Short Communication

Surgical site infections in an abdominal surgical ward at Kosovo Teaching Hospital

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Abstract

Background: Abdominal surgical site infections (SSI) cause substantial morbidity and mortality for patients undergoing operative procedures. We determined the incidence of and risk factors for SSI after abdominal surgery in the Department of Abdominal Surgery at the University Clinical Centre of Kosovọ (UCCK).

Methodology: Prospective surveillance of patients undergoing abdominal surgery was performed between December 2005 and June 2006. CDC definitions were followed to detect SSI and study forms were based on Europe Link for Infection Control through Surveillance (HELICS) protocol.

Results: A total of 253 surgical interventions in 225 patients were evaluated. The median age of patients was 42 years and 55.1% of them were male. The overall incidence rate of SSI was 12%. Follow-up was achieved for 84.1% of the procedures. For patients with an SSI, the median duration of hospitalization was 9 days compared with 4 days for those without an SSI ($p<0.001$).

Surgical procedures were classified as emergent in 53.3% of cases. Superficial incisional SSI was most common (55%). Clinical infections were culture positive in 40.7% of cases. Duration of operation, duration of preoperative stay, wound class, ASA score >2, use of antibiotic prophylaxis and NNIS class of >2 were all significant at $p < .001$. The SSI rates for the NNIS System risk classes 0, 1 and 2-3 were 4.2%, 46.7% and 100%, respectively.

Conclusions: SSI caused considerable morbidity among surgical patients in UCCK. Appropriate active surveillance and infection control measures should be introduced during preoperative, intra-operative, and postoperative care to reduce infection rates.

Key Words: Kosova, nosocomial infections, surgical site infections.

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Introduction

Nosocomial infections constitute a major public health problem worldwide. They result in high morbidity and mortality, prolonged hospital stays, greater use of antibiotics, and increased costs [1,2].

Surgical-site infections (SSI) along with pneumonia, urinary tract infections, and bloodstream infections are the most common nosocomial infections [3]. Although SSIs are not associated with a high mortality rate, they are a significant source of morbidity among surgical patients.

Approximately 500,000 episodes of SSI occur in the United States every year, accounting for an average of 7.3 excess hospital days and more than 1.6 billion dollars of extra hospital charges. Surveillance programs can lead to reduction of SSI rates of 35-50% [4,5].

Infection control in Kosovo is in its infancy compared with infection control programs in other countries. There are not yet established surveillance programs for nosocomial infections. This situation is due to the lack of national policies and protocols regarding this issue and limited human and financial resources. Reports about the incidence of and risk factors for acquiring SSI are absent for all hospitals in Kosovo. The first article published in the field of nosocomial infection was on bacteraemia amongst paediatric patients in Kosovo in 2002, and showed a crude mortality rate of 31% amongst newborns [6]. A descriptive

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prevalence study on nosocomial infections in targeted high-risk areas was undertaken in December 2003 in the University Clinical Centre of Kosovo [7]. This study showed an overall prevalence rate of 17.4%.

Infection control activities were limited to passive monitoring activities, and actions were only initiated as a response to late stages of outbreaks. Within UCCK and some other regional hospitals, hospital infection control committees existed solely on paper. The awareness for nosocomial infection increased during 2006, when the Ministry of Health of Kosovo established the National Committee for Prevention and Control of Nosocomial Infections as the executive body to combat this modern challenge of health care.

This study aimed to determine the incidence of SSI in the abdominal surgical ward of the UCCK in Pristine, Kosovo, and to identify risk factors associated with the development of SSI. Data from this study might help to design intervention studies for all hospitals in our country.

Materials and Methods

The study was conducted at the University Clinical Centre of Kosovo (UCCK), in Pristine, the capital city of Kosovo, a city with 500,000 inhabitants. The center has 2,100 beds with approximately 60,000 admissions per year and serves as the only referral tertiary care center for a population of approximately 2.1 million. Approximately 3,000 different surgical interventions are performed monthly at the UCCK. The abdominal surgery department has a surgery ward with 75 beds and an ambulatory clinic.

Prospective cohort study for surveillance of SSI was conducted from December 15, 2005, to June 15, 2006. All patients who required abdominal surgery were enrolled in the study.

Patients were excluded from the cohort by the following criteria: deficient medical records; having undergone surgical interventions at another hospital and then referred to UCCK; or death after surgery or within the following 30 days.

Three surgery residents were previously trained for this study and were part of the teams who performed the surgical intervention. They closely observed and examined the patients during hospitalization and searched daily for SSI and potential risk factors. Data regarding SSI were obtained on a daily basis during the patients' hospitalization and until 30 days after surgical intervention. If the patients were discharged prior to 30 days, the clinical evaluation in the ambulatory clinic within the hospital was used. There was no telephone contact in post-discharge surveillance. The median was calculated for duration of hospitalization to avoid biases of some patients with prolonged hospitalization due to comorbidities not related to surgical interventions.

The study forms were based on Hospital in Europe Link for Infection Control through Surveillance (HELICS) protocol for surveillance of SSI [8]. CDC definitions were used to detect SSI [9]. The data were grouped into three categories: general data; stratification and preoperative data; and infection data. General data comprised age, gender, operative procedure, date of admission, date of operation, date of discharge or date of last follow-up post discharge, discharge status, and operation codes (NNIS and ICD–9–CM). Stratification and preoperative data consisted of endoscopic procedure, wound contamination class (clean, clean contaminated, contaminated, dirty/infected), duration of operation (minutes), type of surgery (urgent vs. elective), The American Society of Anesthesiologists (ASA) Physical status classification (healthy, mild systemic disease, severe systemic disease, incapacitating systemic disease or moribund patient) [10] and use of antibiotic prophylaxis. The following infection data were collected: type of SSI (superficial, deep incisional, and organ/space); date of infection; and causative microbial agent in culture positive results. Laparoscopy was performed in another specialized unit and was not included in the study.

The NNIS System risk index was calculated based on three risk factors, each worth one point: contaminated or dirty surgical wound, ASA score greater than 2, and duration of surgery greater than the 75th percentile for a specific group of surgical procedures [11]. The NNIS System index ranges from 0 to 3. Use of drainage was also recorded.

Laboratory diagnosis of microbiological samples was done in the Department of Microbiology within the National Institute of Public Health of Kosovo. Standard tests for identification were performed. Antimicrobial susceptibility tests were performed using the Kirby–Bauer method [12]. Analyses were based on 225 patients with SSI.

In statistical analysis, discrete variables were expressed as percentages. Categorical variables were compared using chi-square test or Fisher's exact test as needed. A p value of less than 0.05 was considered significant. Relative risks and 95% confidence intervals (95% CI) were calculated using APIC CD-room for statistical analysis for infection control.

Results

Between December 2005 and June 2006, a total of 253 surgical interventions in 225 patients were evaluated. The median of the cohort was 42 years (range 8 to 88 years), and 55.1% of patients were male. The overall incidence rate of SSI was 12%. There were a total of 27 SSIs, seven (25.9%) of which were identified after discharge. A complete 30-day follow-up was achieved for 213 (84.1%) of the procedures. For patients with an SSI, the median duration of hospitalization was 9 days compared with 4 days for those without an SSI (p<0.001).

Table 1 lists selected potential risk factors related to patient and procedure with their associated SSI rates.

Table 1. Distribution of surgical site infections based on risk factors.

Risk factors	Results	SSI (n)	No SSI	Total	OR (p)
Age(years)	≤25	2	71	73	0.115 (0.52)
	25-60	19	88	107	
	>60	6	39	45	
Gender	Male	11	113	124	0.115
	Female	16	85	101	(0.52)
Preoperative stay (days)	<7	9	152	161	6.62
	≥7	18	46	64	(<0.001)
Endoscopy	Yes	8	14	22	5.53
	No	19	184	203	(<0.001)
Wound class	Clean	2	62	64	5.4
	Clean Contaminated	14	129	143	(<0.001)
	Contaminated	6	7	13	
	Dirty/infected	5	0	5	
Duration of operation hours	>T time*	24	99	123	8.0
	≤T time	3	99	102	(<0.001)
Type of intervention	Emergent	11	99	110	0.38
	Elective	16	99	115	(0.6)
ASA score	1	4	136	140	6.37
	2	15	50	65	(<0.001)
	3	8	11	19	
	4	0	1	1	
	5	0	0	0	
Antibiotic prophylaxis	Yes	20	93	113	3.23
	No	7	105	112	(0.008)
Drain	Yes	18	53	71	6.5
	No	9	173	182	(<0.001)
Surgical procedure	Cholecystectomy	5(5.4%)	87	92	
	Colon surgery	8(12.1%)	58	66	
	Appendectomy	6(7.7%)	73	78	

SSI=surgical site infections, OR=odds ratio, ASA=American Society of Anesthesiologist, T-time=75^{th} percentile of the distribution of procedure duration

Surgical procedures were classified as emergent in 53.3% of cases and appendectomy was the most common surgical procedure (30.8%). Eleven SSI (10.0%) occurred in patients who had undergone emergency procedures and 16 (13.9%) occurred in patients who had undergone elective procedures.

The incidence rate of SSI differed by wound classification: 3.1% for clean (n=64), 9.8% for clean-contaminated (n=143), 46.1% for contaminated (n=13), and 100% for dirty infected wounds (n=5). The relative risk of development SSI for contaminated wounds was 5.4-fold higher than for clean wounds.

The duration of the procedure had a significant effect on the incidence of SSI. The incidence of SSI for procedures lasting longer than one hour was six times as high as that for procedures of less than one hour , p<.001). Most common interventions associated with SSI were cholecystectomy, colon surgery, and appendectomy (70.4%).

Antibiotic prophylaxis was used for 50.2% of the patients. Drains were used in 71 (28.1%) of the procedures. Some patients had more than one drain. Superficial incisional SSIs were most common with 15 cases, 11 were deep incisional, and 1 was organ–space. Clinical infections were culture positive in 40.7% of cases and three of them were polymicrobial infections. The most frequently isolated microorganisms in the three most common procedures were *Escherichia coli* (36.4%) and *Staphylococcus aureus* (14.6%). Among *E. coli* isolates, resistance rates for ceftazidime, ciprofloxacine and gentamycine were 52.4%, 11.9% and 24.3%, respectively.

The incidence of SSI according to the NNIS System risk index is provided in Table 2. An increase in the incidence of SSI and in the relative risk to develop SSI was observed as the NNIS System risk index increased. The SSI rates for the NNIS System risk classes 0 to 3 were 4.2% (8 of 190), 46.7% (14/30) and 100.0% (5/5), respectively. The relative risk for SSI was 12.9 in the group with an NNIS System risk class less than 2, whereas, for NNIS risk classes 2 or more the RR were 23.7.

There was no significant correlation between SSI incidence and sex and type of intervention. However, duration of operation, duration of preoperative stay, wound class, ASA score >2, use of antibiotic prophylaxis and NNIS class of >2 were all significant at p<0.001.

Table 2. The incidence of surgical site infections according to the NNIS System risk index.

NNIS System risk index	No of procedures	Patients with SSI	Incidence rate per 100 interventions	RR (95% CI)
0	190	8	4.21	1
1	30	14	46.7	(12.91-
2,3	5	5	100	23.7)

SSI=surgical site infections, RR=relative risk, CI =95% confidence interval.

Discussion

As in many developing countries, no surveillance or feedback of SSI rates have been implemented in Kosovo The observed incidence rate of SSI (12%) was higher than incidence rates reported from developed countries in Western Europe, such as the United Kingdom (3.1%) and the Netherlands (4.3%); [13-15]. The incidence rate of infections according to surgical procedures was higher than those reported from European countries in HELICS [8]. Colon surgery was accompanied by infections in 12.1% of cases and cholecystectomy by infections in 5.4% of cases compared to 8.1% and 1.4%, respectively in HELICS. The financial situation of the public health system in Kosovo is very poor with an overall budget dedicated to health care of only 30 euro per capita per year. This seems to be the major problem in upgrading health care capacities in the only tertiary care center of Kosovo. Other causative factors were also poor management in this institution, inadequate numbers of trained personnel working in infection control, overcrowded wards, and insufficient equipment and supplies.

One quarter of infections was detected after discharge and almost 20% were not covered by post-discharge surveillance. The main reasons for loss of follow-up were visits to regional family care centers or private clinics and improper records in ambulatory clinics within the hospital.

Preoperative length of stay was relatively long, mainly due to irrational usage of bed capacity, lack of material, or unavailability of an operating room. Patients had to buy antibiotics and very often their own surgical equipment. Nevertheless, the excess length of stay for patients with SSI was in line with reports elsewhere [14-15].

The main risk factors for SSI were similar to those identified in other studies. This study confirms the association between SSI and ASA score, duration of procedure, and wound class. We found a good correlation between the NNIS System risk index and the development of SSI. The relative risk of developing SSI increased significantly with increase of risk index $p<.001$).

In contrast to other reports, the SSI in our study was three times more predominant in surgical procedures preceded by antibiotic prophylaxis. This might be explained by the fact that these were contaminated wounds with increased risk of infection. There is, as yet, no consensus among surgeons regarding the written guidelines for antibiotic prophylaxis in abdominal surgery.

From this study, the following steps emerged as priorities to set in the near future: definition of the antibiotic prophylaxis policy; reduction of preoperative length of stay; increased follow up surveillance and setting up systematic surveillance; and reduction of the length of procedures through adequate training of the staff on proper surgical techniques and intra-operative infection control measures. An initiative for the establishment of an infection control committee at UCCK has been promoted recently.

In conclusion, the high rates of nosocomial infections among surgical patients emphasize that control and prevention of SSI should be a priority in UCCK and other regional hospitals in Kosovo.

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