***Original Research Article***

# Bacteriological profile of surgical site infection: a descriptive study at Deido District Hospital in Douala, Cameroon

**Abstract**

**Background:** Surgical site infection (SSI) is defined as infections occurring within 30 days after a surgical operation, or within one year if an implant is left in place after the procedure. Surgical site infection is classified by the Americancenter for disease control (CDC) into superficial incisional surgical site infections SSI, deep incisional SSI and organ/space SSI.

**Objectives:** The objectives of this study were to determine the prevalence of post-surgical site infections, assess the risk factors, determine the various and most microorganisms encountered and study the antibiotic sensitivity in post-surgical site infection after post-surgical site infection in Deido district hospital Douala.

**Materials and methods**: we conducted a 3 months hospital based prospective study on general surgery, obstetric and gynecologicrecords admission at the Deido district Hospital Douala from February 1st 2020 to April 30$^{th}$ 2020. We included available files of the general surgery, obstetrics and gynecology. We excluded paediatrics and medical. The study was approved by the institutional ethic review board of the faculty of health sciences of the University of Bamenda.

**Results**: We had 133 of post-surgical patients in general surgery, obstetric and gynecologic. The prevalence of post-surgical site infection was 32,3% (43/133). Male gender aged 50-60 years were more affected than female to developed SSI. Diabetes mellitus andimmunodepressionby the human immuno deficiency virus had respective prevalence of 48.1 and 81,8% and increased hosptal stay after operation. Peritonitis with perforation was the mostinvolved(14%). The identified germs were Staphylococcus aureus(11,3%), followed by Escherichia coli (8%), Pseudomonas aeruginosa(3,8%) and pseudomonas spp(3%). Staphylococcus aureus was sensible to vancomycin(73,33%), netilmicin, amikacin (6o%). Escherichia coli was sensible to gentamycin, ciprofloxacin, augmentin with a prevalence of 63,64%. Pseudomonas aeruginosa was sensible to pristinacine (80%) and amikacin (60%). Pseudomonas spp was sensible to netilmicin, amikacin (75%) followed by gentamicin, levofloxacin andofloxacin (50%).

**Conclusion:** The prevalence of Post-surgical site infection was high, the clinical spectrum and bacterial sensitivity was diverse.

**Key words**: Surgical site infection – Deido District Hospital - Bacterial profile

## Introduction

### 1.1 Background

Surgical site infection(SSI) is defined as infections occurring within 30 days after a surgical operation (or within one year if an implant is left in place after the procedure) and affecting either the incision or deep tissue at the operation site, and contributes substantially to surgical morbidity and mortality each year [1]. SSI accounts for 15% of all nosocomial infections and, among surgical patients, represents the most common nosocomial infection, leads to increased length of postoperative hospital stay, drastically escalated expense, higher rates of hospital readmission, and jeopardized health outcomes [2]. With an estimated 27million surgical procedure each year in USA, and 2-5% rate of SSIs, approximately 300 000 to 5 000000 SSIs can be predicted to occur annually [3]. They are believed to increase the risk of dying 2-11 folds, with 77% of these deaths attributed directly to the SSI. The duration of the hospital stay increases 20- fold, and the cost increases 5-fold, which result in a net loss of reimbursement to the hospital [4]. Incisional SSIs are further divided into superficial incisional SSIs involving only skin and subcutaneous tissue and deep incisional SSIs -those involving deeper soft tissues of the incision. Organ /space SSIs involves any part of the anatomy (I.e. organ or space) other than incised body wall layers that was opened or manipulated during an operation [5]. Sutures are a contributory factor in infection, in fact, 66% of SSIs are related to the incision. Microbial adherence to the surface of suture material has been reported in the surgical literature for many years [6].

Most of these infections are caused by organisms that are part of normal skin flora, such as staphylococcus species, Propionibacterium acnes, and gram-negative bacilli. Further,an increasing number of infections are caused by organisms that are resistant to multiple antibiotics[7].The association between staphylococci and SSI is increasnig despitecontinousadvances in aseptic principles of surgery and the ongoing improvement of sterile surgical technique [8].In fact, in the presence of sutures, only 100 colony forms units (CFU)/mg are necessary to produce infection [9].

Various bacteria may contaminate not only the tissue in the surgical wound, but the actual suture material. Once sutures material becomes contaminated, local mechanisms of wound decontamination become ineffective [10]. The risk of acquiring hospital infection on hospitalized patients in relation to surgery is high, since about 77% of death of patients with nosocomial infections was reported to be related with post-operative infections [11]. The number of surgical patients in developing countries is also increasing but surgical care given to the patients is poor. Microorganisms can get access into a wound either by direct contact of air borne dispersal or by contamination [12]. According to the national nosocomial infections surveillance system, the most frequently isolated pathogens from SSI are staphylococcus aureus (20%) and coagulase -negative staphylococci [13].

These organisms are acquired from the exogenous environment or the patient's own skin flora and hence are introduced easily into wounds [14]. Substantial research has been conducted to prevent SSI, and, as a result, recommendations have been published as guidelines for SSI [15]. In these guidelines, sterilization of surgical instruments is recommended as one of the fundamental and classical measures against SSI. If instruments were microbially contaminated, it would lead to increased SSI incidence. Therefore, instruments are decontaminated and sterilized between surgical procedures to prevent cross transmission [16].

However, in spite of sterilization, surgical instruments remain one of the most important sources of SSI. They can be contaminated during surgical procedures through contact with resident skin flora, which recover several hours after preoperative skin preparation, or through contact with microbes in the digestive tract such as stomach, duodenum, and colon. Surgical instruments might act to spread microbes over the surgical field. Previous studies have examined the microbial contamination of surgical instruments in central sterile supply departments, showing a relatively high incidence of contamination with high microbials counts [17].

The risk of developing a surgical wound infection is largely determined by three factors: the load, type of microbial contamination of the wound and host susceptibility. Certain transient organisms such as Staphyloccocusaureus, hospital acquired methicillin resistant Staphyloccocusaureus (MRSA) and coliform on the skin can easily contaminated the surgical wound from poor hygiene [18]. To reduce the risk of surgical site infections, effective and persistent skin antisepsis, meticulous operative technique, appropriate antimicrobial prophylaxis, and identification of strategies for decreasing wound contamination must be used; patient – related factors such as age, gender, body mass index,underlying disease, co-morbidities, prior operative procedures, and life-style factors such as smoking and alcohol drinking habits must be highlighted. Hair in the surgical incision area should be left unless removal is necessary for the procedure. If removed, caregivers should do so with clippers immediately prior to surgery. Intraoperative skin preparation is of critical importance, not only that the antibacterial solution used has broad spectrum properties, but also that the product be properly applied [19].

**1.2 Research question**

What is a bacteriological profile on surgical wounds infections in Deido district hospital Douala?

**1.4 Research objective**

The objectives of this study were to determine the prevalence of post-surgical site infections, assess the risk factors, determine the various and most microorganisms encountered and study the antibiotic sensitivity in post-surgical site infection after post-surgical site infection in Deido district hospital Douala.

## Material and methods

**Study design:**This study was a tranverse study conductedover a period of 3months, involving patients from surgery, obstetrics/gynecologyat the Deido district hospital Douala in the first subdivision, Wouri division, Littoral region, an hospitalwhich is considered as a 3$^{rd}$-class category hospital at the reference level of our health system classification.

**Study poplulation**:We included all patients who had general, obstertic or gynecology surgery during the study period, from1$^{st}$February 2020 to 30$^{th}$April 2020. We excluded non operated patients and children. We calculate our sample size, using the Cochran formula:

$n=Z1\text{-}\alpha2[P(1\text{-}P)]/d2$

n = the minimum sample size

$Z1\text{-}\alpha2$ = Is standard normal variate (at 5% type 1error (*P*<0.05) it is 1.96

p = Expected proportion in population based on previous studies or pilot studies which is not more than 7% for this study. So, P=0.12 that was the prevalence at Laquintinie hospital Douala in 2013[20], study done at the reanimation service.

d = Absolute error or precision. At 95% confidence interval, d=0.05

n=1.962[0.12(1-0.12)]/0.052=1.962 [0.12(0.88)]/0.052; n= (3.84)(0.10) / 0.0025 = 153

So, the minimum sample size for statistical significance in this study was 153 patients.

We recruited 133 participants for this study. We used a consecutive non probability sampling method. All files of potential participants who fulfilled the inclusion criteria participated in the study

**Ethical autorisations** : After obtaining ethical approval from the university of Bamenda ethical committee/ institutional review board Uba/IRB), administrative authorization was sought and obtained from the regional delegation of public health for littoral and from the administration ofDeido district hospital Douala.We then proceeded to meet the head of departement of surgery in charge of general surgery, surgeons, obstetricians and gynecologists and presented ourselves and our study, to have access to files and patients.

All eligible patients were assigned codes. We noteddependant and independantvariables We to complete information lacking such as bacterial identification and antibiogram.

**Study variables**

**Study variables independent variables:**

- Prevalence variables: total number of post-surgical site infection, surgery indication.
- Socio demographic variable: Age, sex, residence, profession.
- Clinical variables: comorbidities, surgery indication and performed procedures.

**Study dependent variables:**Surgical site infection type, germ identification and antibiogram.

**Data management and analysis:**All data was checked and coded. We later enter the data into the computer, whose password was known just by the investigator. Data was entered into census survey processus (CS PRO version 7, 2) system and exported to software statistical package for social sciences (spss) version 23.0 for statistical analysis.

## Results

### 4.1 Study population and prevalence

A total of 133 cases had been registered in general obstetrics and gynecologysurgery:16 witout SSI in obstetrics and gynecology and 117 cases in general surgery (with 74 non SSI and 43 SSI). The prevalence of post-surgical site infection was 32,3% (43/133).

### 4.3 General characteristics of patients studied

#### 4.3.1 Age and gender

Among the 43 patients exposed ,18(41,9%) were female,25(58,1%) were male and male gender aged to 50-60 years were more affected than female to developed post-surgical site infection (Table I). The patients with SSI had longer (superior to 21days) hospital stay after postoperative procedure.

**Table I:** Age and sex distribution of the patients studied

| | Evolution | | | | RR (IC95%) | p-value |
|---|---|---|---|---|---|---|
| | Contaminated | | Clean | | | |
| | n | % | n | % | | |
| [10-20[ | 5 | 11,6 | 14 | 15,6 | | 1 |
| [20-30[ | 10 | 23,3 | 28 | 31,1 | 1,01(0,28-3,49) | 0,899 |
| [30-40[ | 4 | 9,3 | 22 | 24,4 | 0,50(0,11-2,22) | 0,37 |
| [40-50[ | 9 | 20,9 | 12 | 13,3 | 2,1(0,55-8,01) | 0,277 |
| [50-60[ | 10 | 23,3 | 4 | 4,4 | 7,1(1,49-32,81) | 0,014* |
| ≥60 | 5 | 11,6 | 10 | 11,1 | 1,4(0,31-6,16) | 0,656 |
| Male | 25 | 58,1 | 32 | 35,6 | 2,51(1,19-5,29) | 0,015* |

**4.3.2 Comorbidities**

Among their exposed patient, diabetes mellutis 13 (48,1%) and immunodepression 9(81,1%) were the principles risks factors involved (Table II).

**Table II: Comorbidities distribution of the patients studied**

| | **Evolution** | | | | **RR (IC95%)** | **p-value** |
|---|---|---|---|---|---|---|
| | Contaminated | | Clean | | | |
| | n | % | n | % | | |
| **histrory of gastristis** | 4 | 44,4 | 5 | 55,6 | 1,74(0,44-6,85) | 0,426 |
| **histrory of Obesity** | 4 | 100,0 | 0 | 0,0 | - | 0,999 |
| **history of tobaccoconsumption** | 2 | 50,0 | 2 | 50,0 | 2,14(0,29-15,77) | 0,453 |
| **HTA** | 8 | 25,8 | 23 | 74,2 | 0,66(0,27-1,64) | 0,377 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Diabetes** | 13 | 48,1 | 14 | 51,9 | 2,35(1,01-5,58) | 0,043* |
| **Epilepsy** | 0 | 0,0 | 1 | 100,0 | - | 0,999 |
| **Alcoholism** | 12 | 28,6 | 30 | 71,4 | 0,77(0,34-1,71) | 0,529 |
| **immunodepressed** | 9 | 81,8 | 2 | 18,2 | 11,64(2,39-56,68) | 0,002* |
| **Drug abusers** | 3 | 100,0 | 0 | 0,0 | - | 0,999 |

**4.4 Prevalence of variousgerms.**

The various and most germs was gram positive staphylococcus aureus with a prevalence of 15%, gram-negative Escherichia coli with a prevalence of 11% followed by Pseudomonas aeruginosa and Pseudomonas spp (Table III).

**Table III: Various germs involved in SSI**

| | Frequency N=43 | Percent (%) |
|---|---|---|
| **StaphylococusAureus** | 15 | 11,3 |
| **Escherichia Coli** | 11 | 8,3 |
| **Pseudomonasaeruginosa** | 5 | 3,8 |
| **PseudomonasSpp** | 4 | 3,0 |
| **SerratiaOdorifenes** | 2 | 1,5 |
| **SerratiaLiquefaciens** | 2 | 1,5 |
| **KlebsiellaOzanae** | 1 | 0,8 |
| **SalmonellaSsp** | 1 | 0,8 |
| **EnterobacterAlvei** | 1 | 0,8 |
| **EnterobacterCloacae** | 1 | 0,8 |
| **SteptocoqueGroupA** | 1 | 0,8 |
| **EnterococusSpp** | 1 | 0,8 |
| **ProvidenciaStuartii** | 1 | 0,8 |
| **CitrobacterFreundii** | 1 | 0,8 |
| **StaphylococusSaprophyticus** | 1 | 0,8 |
| **EnterobacterSakazaki** | 1 | 0,8 |

**4.5 Antibioticsensitivity**

For Gram positive bacteria, Staphylococcus aureus was sensible (Table IV) to vancomycin with a prevalence of 73,33%, netilmicin and amikacin with a prevalence of 60%.

For gram negative bacteria (Table V) Escherichia coli was sensible to gentamycin, ciprofloxacin and augmentin with a prevalence of 63.33%. Pseudomonas aeruginosa was sensible to pristinicine with a prevalence of 80% and amikacin with a prevalence of 60%. Pseudomonas.spp was sensible to netilmicine, amikacin with a prevalence of 75% followed by gentamicine, levofloxacin and ofloxacin with a prevalence of 50%.

**Table IV:** Antibiotics sensitivity of Gram-positive organisms

| Antibiotics | Gram positive organisms |
|---|---|
| | StaphylococusAureus |
| Netilmicine | 60,00% |
| Fosfomycine | - |
| Vancomycine | 73,33% |
| Amikacin | 60,00% |
| Gentamicine | 53,33% |
| Penicilline | 6,67% |
| Levofloxacine | 13,33% |
| Erythomycine | 46,67% |
| Ciprofloxacine | 46,67% |
| Fosfomycine | 20,00% |
| Ofloxacine | 26,67% |
| Ceftriaxone | 53,33% |
| Ampicilline | - |
| Augmentin | 33,33% |
| Nalidixic acid | - |
| Azithromycine | 20,00% |
| Doxycycline | 13,33% |
| Cotrimodazole | - |
| Kanamycin | - |
| Cloxacillin | 27% |
| Norfloxacin | 7,14% |
| Chloramphenicol | - |
| Perfloxacine | - |
| PeniG | - |
| Pristinacine | 27% |
| Imipenem | - |
| Oxacilline | - |

**Table V:** Antibiotics sensitivity of gram negative organism

| Antibiotics | Gram negative bacteria | | |
|---|---|---|---|
| | Escherichia coli | Pseudomonas aeruginosa | Pseudomonas. Spp |
| Netilmicine | 9,09% | - | 75,00% |
| Fosfomycine | - | - | - |
| Vancomycine | - | - | - |
| Amikacin | 45,45% | 60,00% | 75,00% |
| Gentamicine | 63,64% | - | 50,00% |
| Penicilline | - | - | |
| Levofloxacine | 27,27% | - | 50,00% |
| erythomycine | - | - | |
| Ciprofloxacine | 63,64% | 20,00% | 25,00% |
| Fosfomycine | 27,27% | - | |
| Ofloxaxine | 9,09% | - | 50,00% |
| Ceftriaxone | 27,27% | 20,00% | - |
| Ampicillin | 27,27% | - | - |
| Augmentin | 63,64% | - | |
| Nalidixic acid | - | - | - |
| Azithromycine | - | - | - |
| Doxycicline | - | - | - |
| Cotrimodazole | - | - | - |
| Kanamycin | - | - | - |
| Cloxacillin | - | - | - |
| Norfloxacin | 18,18% | - | - |
| Chloramphénicol | - | - | - |
| Perfloxacine | - | - | - |
| PeniG | - | - | - |
| Pristinacine | - | 80,00% | - |
| Imipenem | 18,18% | - | |
| Oxacilline | - | - | 25,00% |
| Ertapemen | - | - | |
| Ceftazidime | - | - | |

**Discussion**

**5.1 Prevalence ofpost-surgical site infection**

The management of patients with bacterial infection depends on the identification of bacterial pathogens and on the selective of an antibiotic effective against the organisms in question.

The prevalence of surgical site infection in the present study was 32,3% which was not in concordance by the study done at Laquintinie Hospital Douala in the reanimation department by ClotildeNjall and al. in 2013 [20].

**5.2 General characteristics of patients studied**

**5.2.1 Age and gender.**

The advance age with male gender may contribute to increased rate of surgical site infection which were comparable with the study conducted in 2013 [21] by Koral et al .

**5.2.2 Comorbidities**

Diabetis mellitus and immunodepression status especially HIV were the two majors'comorbidities incriminated and they were comparable with the same study [10] done by Koral et al.

**5.2.3 Length of post operation stay.**

The patients more exposed were those with the expensive length of postoperative stay in the hospital more than 21days and it was comparable by the study done in 2011 [22] by Gibbon et al.

**5.3 Prevalence of various germs**

In our study we had four various germs identified staphylococcus aureus, Escherichia coli, pseudomonas aeruginosa and pseudomonas spp. The predominance of staphylococcus aureus was seen and this finding was consistent with reports in 2017 [23] by Kanwalpreet and al. Infection with staphylococcus aureus is most likely associated with endogenous source as it is a member of the skin and nasal flora and also exogenous source with contamination from environment or from hands of health workers. Pseudomonas aeruginosa and Pseudomonas spp were also present in the components of our various germs in our study. This finding was also consistent with reports in 2017 [23] by Kanwalpreet and al. which are among the common nosocomial infection encountered in the hospital setting.

**5.4 Antibiotic sensitivity.**

In our set up, vancomycin was seen of staphylococcus aureus isolates followed by netilmicine, amikacin. This finding was not in concordance with the study done in 2017 [23] by Kanwalpreet and al. Gentamicine, ciprofloxacilline and augmentin were seen in 63,64% of Escherichia coli isolates, pseudomonas aeuriginosa was sensible to pristinacine and amikacin, pseudomonasspp was sensible to netilmicine, amikacin followed by gentamicine, levofloxacilline and ofloxacilline. Those finding were not in concordance with the same study done in 2017 [23] by Kanwalpreet and al.

**Conclusions and recommendations**

**6.1 Conclusions**

This study revealed that the prevalence of post-surgical site infection was 32,3%. Several risk factors contributed to the infection rate: elderly male patients with a chronic condition notably diabettus mellitus, HIV status (immunodepression). SSI increased the hospital stay after operation. Staphylococcus aureus, Escherichia coli, pseudomonas aeruginosa and pseudomonas spp were the major's germs encountered with prevalence of 11,3 ; 8,3 ; 3,8 and 3 % respectively. All isolates of Staphylococcus aureus was sensible to vancomycin, netilmicin, and amikacin. Escherichia coli was sensible to gentamicin, ciprofloxacin % and augmentin with the prevalence of 63,64%. Pseudomonasaeruginosa was sensible to pristinacine and amikacin. Pseudomonas spp was sensible to netilmicin, amikacin followed by gentamicin, levofloflaxicne and ofloxacin.

**6.2 Recommendations** : do prevention and cure, and carry out large scale studies in the different parts of the country in order to establish the actual national incidence and prevalence of post-surgical site infection and their complications.

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