British Journal of Medicine & Medical Research
9(3): 1-7, 2015, Article no.BJMMR.17550
ISSN: 2231-0614

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Epidemiological Characteristics of Surgical Wound-Infections in Cancer Patients from Jalisciense Institute of Cancerology. México

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Authors' contributions

This work was carried out in collaboration between all authors. Authors IEVB, JAG and GGO designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors AGR, FMG and EMJ managed the literature searched the analyses of the surgical wound infection. Authors FPPM, IEVB and EDGR managed the experimental process and statistical analysis. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/17550
Editor(s):
(1) Divya Kesanakurti, Dept. of Cancer Biology and Pharmacology, University of Illinois College of Medicine, U.S.A.
Reviewers:
(1) Elizabeth Awoyesuku, Department of Ophthalmology, University of Port Harcourt Teaching Hospital, Nigeria.
(2) Heba Abo Bakr Mohamed Salama, Surgical Department, Mansoura University, Egypt.
Complete Peer review History: http://sciencedomain.org/review-history/9834

Original Research Article

Received 18th March 2015
Accepted 7th May 2015
Published 18th June 2015

ABSTRACT

Background: The surgical wound infections (SWI) are common in hospitals, depending on the type of surgery and the presence of risk factors, cancer patients have a higher prevalence of infection, (immune-compromised state in which it is located). A low rate of infection is one parameter to measure the quality of surgical services. The aim of the present work was to determine the epidemiological characteristics of SWI in cancer patients in the Jaliscience institute of cancerology.

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Study Design: A descriptive, retrospective study.
Methodology: 46 patients were studied with SWI. Centers of disease control and prevention criteria for surgical wound infection were considered. Information was obtained from the Jaliscience Institute of Cancerology epidemiological department, using the hospital network for epidemiological surveillance (HNES) format record´s, included microbiological results and clinical data. The statistical analysis were performed with the SPSS-20 program.
Results: There were 2637 major surgeries from April 2008 thru December 2010. 46 had SWI. Frequency of service per 100 infected surgeries was: Gastroenterology 58.6%, Gynecology 32.6%, Urology 4.4, Head and Neck 2.2% and Traumatology 2.2%. Incidence by gender: men (1.1), women (0.83), with no significant difference. Average age of 51 years. The surgical-wound infected (SWI) were detected between 7.4±4.2 days. Average days stay 19 days. The results of microbiology cultures exhibited: *Escherichia coli* 53.3%, *Pseudomonas aeruginosa* 11.9%, *Morganella morganii* 4.8%, *Enterococcus faecium* 11.9%, *Enterococcus faecalis* 23.8%, *Staphylococcus*-coagulase-negative 7.1%, *Streptococcus ß-hemolytic* 4.8%.
Conclusion: Surgical wound infection rates were similar to that reported in other countries and below the rates reported in oncology hospitals in México. It is important to note that a proper preventive approach and epidemiological surveillance are critical to avoid mortality of patients.

Keywords: Surgical wounds; infection; oncology.

1. INTRODUCTION

Surgical wound infections (SWI) occurs from bacterial contamination caused by (or in) a surgical procedure. Although the definition is limited to the "wound", it also extends to the involvement of deeper tissues in the surgical procedure, which usually are germ-free under normal conditions. SWI are common in hospitals, although this depends on types of surgery and the presence of risk factors [1]. In the United States it is estimated that SWI are responsible for 24% of all infections, and occur three per 100 surgeries [2]; worldwide SWI rates ranging from 2.5% to 41.9% [3], and are the adverse event more common in a hospital. SWI are classified into two broad categories: incisional, and organ or spaces (involving anatomic areas other than the incision itself that are opened or manipulated in the course of the procedure). Incisional surgical wounds are further subdivided into surface and deep surgical wounds. Using the NOM criteria (NOM-EM-002-SSA2-2003), SWI can be subdivided into clean, clean-contaminated, contaminated and dirty or infected [4]. Many factors influence surgical wound healing and determine the potential for, and the incidence of, infection: type of surgery, if there are implantation of foreign material to the host, the extent of surgical trauma, type of microorganisms and their ability to produce potentially destructive virulence factors, perioperative prophylaxis, systemic defenses and number of underlying diseases [5,6]. Cancer patients have an increased risk of infection secondary to their immunocompromised state [7]. SWI are a significant burden on the patient in terms of pain, suffering, mortality and morbidity. They also place a financial burden on the healthcare system by extending the patient's length of stay in hospital [8,9]. SWI are considered an undesirable outcome, and as some are preventable, they are considered an indicator of the quality of patient care, an adverse event, and a patient safety issue [10].

At the Jali science Institute of Cancerology (IJC), the prevention, identification and monitoring is done through SWI epidemiological and infection control program, and it is done by of medical epidemiologist and a nurse. Surveillance staff assessed patients by direct observation, case note review, and questioning of the nurses caring for the patients. Monitoring is conducted daily, with visits to the hospitalized patients, records are reviewed, identify risks, signs of infection and antibiotic scheme, cultures were taken, collected results and corresponding log record; the positive monitor microbiological studies are given. The IJC has a committee of epidemiological surveillance, which establishes an effective monitoring system to determine the general characteristics of nosocomial infections in general, define prevention, control strategies and information.

The aim of the present study was to determine the epidemiology of nosocomial infections in cancer patients treated at the IJC between April 2008 and December 2010.

2. MATERIALS AND METHODS

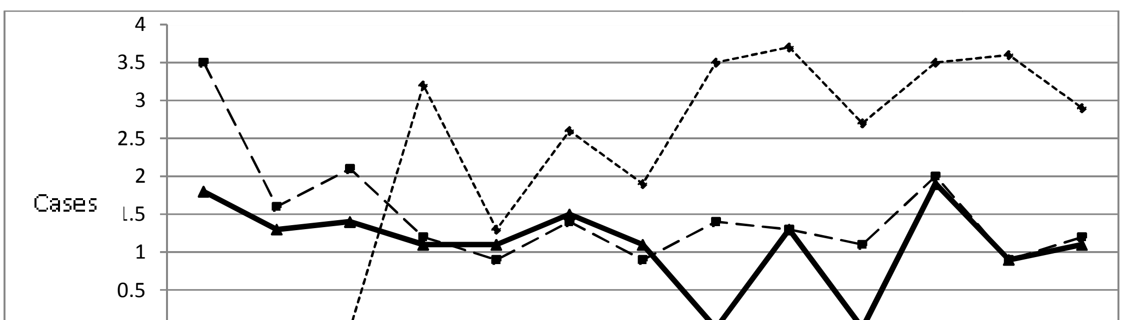
Hospital based retrospective study was conducted at the IJC from April 2008 to December 2010, All patients operated from April 2008 to December 2010 were considered in this study. Inclusion criteria were: patients who received surgery, regardless of gender, age, type of surgery, or cancer diagnosis, outpatient surgery were excluded. The CDC criteria (Centers of Disease Control and Prevention) for surgical wound infections were followed [11]. Epidemiological Record information IJC, the format of the Hospital Network for Epidemiological Surveillance (HNES) was obtained, results of microbiological studies and clinical records of patients during the study period had some type of SWI. Statistical analysis was performed using SPSS (v 20.0 Windows) program. General patient data were obtained. Descriptive statistics were used by frequency summations; we calculate relative frequencies (%) (for anatomic location, type of injury and procedure categories); measures frequency (annual incidence rate / monthly SWI of 100 surgeries performed, incidents by gender, degree of contamination, mortality rate), risk factors were identified, the average percentage of days stay and patient outcomes, microbiological report percentage. Chi-square test was used to determine the relationship between the dependent and the independent variables. P value <0.05 was considered as statistically significant.

3. RESULTS

In this work, the population studied was 2637 patients with major surgeries from April 2008 to December 2010, of these 46 had SWI; 76% (35) were incisional deep, 17.4% (8) of bodies and spaces and 6.6% (3) superficial incisional. Out of the 2637 patients in the study, 1500 (56.9%) belonged to the clean surgery group, 23.1% to the clean contaminated, 8% to the contaminated, and 2% to the dirty surgery group. The clinical specialties to which they belonged were: 54.3% (25) Joint Clinic, 36.9% (17) Clinical Pelvis, 6.6% (3) Clinical head and neck and 2.2% (1) Clinical breast. The overall rate of SWI, showed a decreasing manner; 2.9 in 2008; 1.2 in 2009; 1.1 in 2010; Statistical record´s from IJC showed that the highest rates were recorded in April (3.2) and from August of 2008 to January 2009, Then the rate tends to decrease (Fig. 1).

Frequencies of SWI by procedure categories were: Gastroenterology (GE) 27 (58.7%), Gynecology (GYN) 15 (32.6%), Urology (URO) 2 (4.3%), head and neck (HC) 1 (2.2%) and Traumatology (TRAU) 1 (2.2%). SWI rates per degree of microbial contamination and service are shown in Table 1.

The overall incidence of SWI by gender were similar in men (1.1) and women (0.83), (P = 0.07). Risk factors that predisposed to the development of SWI were: urinary catheter, 48%; peripheral catheter, 59%; central catheter, 32%;



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Per year
2008				3.2	1.3	2.6	1.9	3.5	3.7	2.7	3.5	3.6	2.9
2009	3.5	1.6	2.1	1.2	0.9	1.4	0.9	1.4	1.3	1.1	2	0.9	1.2
2010	1.8	1.3	1.4	1.1	1.1	1.5	1.1	0	1.3	0	1.9	0.9	1.1

Fig. 1. Rate overall incidence of surgical wound infections per 100 surgeries per month and year, in Jaliscience Institute of Cancerology, México from April 2008 thru December 2010
Source: Clinical record IJC, Capture format RHOVE-SSA-1

Table 1. SWI rates per 100 infected surgeries by degree of contamination and surgical procedures, at Jaliscience Institute of Cancerology, México, from April 2008 through December 2010

	Clean	Clean contaminated	Contaminated	Dirty	Total	Global rate
	SWI rate	SWI rate	SWI rate	SWI rate	SWI rate	
GE	2.17 (1)	4.34 (2)	30.49 (14)	21.70 (10)	58.7 (27)	1.07
GYN	-	8.70 (4)	11.68 (5)	12.22 (6)	32.6 (15)	0.60
URO	-	4.3 (2)	-	-	4.3 (2)	0.08
HC	-	2.2 (1)	-	-	2.2 (1)	0.04
TRAU	-	-	2.2 (1)	0	2.2 (1)	0.04
TOTAL	2.17	19.54	44.37	33.92	100	1.83

Source: Clinical record IJC, Capture format RHOVE-SSA-1

stomata, 45%; sprays, 38%, blood transfusion, 39%; parenteral feeding, 29%; nasogastric, 36%; oxygen, 32%; mechanical ventilation, 18%; drainage penrose, 47%; prior hospitalization, 26%; and chemotherapy, 16%. The age range of the population was 16-84 years and the average age was 51 years. Adults aged 40 to 69 were the most diagnosed age group for SWI. 69.6% of SWI were detected in the first 8 days after surgery, 13% were from day 9 to 15 and 17.4% were from the day 16 to 30. The average time of detection of SWI was 7.4±4.2 days. In 87% (40) of cases the infection is present being hospitalized, while 13% (6) readmission for infection. Considering from the first day that SWI was confirmed, the average stay at the time of discharge of the patient was 19 (range 6-30) days. The outcome of patients; 71.8% (33) was living/improvement, 13% (6) death was associated with infection and 10.8% (5) death not associated with infection and 2 were discharged voluntarily (4.4%). The mortality rate was 5 deaths per 100 cases. As shown in Table 1, forty five patients had development of a SWI. Specimens were obtained for culture from 73.9% of the surgical wounds with evidence of infection, and all isolates recovered were identified by standardized methods. A single agent was identified in 10 patients, two or three agents were found in 28 patients, and multiple agents were found in 4 patients. Fig. 2 shows the frequency of Gram negative and Gram positive bacteria from post-operative wound infections. A high incidence of aerobic bacteria was observed. Among the Gram negative bacteria were *Escherichia coli* (27 patients, 53.3%), *Pseudomonas aeruginosa* (5 patients, 11.9%) *Morganella morganii* (2 patients, 4.8%). Frequency of Gram bacteria were *Enterococcus faecium* (5 patients, 11.9%), *Enterococcus faecalis* (10 patients, 23.8%), Coagulase-negative staphylococci (3 patients, 7.1%), ß-hemolytic streptococcus (2 patients, 4.8%).

4. DISCUSSION

The SWI are common in hospitals [12]; these infections can lead to a reoperation, delayed wound healing, increased use of antibiotics and increased length of hospital stay, all have a significant impact on patients and the cost of health care [13].

The data presented correspond to the results that were generated through the system for prevention of nosocomial infections and epidemiology at the IJC in the period from April 2008 to December 2010. From April 2008 to January 2009 the incidence of SWI showed higher values. Therefore, it was necessary to reinforce the actions and the approach of the International Organization of Nosocomial Infection Control Consortium (INICC) [14] was implemented in order to reduce infection rates at the IJC. The overall infection rate in our study was less than 5% and it was similar to the reported in other hospitals [15], but it was lower compared with other hospitals of oncology in Mexico, where the incidence average was 9.2% [16]. While the risk for developing an infection after surgery varies with the type of operation performed and the severity of the patient's disease, the risk of SWI is greater when surgery is performed in certain organs such as the gastrointestinal tract. In consonance, Gastroenterology was the surgical procedure with higher rates of SWI. On the other hand, the genesis of the SWI is multi-causal, and therefore

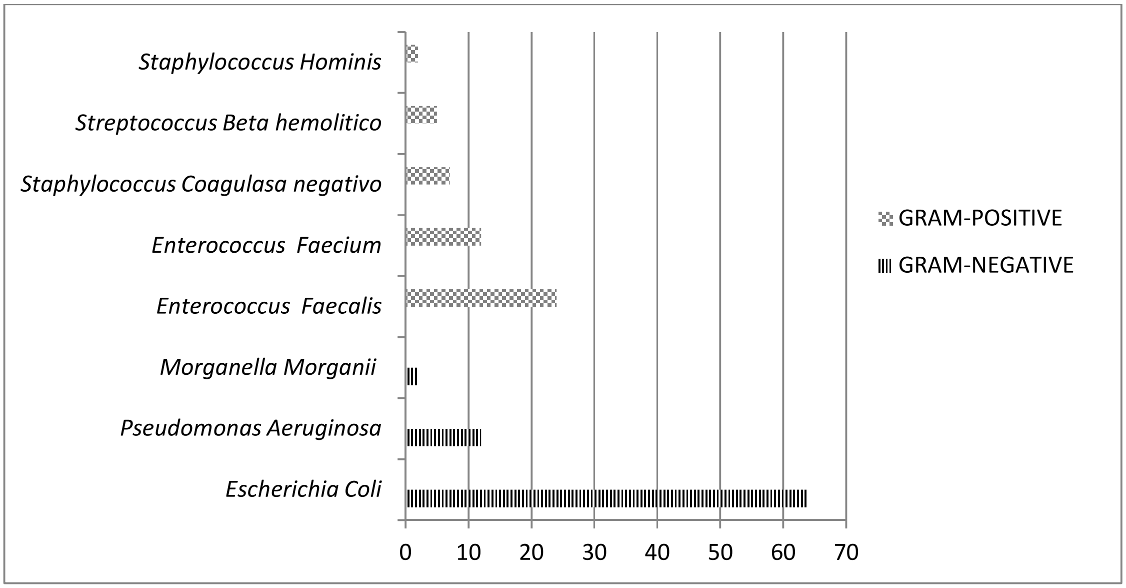


Fig. 2. Frequency of gram negative and gram positive bacteria from post-operative wound infections. According to a microbiological report

Source: Clinical Record IJC, Capture format RHOVE-SSA-1, Results from bacteriological culture

risk factors of SWI in cancer patients are: the patient's condition, type of tumor, degree of tumor progression, simultaneous exposure to various surgical fields and duration of surgery.

Some studies mention that SWI incidence should not exceed more than 5% and most of the SWI in cancer patients originates from an exogenous source (operating room air, fomites). Patient-related factors for SWI include existing infection, low serum albumin concentration, older age, obesity, smoking, diabetes mellitus, the particular surgical procedure carried out, etc. Therefore our data provides evidence that by implementing standard guidelines, quality care and patient safety goals can be achieved as previously suggested [17]. For contaminated and infected surgeries rates the IJC is below the frequency reported in other hospitals. The actions taken to reduce the incidence of SWI were aimed at strengthening the proper practice of surgical hand washing, proper pre-surgical preparation of the patient and care of the surgical wound in the postoperative period. We must take into account that there are external factors to the institution such as the advanced and debilitating stage of cancer disease of the patients. Other important aspects are the very low income, lower education, and bad habits of hygiene of the patients. This contributes to the deterioration of the patient with cancer.

A number of studies have shown the health and economic profitability of preventing SWI [18,19]. On the other hand, it is known that cancer patients have a higher risk for infection and they might be immunocompromised because of high-dose steroids or other intensive therapy [20]; in fact, infections are higher in cancer hospitals compared to hospitals [21]. Accumulating clinical and epidemiological evidence suggests significant gender differences in the incidence of and outcome following an SWI, at this regard, researchers from McGill University found gender differences in the immune response of males. It can be due they are more vulnerable than women. Our data showed a similar rate of SWI between man and woman (P= 0.07).

Some risk factors for SWI are inevitable. Thus epidemiological surveillance and microbiological studies in these patients are very important [22]. The predominant age group of patients with SWI was 40-69 years and this is related to the age at onset of cancer more frequently in adults. On the other hand, the average stay of hospitalization at the IJC 4.5 was days and the duration of the infections was 19 days (minimum 6, maximum 30), prolongation of hospital stay is the parameter that best reflects the cost attributable to the SWI [23,24]. The SWI were detected in times that match the criteria CDC [25]. The mortality rate specified was lower than 5 deaths per 100 cases. Microbiological diagnosis of SWI affects the proper selection of antibiotic for treatment and quality of epidemiological and microbiological surveillance. In the case of microbiological report of Gram negative bacteria, Escherichia coli ranked first and although the literature shows different data [26]. Escherichia coli is part of the intestinal flora and SWI Gastroenterology were the most common; the remaining largely negative, has a similar to that reported in the literature [27] distribution in relation to Gram positive coincides with the reports on the literature [28].

4. CONCLUSION

Despite modern surgical and sterilization techniques and prophylactic use of antibiotics, SWI remains a major contributory factor of patient's morbidity and mortality. Although surgical wound infections cannot be completely eliminated and the overall SWI rate at the IJC was lower than in other hospitals, measures can be taken in the pre-, intra- and postoperative phases of care to reduce risk of infection.

CONSENT

All authors declare that this work were approved by the local Ethical Committee.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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