI was 1.3% and organ/space SSI was 0.5%. The incidence of SSI increased from 2.5% in patients with clean wounds to 5.8% in contaminated or dirty wounds (Table 2). Using the NNIS risk index, the SSI rate increased significantly with the number of factors present, from 1.3% in patients with NNIS of 0 to 40% in patients with NNIS risk of 3 ($p<0.001$) (Table 2).

Table 2: Cumulative incidence of surgical site infection by wound class and NNIS index

		NNIS=0, N=505 [N (%)]	NNIS=1, N=470 [N (%)]	NNIS=2, N=114 [N (%)]	NNIS=3, N=5 [N (%)]
All wound classes, N=1094	41 (3.7)	7 (1.3)	21 (4.5)	11 (9.6)	2 (40)
Clean, N=318	8 (2.5)	2 (0.9)	5 (6.1)	1 (20)	-
Clean-contaminated, N=485	16 (3.3)	5 (1.8)	5 (3.1)	6 (12.5)	-
Contaminated or dirty N=291	17 (5.8)	-	11 (4.9)	4 (6.6)	2 (40)

Using univariate analysis to examine the relationship between each of the independent variables, factors associated with increased SSI rates were Age ≥ 60, ASA score > 2 and contaminated or dirty wound class. Emergency procedures and timing of surgery ≥ 120 minutes tended to be associated with SSI, but the association was not statistically significant. Pre-operative length of stay ≥ 2 days was not related to SSIs (Table 3).

In multivariate analysis, having a contaminated or dirty wound class, ASA score > 2 and age ≥ 60 were independent risk factors for SSI. Age, emergency procedures and the timing of surgery were of borderline significance (Table 4).

Table 3: Univariate analysis of hypothesized risk factors for surgical site infections (SSIs)

	SSI (total=41) N (%)	No SSI (total=1053) N (%)	OR	95%CI	P value
Age > 60	14 (34.1)	189 (17.9)	2.4	1.15-4.84	<0.01
ASA score > 2	10 (24.4)	124 (11.8)	2.4	1.07-5.33	0.01
Contaminated or dirty wound class	17 (41.5)	275 (26.1)	2	1.01-3.97	0.03
Timing of surgery > 120 minutes	12 (29.3)	210 (19.9)	1.7	0.78-3.48	0.1
Pre-operative length of stay > 2 days	15 (36.6)	372 (35.3)	1.1	0.52-2.12	0.9
Emergency procedure	27 (65.9)	570 (54.1)	1.6	0.81-3.34	0.1

Table 4: Multivariate analysis of hypothesized risk factors for surgical site infections

	OR	95%CI	P value
Contaminated or dirty wound class	2.2	1.13-4.38	0.02
ASA score > 2	2	1.01-4.33	0.05
Age > 60	1.9	0.97-3.96	0.06
Timing of surgery > 120 mn	1.6	0.74-3.51	0.1
Emergency procedure	2.1	0.92-4.93	0.07

Discussion

We performed active SSI surveillance in a large hospital in Algeria. We found that the incidence rates from our surgical patients are comparable with those reported in Europe[5-7]. When compared with reports from other studies from undeveloped countries, our rates are lower than those reported in Morocco (5.2%)[8] or Vietnam (12.5%)[9]. Similar to other studies [5-9], having a dirty wound or high ASA score (> 2) were predictors of SSI in our population. In this study population, the NNIS risk index[10] was a good predictor of SSI. Our study provides critical information that can be used to target future efforts to evaluate and improve quality of surgical care in Algerian hospitals.

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