Incidence of Surgical Site Infections and Microbial Pattern at Kilimanjaro Christian Medical Centre

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Abstract

Background

Surgical site infection (SSI) remains a major cause of morbidity and death. We conducted a study to determine the incidence of surgical site infections and microbial pattern at Kilimanjaro Christian Medical Centre.

Patients and Methods

A prospective hospital based study was conducted at KCMC general surgical wards from November, 2010 to March, 2011. A total of 263 newly operated inpatients were enrolled but 27 patients among the group were lost on follow up visits and were therefore excluded from the study. So, only 236 patients completed the study's one month follow up.

Results

Two hundred and thirty six patients were followed up for the development of surgical site infection. Eighteen patients developed features of surgical site infection. Four patients had culture negative results. One patient who developed SSI due to an infected implant died. Superficial SSIs constituted (61.1%) while deep SSI constituted (27.8%) and organ/space (11.1%). The overall SSI rate was 7.6%. Clean, clean contaminated, contaminated and dirty wounds had infection rates of 3.5%, 8.7%, 25.4% and 29.4% respectively. There were 15 bacterial isolates and multidrug resistance was also observed in a number of bacterial isolates.

Conclusion

The incidence of infection in our centre is low and the pattern of microbes causing surgical site infection at the centre has remained the same over time.

Introduction

Surgical site infection (SSI) is an infection that develops within 30 days after an operation or within one year if an implant was placed, and the infection appears to be related to the surgery (14). It remains a major cause of morbidity and death among the operated patients(1). Post-operative SSIs are the most common healthcare-associated infection in surgical patients, occurring in up to 5 percent of surgical patients(2,14). In the United States, between 500,000 and 750,000 SSIs occur annually(3,16). Patients who develop a SSI require significantly more medical care. If an SSI occurs, a patient is 60 percent more likely to spend time in the ICU after surgery than is an uninfected surgical patient, and the development of a SSI increases the hospital length of stay by a median of two weeks (12,17). The risk of SSIs continues after discharge. SSIs develop in almost 2 percent of patients after discharge from the hospital and these patients are two to five times as likely to be readmitted to the hospital (12,16,17). The high morbidity associated with SSIs prolongs the hospital stay. This not only increases the medical care cost but also the mortality(10).

Clinical presentation of SSI varies from a spontaneous wound discharge within 7-10 days of an operation to a life-threatening postoperative complication. Most surgical site infections are caused by incision contamination by microorganisms from the patient's own body during surgery. Infection caused by micro-organisms from an outside source following surgery is less common. Most of surgical site infections are preventable.

Surgical site infections are the most common post operative complication, which can adversely affect the life of the patient. The morbidity associated with this not only increases the cost of care but also carries a significant mortality(6, 7).

In the United States of America (USA) approximately one million patients develop SSI each year; increasing duration and cost of hospital stay (8).

The magnitude of SSI varies considerably in different parts of the world. The rate of surgical of site infection in USA has been reported to be 2.6 percent, while a report from Tanzania shows this figure to be 19.4 percent (5,7). Surveillance of SSI and providing feedback to the surgical team has been shown to reduce the incidence of surgical site infection and the cost incurred due to it (4).

SSIs are classified as being either incisional or organ/space. Incisional SSIs are divided into those involving only skin and subcutaneous tissue (superficial incisional SSI), and those involving deeper soft tissues of the incision (deep incisional SSI)(11).

Patients and methods

Patient characteristics, wound properties and culture data were collected from patients' files and culture reports. Diagnosis of SSI was made according to the National nosocomial infection surveillance (NNIS. Surgical wounds were classified according to the Centre for Disease Control (CDC) classification (11). Patients' wounds were inspected from day one post operative until the day of discharge from the hospital and later were followed up for four weeks at the outpatient clinic. Some surgeons open surgical wounds from day three post operative. However, in this study, it was made the standard to open surgical wound from day one post operatively in order to identify those with early signs of SSIs. They were told not to change the wound dressings in the peripheral health facilities until they were seen at the surgical clinic. Those patients who did not show for the follow up visits were excluded from the study. The data of each patient were filled into a data sheet. For patients who showed signs of SSIs, wound swabs were taken, put in Stuart's transport medium and sent to the laboratory for culture and antibiotic sensitivity. The duration of culture was three days. Microscopy was conducted for positive cultures. The hospital laboratory had no techniques for culturing anaerobic and fastidious organisms. Data analysis was conducted using SPSS ver 16.0. Statistical significance was tested using Chisquare test and the P- value was set at <0.05.

Results

A total of 263 patients were enrolled in the study but 27 patients who are equivalent to 10.3% of the total patients enrolled were lost on follow up visits and were removed from the study. Of the remaining 236 patients, 134(56.8%) were males and 102 (43.2%) were females. 153 patients were elective patients whereas 83 were emergencies.

The majority of the operations performed were laparotomy (96 cases), thyroidectomy (35 cases) and head surgery (28 cases)(Table 1).

Table 1: Type of surgeries done (N=236)

Procedure	Frequency	Percent
Laparotomy	96	40.7
Thyroidectomy	35	14.8
Craniotomy	28	11.9
Perineal and inguinal	18	7.7
VP shunting	17	7.2
Excisions*	16	6.8
Thoracotomy	11	4.7
Laparoscopic Cholecystectomy /appendicectomy	8	3.4
Amputations	2	0.8
Contracture release	2	0.8
Haemorrhoidectomy	1	0.4
Tracheotomy	1	0.4
Cleft lip repair	1	0.4
Total	**236**	**100.0**

*= (Breast cancer, teratoma, lipoma, mandibular tumors excisions).

Of the enrolled patients the majority (60.2%) had clean wounds while only a minority had dirty wounds (Table 2).

Table 2: The distribution of the study population by wound classes (N=236)

Wound class	Frequency	Percent
Clean wound	42	60.2
Clean contaminated wound	69	29.2
Contaminated wound	8	3.4
Dirty wound	17	7.2
Total	**236**	**100.0**

Out of 236 patients, 18 patients developed signs of SSIs, giving an incidence of 7.6%. Wound swabs for culture and sensitivity were taken. 4 patients out of 18 patients had negative cultures, the remainders were culture positive. The majority of SSI were superficial SSIs (61.1%) followed by deep (27.8%) and organ/space (11.1%) SSIs. The rate of infection in elective surgeries was 5.9% and in emergency surgeries was 10.8 % (Table 3).

The majority of the patients who showed signs of SSIs were under the age of 13 years.

Table 3: The patients whose wounds showed signs of SSIs (N=18)

Variable	Entity	Number	Percentage
Age distribution	0-12years	10	55.6
	13-55years	5	27.8
	56-90years	3	16.6
Culture status	Positive	14	77.8
	Negative	4	22.2
Distribution of SSIs by CDC criteria	Superficial	11	61.1
	Deep	5	27.8
	Organ/space	2	11.1
Rate of infection by category of surgery	Elective	9	5.9
	Emergency	9	10.8

The majority of infections were seen in laparotomy procedures (Table 4).

Table 4: The distribution of infection by surgical procedure (N=18)

Procedure	Frequency	Percent
Laparotomy	13	72.2
Excisions	3	16.7
Craniotomy	1	5.6
VP shunting	1	5.6
Total	**18**	**100.0**

The overall SSI rate was 7.6%. The infection rates for different classes of wounds were clean wound, 3.5%, clean contaminated wounds, 8.7%, contaminated wounds, 25.4% and dirty wounds, 29.4%. The difference observed in the infection rates in different classes of wounds was statistically significant, pvalue of 0.000 on Chi square test (Table 5).

Table 5: The rate of infection in different wound classes

Wound classes	Infection rate	p-value
Clean wound	3.5%	
Clean contaminated	8.7 %	
Contaminated wound	25.0 %	**0.000**
Dirty wound	29.4 %	
Overall	**7.6%**	

One patient who developed SSIs showed a mixed infection of Staphylococcus aureus and Klebsiella spp. Gentamicin was found to be very potent against Klebsiella spp, E. coli, Proteus spp, Coliforms and pseudomonas spp. Ceftriaxone and metronidazole were the commonest used prophylactic drugs following abdominal surgeries, and chloramphenical and benzyl penicillin were used as prophylaxis following head surgeries. A number of bacterial isolates responded favourably to all the tested antibiotics. 28.6% of staphylococcus aureus isolates (2 isolates) were sensitive to all the tested drugs. Multidrug resistance was also observed in a number of bacterial isolates. Proteus spp exhibited resistance to metronidazole and ampiclox. Of the three Klebsiella spp isolates, two showed resistance
to both cloxacillin and cotrimoxazole, and one showed resistance to cloxacillin, erythromycin and tetracycline. Pseudomonas spp was resistant to metronidazole. There was no growth of staphylococcal aureus which was found to be methicillin resistant.

Discussion

The overall SSI rate observed in this study is still higher compared to those seen in the developed countries, in Italy, an overall SSI rate 5.9% and in USA, 2.6%(1, 7). The high standards of health care in the developed countries still remain as the only explanation to this difference in the rates of infection observed.

The overall infection rate in this study was 7.6% and in the different classes of wounds;-clean wounds, clean contaminated wound, contaminated and dirty wounds were 3.5%, 8.7%, 25.4% and 29.4% respectively. In a similar study by Ericksen et al, 2003 at KCMC, the overall infection rate was 19.4% and the rates of infection by wound classes were;-clean wounds, 15.6%, clean contaminated wounds, 17.7%, contaminated wounds, 37% and dirty wounds 50%. The difference observed may be due to increased standards of health care (asepsis in surgery, the use of antibiotic prophylaxis, surgical technique, appropriate wound care, etc) provided by surgical team at our centre. The differences in rates of SSIs observed in different classes of wounds in this study are statistically significant with a P-value of <0.05. The rate of infection in elective surgeries was 5.9% and in emergency surgeries was 10.8 %. Poor health conditions and poor preparation of the patients might have contributed to the higher rate of surgical site infection in emergency cases. The infection rate in clean cases in this study is lower than that observed at Muhimbili National Hospital(18). This suggests that the standard of care for surgical wounds at our centre may be higher than that at Muhimbili National Hospital in 2000. This comparison to Muhimbili National hospital was done because it is a national centre in the same country as our centre.

Among the cases which showed signs of SSI, the majority (72.2%) were those which underwent laparatomy and this is different from an observation made by Lilani et al, 2005, where cases which underwent thoracotomies were leading in infection (44.4%). Most of the wounds after laparotomy are clean contaminated to dirty wounds and carry a high risk of infection.

Negative cultures are not uncommon as it has been observed in this study and in other studies (4,13). Fastidiousness of the microbes (atypical microorganisms like mycoplasma, Norcadia, legionella,'small colony variant' Staphylococcus aureus, atypical mycobacteria, etc.), poor microbial yields in the fluids at surgical sites and culture techniques could attribute to this.

One patient who developed surgical site infection died. She had an infected VP shunt. This is an important example of the mortality associated with infected implants. Implants are associated with an increased risk of surgical site infection if antibiotic prophylaxis is not used and asepsis in surgery not absolute.

Staphylococcus aureus has remained to be the commonest bacterial isolate in this study and in the majority of SSIs in other studies, as it is found in abundance on the skin unlike other microbes(4,13,15). The finding on drug resistance in our study has also been shown in other studies (4). 28.6% (2/7) of staphylococcus aureus isolates were sensitive to all the tested drugs; conversely, 54.5% of staphylococcus aureus isolates were sensitive to all the tested drugs (4). The decrease in staphylococcus aureus sensitivity to drugs may suggest evolution of resistant strains.

The multidrug resistance observed may also suggest an increase in inappropriate prescription and use of antibiotics.

In conclusion, it has been observed that there is an improvement in the quality of care of patients evidenced by the lower infection rates when compared to those observed at the same centre in an earlier study (4). However, the pattern of microbes causing SSIs has not changed much over time.

Recommendations

1. Tissue specimens in addition to swabs from surgical sites should be advised to reduce the rate of negative culture.
2. Culture duration should be extended from the normal 72 hours to five days to try and accommodate for the growth of many atypical microorganism (atypical mycobacteria, ureaplasma, Norcadia, 'small colony variant' staphylococcus aureus, etc.
3. For bacteria strains which show resistance to the standard antibiotics, further studies (microbiology) should be done to find appropriate drugs for their eradication.
4. There is a need for improvement of the hospital laboratory so that it is able to culture fastidious and anaerobic organisms.

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