

Risk factors of surgical site infections in a general surgery ward in Tirana

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Abstract

Aim: Surgical site infections (SSI) are among the most common complications in hospitalized patients and have serious consequences for treatment outcomes and costs. The aim of this study was to investigate the frequency of SSI in patients admitted at the general surgery ward of a tertiary hospital in Tirana, Albania.

Methods: This was a cross-sectional study carried out at the general surgery ward of the University Hospital Centre “Mother Theresa”, a tertiary care hospital in Tirana during the period 2012-2013. Patients were followed for up to 30 days for development of surgical site infections. Socio-demographic data and information about SSI was collected for all the hospitalized patients undergoing surgery during the time period of the survey. Binary logistic regression was used to assess the association of SSI with several independent factors.

Results: Of the 678 patients, 41 (6%) developed surgical site infection. The mean age of the patients was 52.7 ± 14.5 years. The most common surgical procedures were the colon surgery and fistulectomy. The factors significantly associated with the occurrence of SSI were smoking, diabetes, hypertension, inadequate skin preparation, presence of drain and contaminated wounds.

Conclusion: The prevalence of surgical site infections after surgical procedures in Albania is higher compared to the European average, even though the situation has improved compared to previous reports. Surgical site infections remain common and constitute a major cause of postoperative morbidity in Albania, a transitional country in the Western Balkans.

Keywords: preparation, prevention, skin, surgical site infections.

Introduction

Infections of operating wounds or surgical site infections (SSI) constitute one of the main adverse effects of surgical procedures and reflect with a high degree of reliability the level of infection control in a particular unit (1). They are associated with the prolongation of recovering period of surgical patients, increased length of stay in hospital and significantly influence the postoperative morbidity and mortality. In additions, SSIs are associated with significantly increased medical care costs. Therefore SSI prevention and/or control is an important measure of the quality of patient's care.

The rates of in-site surgical infections in a country represent the level of education of the medical staff, the level of knowledge regarding the causes of infection and the efficacy of applied preventive strategies (2). Prevention of surgical infections is closely related to the continuous surveillance of operative wound infection and periodic feedback to the respective surgical staff enabling them to appraise the results and identify measures that reduce the risk of infection (2). The most important strategy in the management of SSI is to prevent them. This includes applying the proper surgical method, the use of appropriate antimicrobial therapy before intervention and a range of other actions such as hand washing, disinfection and sterilization activities by surgeons and other staff to prevent the spread of different pathogens in surgery settings. Furthermore, proper preoperative skin preparation is important as it has implications on post intervention wound infection rate (3). The risk factors for SSI are related to the patient conditions, the nature of surgical intervention and anaesthesia. Patients in serious conditions such as sepsis, the elderly, the new-born, smokers, those with chronic diseases such as diabetes and cardio-pulmonary diseases, cerebrovascular accidents etc. are at a high risk for developing SSI and pneumonia (4). The risk of infection is higher when patients are exposed to invasive procedures. Usually surgical site infections occur within a month after the operative procedure (5).

SSIs constitute a considerable public health concerns in many countries of the world (6), including Albania. However, the scientific information regarding SSI in Albania is still scarce and limited. Previous surveys at general surgical service at University Hospital Centre "Mother Theresa" suggest a decreasing trend of the SSI over time (7-9). The lack or incomplete information on the number of patients experiencing SSI either at national or at local level and the related hospital costs represents a challenge for a modern hospital management (5). For this purpose there have been established committees of infection control in all regional hospitals of the country following an order by Ministry of Health of Albania (10). Surveillance of SSI is crucial as it provides an insight into the magnitude of the problem and thus helps the policy makers to take measures to reduce them. In this context our aim was to determine the frequency of SSI in hospitalized patients admitted in the general surgery ward of a tertiary hospital in Tirana, Albania.

Methods

This was a cross-sectional study of surgical site infections among all hospitalized patients admitted at the third surgical clinic of the University Hospital Centre "Mother Theresa", a tertiary care hospital in Tirana, the capital of Albania, during the period 2012-2013. Patients undergoing proctologic and laparoscopic interventions were excluded from the study. Patients were followed for up to 30 days for the development of any surgical site infection. Infected cases were classified using the USA Centre for Disease Control and Prevention (CDC) definition for surgical site infections.

A form was filled-in for all the patients undergoing surgery in this clinic during the study period. The questionnaire comprised of two parts. The first part included information on basic socio-demographic data such as gender and age; information regarding smoking status and also information about chronic conditions. The second part of the questionnaire included information about preparatory actions before surgery such as skin preparation, hair removal and

data about the type of surgical intervention, duration of operation, length of stay (LOS) in hospital, wound contamination class (CDC, 1999: clean, clean contaminated, contaminated, dirty) and use of antibiotic prophylaxis.

Statistical analysis

Absolute numbers and their respective percentages were reported. Chi square test was used to compare the differences in proportions between categorical variables. Binary logistic regression was used to assess the likelihood of SSI according to selected

independent variables. The observed relationships were considered as statistically significant if the P-value $\leq 0,05$. The statistical program SPSS 16.0 was used for the analysis of data.

Results

A total of 678 patients undergoing surgery in the general surgical ward of "Mother Theresa" hospital were included in the study. The mean age of the patients was 52.7 ± 14.5 years with a range between 15-83 years. Out of the total patients, 302 (44.5%) of them were males. The prevalence of SSI was

Table 1. Distribution of Surgical Site Infections (SSI) according to the study variables

Variable		SSI	
		Yes (n=41)	No (n=637)
Gender	Female	19 (46.4)*	360 (56.5)
	Male	22 (53.6)	277 (43.5)
Age-group	≤ 20	7 (17.0)	171 (26.8)
	21-40	11 (26.8)	211 (33.1)
	41-60	13 (31.7)	152 (24.0)
	> 60	10 (24.5)	103 (16.1)
Underlying condition	None	16 (39.0)	431 (67.7)
	Diabetes	12 (29.3)	62 (9.8)
	Hypertension	13 (31.7)	143 (22.5)
Smoking	No	23 (57.2)	612 (96.1)
	Yes	18 (42.8)	25 (3.9)
Preoperative hospitalization	≤ 5 days	26 (62.4)	473 (74.3)
	> 5 days	15 (37.6)	164 (25.7)
Antimicrobial prophylaxis	Yes	5 (11.1)	127 (19.8)
	No	36 (88.9)	510 (80.2)
Hair removal	No	39 (95.1)	618 (97.0)
	Yes	2 (4.9)	19 (3.0)
Skin preparation	Iodine and alcohol	18 (42.4)	579 (90.8)
	Iodine	23 (57.6)	58 (9.2)
Type of operation	Elective	28 (79.2)	472 (74.1)
	Emergency	12 (31.7)	165 (25.9)
Use of drain	No	25 (61.3)	550 (86.2)
	Yes	16 (38.7)	87 (13.8)
Wound classification	Clean	25 (61.4)	500 (78.5)
	Clean contaminated	3 (7.4)	40 (6.3)
	Contaminated	13 (31.2)	97 (15.2)

* Absolute numbers and column percentages (in parenthesis).

6.04% (95%CI for the proportion: 4.42-8.62). Among SSI cases, in 9 (22.0%) of them the operation procedure was urgent (Table 1).

The mean duration of the operation was 2.7 hours, the mean duration of hospital stay 11.4 days (data not shown). Diabetes (29.3%) and hypertension (31.7%) were the most frequent underlying conditions among SSI patients and 42.8% of them were active smokers (Table 1). The proportion of smokers, diabetics and persons with hypertension among SSI patients was significantly higher compared to their respective non-SSI counterparts

(Table 1). Also, the proportion of SSI patients being hospitalized for longer than five days, not receiving antibiotics prophylaxis, their skin being prepared only by iodine, with presence of drain and those with contaminated wounds were also higher compared to their non-SSI counterparts (Table 1).

The distribution of SSI by the type of surgical procedures is presented in Table 2. It can be noted that the proportion of SSI was significantly higher in patients undergoing colon surgery and fistulectomy as compared to other procedures (Table 2).

Table 2. Distribution of Surgical Site Infections (SSI) according to surgical procedures

Surgical procedure	Total	SSI: N (%)
Cholecystectomy	132	5 (3.8)
Gastrointestinal surgery	107	4 (3.7)
Appendectomy	96	5 (5.2)
Colon surgery	68	13 (19.1)
Thyroidectomy	81	1 (1.2)
Hernioplasty	76	1 (1.3)
Fistulectomy	64	10 (15.9)
Ca hepar and pancreas	56	2 (3.6)
Total	678	41 (6.0)

Antibiotics, mainly ciprofloxacin and cefazolin were used for prophylaxis in 132 (19.5%) of total patients (data not shown in tables). The mean length of post-operative stay after different surgical procedures was 2.7 ± 1.8 days for clean wounds, 3.3 ± 2.1 days for clean contaminated wounds, 3.7 ± 2.8 days for contaminated wounds and 6.3 ± 3.7 days for dirty wounds. Also, the mean post-operative stay was significantly higher among SSI cases compared to non SSI cases (data not shown in tables). The most commonly isolated bacteria after surgical procedures was *Staphylococcus aureus* (present in 40% of cases), followed by *Escherichia coli* (in 26% of cases), *Clostridium perfringens* (10%), coagulase negative *Staphylococcus aureus* (10%), *Klebsiella pneumoniae* (3%) and various infectious agents in the

remaining cases (data not shown).

The factors associated with the presence of SSI after surgical interventions are presented in Table 3. The association with gender was significant ($P=0.03$) with males being 2.03 times more likely to develop SSI after a surgical procedure compared to females (Table 3). The association with age was not significant even though the likelihood of SSI increased almost steadily with increasing age. Diabetics, hypertensive patients and smokers were 5.2, 2.5 and 19 times significantly more likely, respectively, to develop SSI after a surgery compared to subjects with no such conditions (Table 3). Other factors that were associated with significantly increased likelihood of SSI after surgery were preparation of skin only with iodine, use of drain, and contaminated wounds (Table 3).

Table 3. Factors associated with the presence of SSI after a surgical intervention; odds ratios (ORs) from the binary logistic regression

Variable		OR(95%CI)	P-value
Gender	Female	1.00 (reference)	0.05
	Male	1.23 (0.96-3.87)	
Age-group	≤20	1.00 (reference)	0.61
	21-40	1.27 (0.48-3.35)	
	41-60	2.07 (0.80-5.33)	
	>60	2.37 (0.87-6.42)	
Underlying conditions	None	1.00 (reference)	<0.01
	Diabetes	5.2 (2.35-11.53)	
	Hypertension	2.5 (1.15-5.21)	
Smoking	No	1.00 (reference)	<0.01
	Yes	19.15 (9.18-39.9)	
Preoperative hospitalization	≤5 days	1.00 (reference)	0.15
	>5 days	1.66 (0.86-3.21)	
Antimicrobial prophylaxis	Yes	1.00 (reference)	0.20
	No	1.79 (0.68-4.66)	
Hair removal	No	1.00 (reference)	0.53
	Yes	1.60 (0.37-7.42)	
Skin preparation	Iodine and alcohol	1.00 (reference)	<0.01
	Iodine	12.75 (6.6-25.0)	
Type of operation	Elective	1.00 (reference)	0.67
	Emergency	1.30 (0.87-1.72)	
Use of drain	No	1.00 (reference)	<0.01
	Yes	4.04 (2.07-7.88)	
Wound classification	Clean	1.00 (reference)	0.51
	Clean contaminated	1.50 (0.43-5.18)	
	Contaminated	2.68 (1.32-5.42)	

Discussion

This is one of the few studies addressing the surgical site infections following surgical procedures in surgery wards of the tertiary hospital and their associated factors in transitional Albania. The findings suggested that the most common surgical interventions during 2012-2013 were the colon surgery and fistulectomy. The prevalence of SSI was around 6% and the factors that significantly increased the likelihood of infection following surgery were smoking, presence of diabetes and hypertension, inadequate skin preparation (iodine only), presence of drain and contaminated wounds.

Surgical site infections are one of the most common forms of nosocomial infections that can complicate the surgical procedure. The overall infection rate of 6% observed in our study is higher compared to other European countries (3.3%) (11). This finding suggests that disinfection measures might have not been implemented appropriately, especially in the context that our patients were all treated in a tertiary care hospital that should offer the highest infection control standards. However, there is need of further information from surgical wards in other district hospitals as well in order to fully assess the

situation of SSI in Albania.

Surveillance of SSI is important in control and prevention of surgical site infections following surgical procedures (12). It can highlight and pinpoint the causes of infections including the inappropriate infection control system in place, poor practices of antibiotic use or antibiotic abuse not following standard guidelines, poor hospital hygiene and overcrowding, etc.

Similar to other reports published in international literature, the rate of SSI in our study was higher in the case of contaminated wounds. In a univariate analysis we found significant associations of SSI with diabetes, hypertension, smoking, the presence of drain and contaminated wounds. Also, similar to other studies we noticed that the likelihood of SSI increased with age (even though the results were not statistically significant) (13,14). This could be associated with the decreasing of the immunoreactive protection capabilities of the organism as an individual grows older (13,14). The frequency of SSI is higher in emergency surgery due to insufficient measures of infection control in emergent circumstances. However, this association did not reach statistical significance. The most frequent underlying conditions were diabetes and hypertension which has been reported by several studies as an important risk factor for the development of wound infections (15). We also observed that the length of stay was higher among patients with SSI compared to those not developing SSI after a surgical procedure, a finding reported by previous studies as well (16). The increased length of hospitalization usually is associated with added cost for the patient and the

respective hospital (16). Also, we didn't find any association between the use of antibiotic prophylaxis and the occurrence of SSI. Indeed, it has been suggested that the antibiotic prophylaxis should be used only in contaminated wounds since no relationship was found between their use and the occurrence of SSI after surgical procedures (17). As mentioned earlier, the prevalence of SSI in this general surgical ward in a tertiary hospital in Albania is similar to the rate found in developing countries, but is higher than that of developed countries. Also, the isolated pathogens found in our study are similar with other reports in literature (6). However, compared to previous reports from our clinic, there is a significant reduction of SSI rate which is dedicated to several factors, among which the most important refer to the different surgical and wound treatment techniques, aggressive antimicrobial treatment of several inflammatory pathologies, the use of suture material causing less tissue reaction, tendency to operate through smaller incisions, replacement of local anaesthesia with other types of anaesthesia, as well as the increased awareness of surgeons about the importance of this SSI. All the above mentioned factors along with early surgical treatment of infectious pathologies have contributed in one way or another in the reduction of the risk of infection following surgical procedures in Albania. A continuous surveillance and implementation of measures of hospital infection control, knowledge about SSI associated pathogens and assessment of antibiotic sensitivity pattern is essential for the appropriate treatment and reduction of SSI rates and early discharge of hospitalized patients.

Conflicts of interest: None declared.

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