



Full Length Research Paper

Prevalence of surgical site infections and evaluation of risk factors after surgery, case of three public hospitals in Cameroon

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Abstract

Surgical site infections (SSIs) are the most common complications after surgery that has significant impact in patient morbidity, mortality and health care cost. A prospective case-control study was conducted with the aim of contributing to the safety of inpatients. It consisted in determining the rate of SSIs in patients who underwent surgery in three public hospitals in Yaounde, from November 2011 to March 2012. Patient-specific demographic determinants and elements related to surgery or to hospital care organisation were also evaluated as risk factors. During the study period, 1201 patients underwent surgery. Most of the patients were women (60.78%) and their mean age was 37. Out of the study population, 110 developed incisional SSIs, giving a prevalence rate of 9.16%. The infection was superficial for 68.18% cases. Environmental factors such as the hospital, the type of surgical ward and surgical factors like the American Society of Anaesthesiology (ASA) score, the wound class contamination, the status of surgery and the type of surgery were significantly associated to SSI occurrence. The study revealed a higher SSI rate in the three hospitals, compared to the standard international levels. Therefore, developing SSI prevention strategies is a clear indication.

Keywords: Surgical site infection, prevalence, risk factors.

INTRODUCTION

An infection is said to be nosocomial if it was absent (neither symptomatic nor incubating) in a patient on his admission to hospital. When the infectious status on admission is unknown, a delay after admission of at least 48 hours or longer than the incubation duration when it is known is commonly accepted to distinguish it from a community-acquired infection. Therefore, monitoring nosocomial infections is a key component in ensuring inpatient safety.

Surgical site infections (SSIs) are infections that occur where the surgery took place. They are classified according to the Centre for Disease Control and prevention (CDC) criteria (Horan *et al.*, 1992). Thus, they are nosocomial if they develop within 30 days after surgery. This period can last up to one year in case of

prosthesis or implant operation. SSIs are the most common hospital acquired infections among surgical patients and it remains a major clinical issue in terms of morbidity, mortality and health care cost (Shahane *et al.*, 2012). In developed countries, SSI incidence has been reduced by active surveillance systems (Brandt *et al.*, 2006; Miliani *et al.*, 2009). In Africa, little is known about its determinants because of the paucity of studies and the diversity of methods used. But, considering the results of the studies carried out, the prevalence rates of SSIs seem high. In the Central African Republic, 18% was reported (Bercion *et al.*, 2007), 12% in South Africa (Juko and Moodley, 2002) and 11.4% in Ethiopia (Amenu *et al.*, 2011).

In Cameroon, some studies have targeted a single type of surgical procedure, a single wound contamination class or a single surgical ward or centre (Epanya, 2003; Ateba, 2004; Hentchoya, 2007). Thus, a multi-centre study mixing various surgical determinants would be

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worth conducting. The study aims at contributing to improving inpatient safety by assessing the prevalence of SSIs and determining SSIs risk factors.

METHODS

This prospective case control study was conducted from November 2011 to March 2012, in three public hospitals in Yaounde (Cameroon). Two were University Teaching Hospitals and one was a Community Hospital namely the Yaounde Central Hospital (HCY), the Yaounde University Teaching Hospital (CHU) and the Biyem Assi District Hospital (HDBA) respectively.

Eight wards in HCY (Maternity A, Maternity B, General Surgery, Visceral Surgery, Pediatric Surgery, Urology, Traumatology A and Traumatology B) and the singles General Surgery wards in CHU and HDBA were involved.

Patients were recruited pursuant to strict ethical considerations. They were male or female inpatients, from any age group, having undergone surgery in one of the three hospitals during the study period. Cases were defined as those who develop SSIs within 30 days after surgery. Controls were those who did not develop SSIs.

Identification of surgical site infection

All the SSIs were identified by surgeons, using the Centres for Disease Control and Prevention (CDC) standardized criteria, (Horan *et al.*). SSIs are classified as incisional or organ/space. Incisional SSIs are divided into those involving skin and subcutaneous tissue (superficial incisional) and those involving deeper soft tissue of surgical incision (deep incisional SSIs). Organ/space SSIs involve any part of the anatomy other than incised body wall layers that were opened or manipulated during an operation.

Data collection

Demographic, preoperative variables were collected from the medical records using a standardized data collection form. Demographic data included age at time of surgery and gender. Preoperative information were: status of surgery (elective or emergency), American Society of Anaesthesiologists (ASA) physical status score (Owens *et al.*), type of surgical procedure, antimicrobial treatment and wound contamination class according to the four-point wound infection score of the National Research Council (Garner, 1986) that is Class I-Clean, Class II-Clean contaminated, Class III-Contaminated and Class IV-Dirty.

Furthermore, in order to assess the quality of the environment and the respect of infection prevention practices, a survey questionnaire for 200 health workers

(20 in HDBA, 20 in CHU and 160 in HCY) was administered. Environmental data included ward cleanliness, number of beds per room, room airing and ventilation, patients cleanliness, hand washing frequency, gloves wearing while dressing, gloves change after each dressing.

Prevalence rate of SSIs

In each hospital, the number of patients who underwent surgery throughout the study period, the number of those with SSI (SSI (+)) and the number of those without SSI (SSS (-)) were recorded. The prevalence rate of SSIs was calculated by dividing the number of SSI (+) patients by the number of operated patients.

Data analysis

The data obtained were compared using the Chi-square (X²) test. A p value < 0.05 was considered statistically significant.

RESULTS

In the three hospitals, surgery was performed on 1201 patients distributed as follow: 925(77.02%), 150(12.49%) and 126 (10.49%) in HCY, CHU and HDBA respectively.

Prevalence of SSIs and others clinical considerations

Among the 1201 patients included in the study, 110 presented SSIs which gave a prevalence rate of 9.16%. Out of the 110 lesions, 90% were open; 68.18% and 31.82% were respectively classified as superficial and deep infections. All the patients received antimicrobial treatment.

SSI risk factors

Gender

There were 471 (39.22%) men and 730 (60.78%) women. There was no difference between SSI rates in male (9.13%) and female (9.18%).

Age

The age of participants ranged between 2 to 85 years. The mean age was 37. The modal class was 26-31 years. The higher SSI rate (13.92%) was observed in the 44-49 years range and the smaller (4.54%) in the 68 to

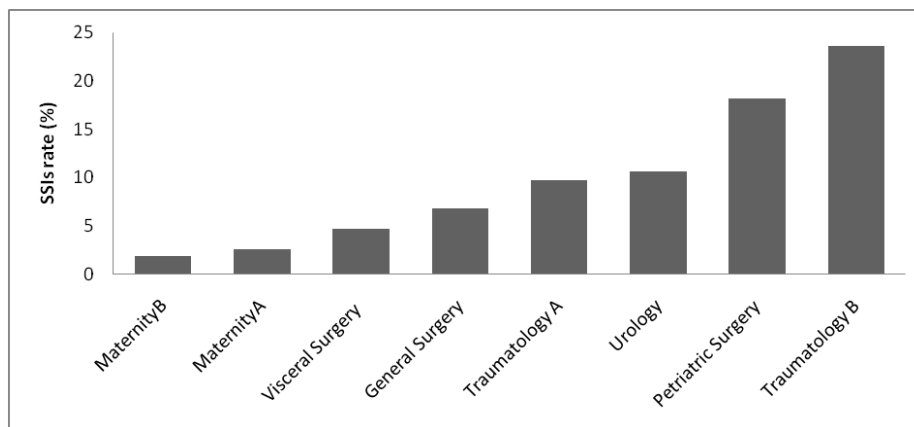


Figure 1. Frequencies of SSI according to hospital ward

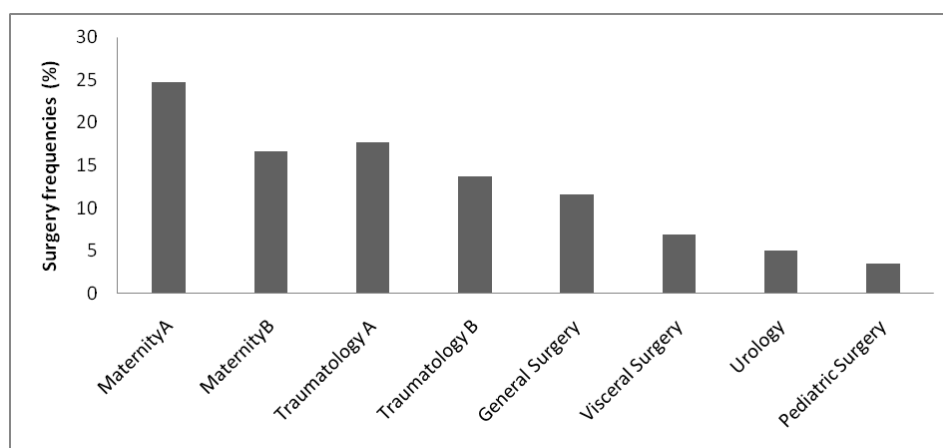


Figure 2. Frequencies of surgical procedures according to hospital ward

73 but, these differences were not significant ($\chi^2 = 9.83932$; $ddl = 9$; $p > 0.30$).

Hospital

Out of the 925 patients who underwent surgery in HCY, 87 (9.40%) developed SSI. In this way, surgery was performed on 126 and 150 patients in HDBA and CHU with respectively 4 (3.17%), 19 (12.67%) post operative site infection. Therefore, the highest SSI rate was observed in CHU and the lowest in HDBA. These differences were significant ($\chi^2 = 7.707$; $ddl = 2$; $p < 0.05$).

Type of surgery ward

During the study period, maternity A had the highest surgery rate (24.76%) followed by Maternity B (16.65%) while Pediatric Surgery had the lowest (3.50%). The highest SSI rate was recorded in Traumatology B ward

(23.62%) and the lowest in Maternity B ward (1.95%). These variations presented in Figure 1 were statistically significant ($\chi^2 = 62.963$; $ddl = 6$; $p < 0.001$).

Status of the surgery

Most of the patients underwent elective surgery (76.02%). Nevertheless, SSIs prevalence rate was two times lower (7.45%) in elective surgery than in emergency conditions (14.58%).

Type of surgical procedure

Caesarean section was the most performed surgery (26.14%), followed by osteosynthesis (20.90%) whereas laparotomies for prostate were the least frequent (2.16%). The lowest SSI rate was observed in caesarean section (2.87 %) and the highest in peritonitis (22.47%), as showed in Figure 2. These differences were significant

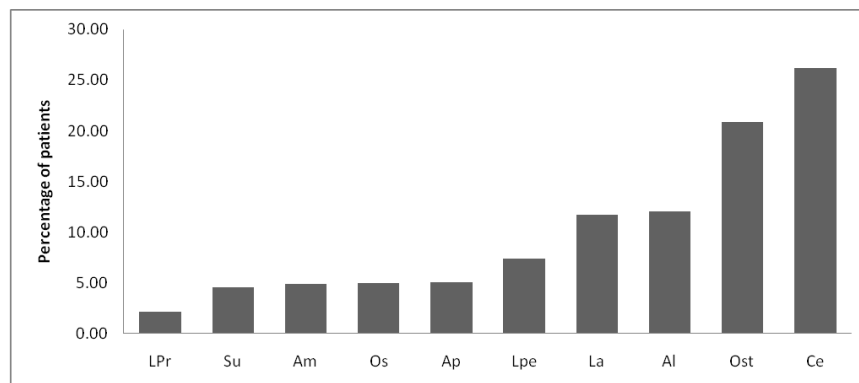


Figure 3. Population of the study frequencies according to the type of surgical procedure; *LPr* : laparotomy for prostate, *Su* : suture, *am* : amputation, *Os* : ostéotomie, *Ap* appendectomy, *LPe* : laparotomy for peritonitis, *La* : laparotomy, *Al* : others, *Ost* : ostéosynthese, *Ce* : caesarean section.

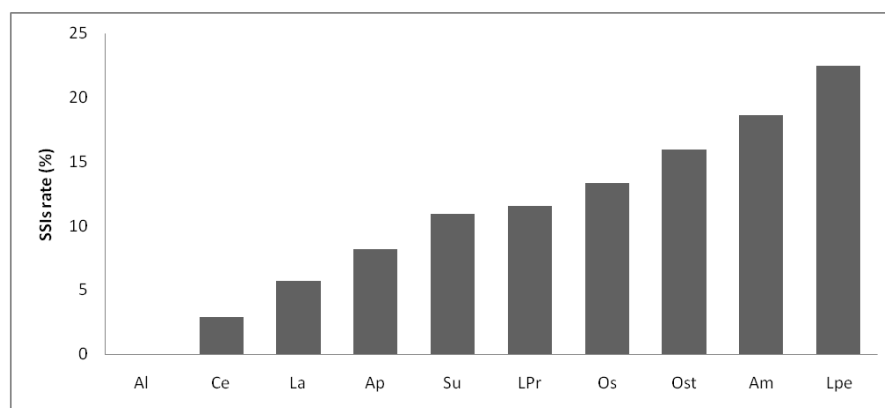


Figure 4. SSI frequencies according to the type of surgical procedure ; *LPr* : laparotomy for prostate, *Su* : suture, *am* : amputation, *Os* : ostéotomie, *Ap* appendectomy, *LPe* : laparotomy for peritonitis, *La* : laparotomy, *Al* : others, *Ost* : ostéosynthese, *Ce* : caesarean section.

($\chi^2 = 67.744$; ddl= 8; $p < 0.001$).

Wound contamination class

440 (36.64%), 125 (10.41%), 233 (19.40%) and 403 (33.55%) patients underwent clean (class I), clean-contaminated (class II), contaminated (class III) and dirty (class IV) surgeries respectively. The rate of SSIs appeared to increase in a statistically significant manner with the class of contamination of surgical operation ($\chi^2 = 48.697$; ddl= 3; $p < 0.001$), as frequencies rates were respectively 2.76%, 4.8%, 12.02% and 15.88%.

ASA score

Most patients were in good conditions with 33.89, 36.38,

22.65 and 7.08%, of them on ASA scores I, II, III and IV respectively. There was no ASA V patient recorded. The ASA score at time of surgery had a statistically significant association with SSI. ($\chi^2 = 34.890$; ddl= 3; $p < 0.001$) with ASA score as the values recorded were respectively 5.6%, 6.4%, 15.4% and 20 %.

Staff survey

All the questionnaires were filled. The survey revealed that the hospital rooms were washed daily and as many times as necessary. There were 8 beds/ room in HDBA and 1 to 6 beds/room in CHU. In HCY, there were single bed rooms (Maternity B and Traumatology A) and 2 to 6 beds /room in all the wards except Traumatology B ward where we counted 5 to 7 beds per room. The room doors were generally open except in maternity B and there was

not ventilation system except in maternity B. Patients' cleanliness was ensured by their own family. Only 1 to 10% of health workers washed their hands after each dressing. All declared that for dressing wounds, they wore gloves that were generally non sterile and always changed after each dressing.

DISCUSSION

The SSIs prevalence rate was 9.16% for the three hospitals which is similar to Jido and Garba findings in Nigeria (2012). This rate is higher than those found in some developed countries: 2.5% in France (Miliari *et al.*, 2009), 5.5% in USA (Pull ter Gunne *et al.*, 2010) and 1.8% in Brazil (Ercole *et al.*, 2011). The high risk of SSI found in our study can be explained by poor preventive strategies of nosocomial infections in the three hospitals. These results mean that much effort should still be made in this area. Nevertheless, these SSIs rate can be favorably compared to those reported for others countries: 13% in Serbia (Grujović and Ilić, 2013), 27% in Finland (Turtiainen *et al.*, 2010), 19.1% in Colombia (Angarita, 2011).

Age and gender were not associated with an increased risk of surgical site infection. These results are similar to Bercion *et al.* (2007) and Amenu *et al.* (2011) findings. Considering the environment, there was a significant difference in SSI rates between hospitals with the lowest rate in the District Hospital and the highest in the University Teaching Hospitals. Indeed, this situation could be as a result of specific policies hospitals pertaining to infection prevention. However, the general profile of patients admitted such as the common status of surgery and the common type of surgical procedure, could also be important. So, heavy surgical emergencies and orthopedic surgery are not usually performed in urban District Hospitals.

As regards the ward, there was also a statistically significant difference in SSIs rates. Hence, the highest SSIs rate was recorded in Traumatology B ward (23.2%). This result could be related to the fact that most patients admitted in this ward suffered from open fractures which are wound contaminations Classes III and Class IV. This issue can also be applied to the highest rate (22.47%) reported for peritonitis (Class II to IV).

Cesarean section was the most performed surgery in the study and presented with the lowest rate of SSI (2.87%). This result is remarkable in our context, according to international standards. These results suggest that in the three hospitals, post cesarean SSIs are not a common cause of maternal morbidity and mortality.

There was a statistically significant relation between the type of SSI and the class of wound at the time of surgery as reported by Amenu *et al.* (2011). Patients who had contaminated or dirty class of wounds were more likely to

have deep infections. Moreover, SSIs rate was highest in dirty type of wounds (15.88%), followed by contaminated wounds (12.02%) and clean contaminated (4.8%). The least rate was found in clean wounds (2.76%). Shahane *et al.* (2012) found similar percentages that is 12.3% for contaminated, 8.0% for clean contaminated and 4.6% for clean wounds.

In this multi-centre study mixing various surgical determinants, SSI occurred more in emergency surgeries (14.58%) than in elective conditions (7.45%). Amenu *et al.* (2011) also found in obstetric cases, SSIs rate two times higher in emergency surgery compared to that of elective conditions. Moreover, a significant association was found between SSI rate and ASA score ≥ 3 . This relation was already highlighted by Namba *et al.* (2012) for orthopedic surgery and others authors in general for single type of surgical procedure or in a single hospital. This study has some limitations which include the absence of other possible host-related risk factors such as body mass index, malnutrition, diabetes, HIV and cancer.

CONCLUSION

The rates of Surgical Site Infections were high in the concerned hospitals and can be related to many factors which are mainly environmental and clinical. It is a clear indication of vigorous strategies towards improving infection prevention practices and decreasing infection rates to acceptable levels.

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