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Epidemiological Aspects of Surgical Site Infections in an Income Country: The Case of Regional Hospital Centre, Borgou (Benin)

Hodonou M Adrien[1*], Allodé S Alexandre[1], Tobome S Romaric[1], Hounkponou-Ahouingnan Fanny[1], Mensah AD Emile[1], Fatigba O Holden[1], Tamou-Sambo Bio[1], Akpata Robert[2], Atakpa S Felix[3], Dadjo A Yves[4], and Mêhinto K Delphin[5]

[1] Faculty of Medicine, University of Parakou, General Surgery, Regional Hospital Centre, Borgou, Parakou, Republic of Benin

[2] Department of Internal Medicine, Saint Jean de Dieu Hospital Centre, Tanguiéta, Republic of Benin

[3] Department of Pharmacy, Regional Hospital Centre, Borgou, Parakou, Republic of Benin

[4] Department of Traumatology, Army Instruction Hospital Centre, Parakou, Republic of Benin

[5] Faculty of Health Sciences, Abomey-Calavi University, Visceral Surgery, National Teaching Hospital Centre, Hubert Koutoukou Maga, Cotonou, Republic of Benin

**Corresponding e-mail: hodasm98@gmail.com*

ABSTRACT

Background: *Surgical site infection is frustrating for the care team and depressing for the patient.* ***Objective****: To determine the epidemiological aspects of surgical site infections in regional hospital, Borgou.* ***Methods:*** *The study was crossed with prospective data collection. Recruitment was done for six months (from February 2013 to July 2013), each patient operated in both surgical services (general surgery and maternity) consents to be followed for one month or year. The surgical site infection was defined according to the CDC/NHSN 2009.* ***Results:*** *The frequency of surgical site infections was 7.3% (44/603). The mean age was 30.7 ± 15.8 years with minimum and maximum of 5 months and 70 years, respectively. They were significantly ($p<0.05$) more common in general surgery than that of maternity and visceral surgery and obstetrics were more concerned (14/44 each); the median time to SSI onset was 7.8 ± 3.8 days. The deep incisional infection was the most frequent (34/44). The most encountered organism was Escherichia coli (64.7%); multidrug resistance was 41.2%. The healing time averaged 30.5 ± 13.8 days with minimum and maximum of 20 and 92 days.* ***Conclusion:*** *Monitoring measures must be taken to reduce surgical site infection at the Regional Hospital Centre of Borgou.*

Keywords: Epidemiology, *Escherichia coli,* infection, surgical site

INTRODUCTION

Surgical site infection (SSI) is an incisional or organ/space infection occurring within 30 days after surgery or within one year in the case of an implant transfer or prosthetic material [1,2]. The SSI induces high mortality or morbidity rates with an increase in care cost, remaining then a public health issue worldwide [1,2]. The SSI situation was hard to assess nationwide in Benin and particularly at the regional hospital of Borgou where there is a lack of documented data. But nowadays, nosocomial infections such as the SSI are considered as the reflection of care quality in hospitals [3,4]. The authors propose to fill this gap through the current survey, aiming at describing the epidemiological characteristics of the SSI in the regional hospital of Borgou (RHC-B).

PATIENTS AND METHODS

Study design time and framework

The current work was a descriptive study with prospective data collection performed in general surgery and obstetrics and gynaecology of the regional hospital of Borgou from 1 February 2013 to 31 July 2014. The two services were

the only ones having surgery. The surgery activities of gynaecology and obstetrics took place in the maternity block, located three hundred meters from the surgical block of all the other surgical specialities. The same anaesthetists worked in both blocks. Cloths and surgical materials were sterilized in the same conditions. Monitoring of SSI was complete and lasted 6 months (February-July 2013). To meet the deadline of one month SSI definition, the latest cases operated in July were followed until the end of August; and the patients who received implants have been followed till July 2014.

Sampling method and sample size: Sample was consecutive and exhaustive.

Inclusion criteria: All the patients operated in both services during the recruitment period were exhaustively included when presenting SSI.

Exclusion criteria: When a patient's consent was not given, he was excluded. Those, lost during the follow-up were excluded. And the patients who died in the follow-up period without SSI were also excluded.

Methodology

All patients operated and presenting a SSI during the monitoring period in the two surgical services and who have given their willingness were monitored within thirty days or twelve months after surgery. Diagnostic criteria of SSI were those defined by the "Centres for Disease Control and Prevention/National Healthcare Safety Network (CDC/NHSN)" in March 2009 [5]. The sociodemographic characteristics of the patients, the surgery indications, the apparition' conditions of the SSI, the type of the SSI, the germs identified and its sensibility were collected. Statistical analysis: Data were analysed using Epi Info 7.1.1.14 software to exprim, Percentage table, and ecart-type.

Ethical approval

The hospital 'authorities allowed this study. The patients gave their consent. The anonymity was respected. The data collected were used only for this study. Since the study was observational, it was not necessary to obtain the agreement of an ethical committee.

RESULTS

From February 1st to July 31st 2013, 603 patients were operated at RHC-B (218 patients in general surgery and 385 in obstetric gynaecology). Forty-four have developed an SSI and all agreed to participate in our study. Our study then focused on these 44 patients and each had only one SSI. The frequency of the SSI at the CHD-B was thus 7.3% (44/603). It meant that 559 patients (92.7%) did not present any SSI. Considering each surgical service, the frequency of SSI was 12.8% in general surgery and 4.2% in obstetrics and gynaecology with p=0.000 (significant). The average age of SSI patients was 30.7 ± 15.8 years, ranging between 5 months and 70 years. In general surgery, of the 28 SSI-patients, 23 were men and 5 women. The sex ratio was 4:6. Twenty-four SSI-patients (54.5%) had income generating activities while 20 had not.

The average time between surgery and the onset of SSI for all patients was 7.8 ± 3.8 days with minimum and maximum of 3 and 24 days, respectively. The SSI occurred in 21 patients (47.7%) during hospitalization (all general surgery) and in the remaining 23 (52.3%) after hospitalization including 7 for general surgery and 16 for gynaecology-obstetrics.

Of the different cases, 34 cases were deep incisional SSI, while 6 cases were reported for superficial incisional SSI and 4 cases for organ or space SSI.

Pathologies associated with the SSI in 44 patients

General and digestive surgery (14 cases; 31.8%): Acute generalized peritonitis (5 cases), appendicular abscess (4 cases), hernia (2 cases), bowel obstruction (1 case), subcutaneous lipoma (1 case), acute appendicitis (1 case);

Obstetrics (14 cases; 31.8%): Acute foetal distress (5 cases), dystocia (4 cases), pre-breaking syndrome (1 case), ovular infection (1 case), hemoglobinopathies during pregnancy (1 case), foetal death *in utero* (1case), bi-scarred uterus (1 case);

Orthopaedic surgery (8 cases; 18.2%): Broken member (4 cases), crushed member (3 cases), chronic osteomyelitis (1 case);

Neurosurgery (5 cases; 11.4%): Lumbar spinal stenosis (1 case), herniated disc (1 case), broken vertebra (1 case), myelomeningocele (1case), tetra-ventricular hydrocephalus (1 case);

Gynaecology (2 cases; 4.5%): Malignant breast and endometrial malignancy; urological surgery (1 case; 2.3%): prostate adenoma.

Emergency surgery was performed on 23 patients (52.3%) with 11 and 12 cases in general surgery and obstetric gynaecology, respectively. The score American Society of Anaesthesiologists (ASA) [5] was 1 for 38.6% and 2 for 27.3% of the SSI patients. It was 4 for 4 patients, all general surgery service (Table). According to Altemeier classification [6], 11 of the patients (25.0%) who developed ISS, were operated for dirty infected surgery and all of them at general surgery service (Table). Based on the standards of the "National Nosocomial Infection Surveillance (NNIS)" of the United States of America [7,8], the distribution pattern obtained for the 33 patients (75.0%) with SSI was depicted in Table 1. The distribution of patients according to the score of "National Nosocomial Infections Surveillance (NNIS)" of the United States of America [5] is set forth in Table 1. Microbiological study of samples revealed a negative result for 12 patients (27.3%) and positive for 32 (72.7%).

Four germs were observed

Twenty-two *Escherichia coli* individuals (64.7%); 7 *Pseudomonas aeruginosa* individuals (20.6%); 4 *Staphylococcus epidermidis* individuals (11.8%) and 1 individual of *Proteus mirabilis* 1 (2.9%). Furthermore, two different germs were found in 2 patients, bringing the number of germs to 34 isolates.

Germs distribution within the SSI types

Superficial incisional SSI: *Escherichia coli* (2 cases); *Pseudomonas aeruginosa* (1 case); *Staphylococcus epidermidis* (1 case).

Deep incisional SSI: *Escherichia coli* (16/32); *Pseudomonas aeruginosa* (6 cases); *Staphylococcus epidermidis* (3 cases); *Proteus mirabilis* (1 case).

Organ/space SSI: *Escherichia coli* (4 cases). In 41.2% of positive culture cases (14/34), any *in vitro* susceptibility to the used antibiotics was observed. It consisted of 10 *Escherichia coli* culture; 2 *Pseudomonas aeruginosa* culture; one *Staphylococcus epidermidis* and one *Proteus mirabilis* culture.

The mean healing duration was 30.5 ± 13.9 days for the 44 patients with 20 and 92 days as minimum and maximum.

Table 1 Distribution of SSI patients according to different variables

Variables	Characteristics	General Surgery Service	Gynaecology Obstetric Service	Total (%)
Income generated activity	Yes	15	9	24 (54.5%)
	No	13	7	20 (45.5%)
Admission mode to the surgery	Emergency surgery	11	12	23 (52.3%)
	Planned surgery	17	4	21 (47.7%)
Infection spot at admission	Yes	10	1	11 (25.0%)
	No	18	15	33 (74.5%)
ASA score	1	7	10	17 (38.6%)
	2	8	4	12 (27.3%)
	3	9	2	11 (25.0%)
	4	4	0	4 (9.1%)
Type of anaesthesia	Spinal anaesthesia	10	14	24 (54.5%)
	General anaesthesia	17	2	19 (43.2%)
	Epidural anaesthesia	1	0	1 (2.3%)
Contamination class of the surgery	Cleaned	6	0	6 (13.6%)
	Cleaned contaminated	8	13	20 (47.7%)
	Contaminated	3	3	7 (13.6%)
	Dirty infected	11	0	11 (25.0%)

NNIS score	0	5	11	16 (38.6%)
	1	8	4	12 (25.0%)
	2	14	1	15 (34.1%)
	3	1	0	1 (2.3%)

DISCUSSION

The current study assessed the frequency of surgical site infection (SSI) at the regional hospital of Borgou from February to July 2013. The SSI frequency was 7.3%, close to that reported by Bibi, et al. [9] (7.3%). This frequency was higher than the 0.9% reported by C-CLIN network [10] in France; the 4.8% found by PREZIES network [11] in the Netherlands in 2010 and the frequency of 2.0% obtained by Oni, et al. [12] in Nigéria in 2006. All these countries have SSI monitoring and control policy, which is not the case of Benin. On the other hand, the current frequency of 7.3% was lower than those reported by Wassef, et al. [13] in Egypt (9.2%); Mankoutodé, et al. [14] at Porto-Novo in Bénin (10.1%); Hernandez, et al. [15] in Pérou (26.7%); Umesh, et al. [16] in India (30.7%). The mean age of 30.7 ± 15.8 years was close to 34.1 years found by Wassef, et al. [13]; but lower than that (60.3 years) obtained by Utsumi, et al. [17] in Japan. According to theses authors, older was a patient; greater was the risk to develop SSI. Indeed, low immunity and co-morbidities were the main factors responsible for such situation. Benin population consisted in majority of young and infectious diseases still dominated surgery. Moreover, the difference observed between general surgery and obstetric gynaecology could be explained by several factors. Of these, the bad ASA score (ASA3, ASA4) and the surgical contamination class according to Altemeier observed in ISS patients of general surgery, remain the most important factors [7]. In fact, infectious diseases (generalized acute peritonitis, appendicular abscess) were the first affections complicated with SSI. The infectious state induced a deterioration of the patients' general status with a higher ASA; thus, considering sepsis, they should be urgently operated. For Akoko, et al. [18], an emergency surgery was three times risky than planned surgery and this could explain the higher SSI recorded in visceral surgery and obstetrics. Chadli, et al. [19] found that SSI rates increased from 2.7% for a NNIS index equal zero to 10.2% for a NNIS score equal 3. The number of people present in the operating room was high and sometimes reached 12, or for Ayliffe [20], the microbial load in the operating room would be proportional to the number of people found in it, their mobility and behaviour. As the hospital is a teaching hospital, learners with various purposes increased the number of people in surgery blocks. Negative gram germs were the most encountered in samples with *Escherichia coli* as predominant species. Resistance rate (41.2%) remains big concern and this should make changes in strategy based on empiric antibiotic therapy. Wassef, et al. [13] found a lower rate (25.3%) while Hernandez, et al. [15] obtained 63.9%. These observations show that these germs were surely hospital multi-resistant ones. The SSI increases morbidity and the mean healing time of thirty days became between the triple and the double of the reasonable period of healing. Morbidity of course increases care costs supported by patients themselves.

CONCLUSION

Our care structures must be aware that surgical site infections should not be considered as inevitable. Everyone must play key role. Patients should wait until their illnesses reach complicated phases before going to the hospital. Caregivers should provide quality care by working on risk factors by remaining vigilant and governmental authorities should provide adequate health facilities and universal health insurance for all citizens; key condition for rapid use of health care facilities.

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