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Effect on Rates of Surgical Site Infection Following Application of an Infection Prevention and Control Training Program in Elsha'ab Hospital, Khartoum, Sudan

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Abstract: Without considering proper precautions, the health care facility can cause the spread of infections and diseases. When providing health services, it is essential to prevent transmission of infections at all times and at different levels. We want to make direct relationship between practice and infection rates. This study is to evaluate the application of training program with designing of guidelines for infection control in the operating rooms (Neuro and Cardiothoracic) among HCWs (health care workers) including surgeons, theatre nurses, surgical technologists, anesthesia assistants, cleaners and porters at Elsha'ab hospital in Khartoum. This was an interventional cross sectional study through a questionnaire, quantitative evaluation (observation/checklist audit) and interventional training of the target group. A reduction in infection rates was achieved after training program intervention. The rate of all cardiothoracic SSIs (surgical site infections) was 16% in the first year and 14% in the second year. Over the same period, the rate of SSIs among clean procedures decreased from 14% to 11%. This reflected the outcome of implementation of comprehensive education and training in an infection control program. It is recommended to implement infection prevention and control training programs and guidelines in all surgical and sterilization set units.

Key words: Surgical site infection, infection prevention control, surveillance, operation theatre, training program.

1. Introduction

The SENIC (Study on the Efficacy of Nosocomial Infection Control) showed that a well-organized surveillance and infection control programs that included feedback of infection rates to surgeons were associated with significant reductions in surgical site infection [1].

In many hospitals, the incidence of infection is unknown, and techniques of ascertainment or surveillance (i.e., discovery and recording) of infection are often not used. Infection records, when kept by the word staff, are often inaccurate, and it is unusual for measures of control based on these records to be carried out. Surveillance has been defined as "the continuing scrutiny of all aspects of a disease that are pertinent to effective control". Surveillance of infection in hospital is necessary for the following reasons [2]:

(1) To recognize, by any unusual level or change in level of incidence, the existing or impending spread of an outbreak, and to identify the appearance of any particular hazardous organism;

(2) To judge the desirability of introducing special measures to control an outbreak, or threatened outbreak, and to assess the efficacy of such measures;

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(3) To assess the efficacy of the regular preventive measures in use in the hospital;

(4) The major importance is early recognition of an impending outbreak, or possible hazards, such as contaminated incubators, which might be followed by infection;

(5) It is the responsibility of the hospital authority to ensure that adequate arrangements are made to control hospital infection. These arrangements should include the setting up of a control of infection committee and the appointment of a control of infection officer and nurse. The health authority should be responsible for implementing recommendations of the officer or committee. Without this information the team cannot be fully effective. Over and above the official responsibilities of the health authority and the Infection Control Team is the personal care and responsibility of clinician in charge [2].

Since skin is normally colonized by a range of microorganisms that could cause infection, defining an SSI (surgical site infection) requires evidence of clinical signs and symptoms of infection rather than microbiological evidence alone [3]. SSIs frequently only affect the superficial tissues, but some more serious infections affect the deeper tissues or other parts of the body manipulated during the procedure.

The majority of SSIs become apparent within 30 days of an operative procedure and most often between the 5th and 10th postoperative days. However, where a prosthetic implant is used, SSIs affecting the deeper tissues may occur several months after the operation [4].

To reduce the risk of nosocomial SSIs in developing countries, a systematic approach must be applied with awareness that this risk is influenced by characteristics of the patient, the operation, the healthcare staff and the hospital. In theory, reducing risk is relatively simple and inexpensive, especially when compared to the cost of the infections themselves, but in practice it requires commitment at all levels of the healthcare system. And, as noted, neither the basic problems responsible for the high nosocomial rates (i.e., lack of training, supervision, infrastructure and resources) nor the recommended solutions have changed over the past 10-20 years in most developing countries [5].

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as SSIs. SSIs are one of the most important causes of HCAIs (healthcare-associated infections). A prevalence survey undertaken in 2006 suggested that approximately 8% of patients in hospital in the UK have an HCAI. SSIs accounted for 14% of these infections and nearly 5% of patients who had undergone a surgical procedure were found to have developed an SSI. However, prevalence studies tend to underestimate SSI because many of these infections occur after the patient has been discharged from hospital [5].

2. Methodology

2.1 Study Design

This was a cross-sectional interventional study with application of guidelines for infection control and prevention in the operating room (Neuro and Cardiothoracic) at Elsha'ab hospital in Khartoum, characterized by being:

(1) a health facility based prospective study;

(2) a quantitative evaluation (observation/check list audit);

(3) an interventional training of the target group with development of guidelines, strategies and surveillance sheet.

2.2 Study Area and Period

Elsha'ab Teaching Hospital was built by donation of the World Health Organization and under the supervision of Dr. Mamoun Hassan Sharif and Zainal Abidin Ibrahim and the opening was in the year 1959. In 1982, the first intensive cardiac care unit was established composed of one room and two beds only. In 1983, professor Daoud Mustafa founded the department of neurology. Now the hospital contains

seven ICUs (intensive care units) and 10 wards and 13 private rooms. The total capacity of ICUs is 49 beds and total capacity of wards is 204 beds.

2.3 Study Population

The 126 HCWs (health care workers) included 28 theater nurse and surgical technologist, 11 anesthesia personnel, 35 supporting staff (cleaners and porter), 20 surgeons and 32 ICU nurse. In the first year, the total number of patients passed through the cardiothoracic department was 225 cases. In the second year, the total number of patients passed through the cardiothoracic department was 207 cases.

2.4 Variables under Study

Variables under study are listed as follows:

(1) knowledge, attitude and practices of surgeons, anesthesiologists, theatre nurses, surgical technologist, anesthesia technologist and porters;

(2) existing infection control structures (committee & units);

(3) disease transmission;

(4) hand washing and proper use of gloves;

(5) instrument processing (decontamination, cleaning, sterilization, high-level disinfection and storage);

(6) use and disposal of needles and other sharps;

(7) waste disposal;

(8) housekeeping;

(9) surgical scrub and surgical attire (gowns, caps, masks, etc.).

2.5 Sampling and Sample

Comprehensive sampling with total coverage of all theatre team and intensive care units included surgeons, nurses and supporting staff.

2.6 Methods of Data Collection

Five methods are applied:

(1) structured questionnaire;

(2) observation and check list;

(3) surgical site infection surveillances sheet;

(4) pre and post training tests. This study focused on situation analysis and then measuring the effectiveness of training of HCWs to improve infection control practices in the operating room. Four major areas (environment cleanliness, hand-washing facilities and compliance, waste disposal, cleaning and decontamination of instruments) were focused on during training and follow-up periods.

(5) in depth interviews (I.C. committee, head surgeon and theatre supervisor)

2.7 Data Analysis and Interpretation

SPSS was used for entry, cleaning and analysis of data.

3. Results

The questionnaire and interviews were completed by 126 HCWs including 28 theater nurse and surgical technologist, 11 anesthesia personnel, 35 supporting staff (cleaners and porter), 20 surgeons and 32 ICU nurse, and 35% of respondents had four years work experiences. About 46% of respondents said that the hands washing facilities were equipped with antiseptic some times. Most of the staff (55%) didn't receive any type of training about infection prevention. With regards to the practice of hand washing and appropriate time of practice among study group, almost all the staff practiced hand washing when touching body fluids after each procedure, but fewer (33%) of them practiced hand washing when leaving the work and when arriving at work (24% only).

Regarding practice of hand washing and appropriate time of practice among the study group, almost all of the respondents (95%) wash their hands only when they touched body fluid and 24% when arriving at work and 35% when leaving work. About half of the staff (49%) said the obstacles to practicing hand washing at the appropriate time was that they were busy.

Regarding practices of waste disposal guidelines,

only 9% respondents used utility gloves. Regarding practice of sharp injury prevention guidelines, few respondents used utility gloves when dealing with sharps. Regarding type of gloves used by nurses and technicians to clean instruments, most of them (95%) used surgical gloves and none used utility gloves.

In the first year of this study (2010), the total number of cases operated in the cardiothoracic department were 225. One hundred and forty eight were clean contaminated and contaminated cases, and 77 were clean procedures (operation) (Table 1). The infection rate among clean operations was 18% (Fig. 1). There were 37 (16%) of total cases who developed surgical site infections (Fig. 2). Of these, 14 (38%) had clean wounds and 23 (62%) had clean contaminated wounds. Infection among thoracotomy procedures was the highest (17 patients), MVR (mitral valve replacement) (eight patients), and decortications (four patients) by type of operation (procedure).

Of the 225 patients, 10 patients (4%) were known to be infected with blood borne disease, seven HBV (hepatitis B virus), two HCV (hepatitis C virus) and one HIV (human immune deficiency virus). In the second year, the total cases operated upon in cardiothoracic department were 207 cases, 125 were clean contaminated and contaminated cases, and 82 had clean procedures (operation). The infection rate among clean operations was 11%.

Of the 207 patients, 11 patients (5%) were known to be infected by a blood borne disease (seven HBV, two HCV and one HIV).

4. Discussion

It is important to improve the KAP (knowledge, attitude and practice) of HCWs toward infection prevention and control, proper application of infection prevention guidelines and adherence to UP (universal precautions) standards [6]. Although there is a growing awareness of the seriousness of HIV, as well as hepatitis C, and how they are acquired in the workplace, many healthcare staff do not perceive themselves to be at risk. Moreover, even those that do perceive the risk

Table 1 Incidence of SSIs.

Types of operations	First year (2010)		Second year (2011)		Total
	Developed SSI	No SSIs	Developed SSI	No SSIs	
Clean procedures	14	63	9	73	159
Clean contaminated/contaminated procedures	23	125	18	107	273
Total	37	188	29	178	432

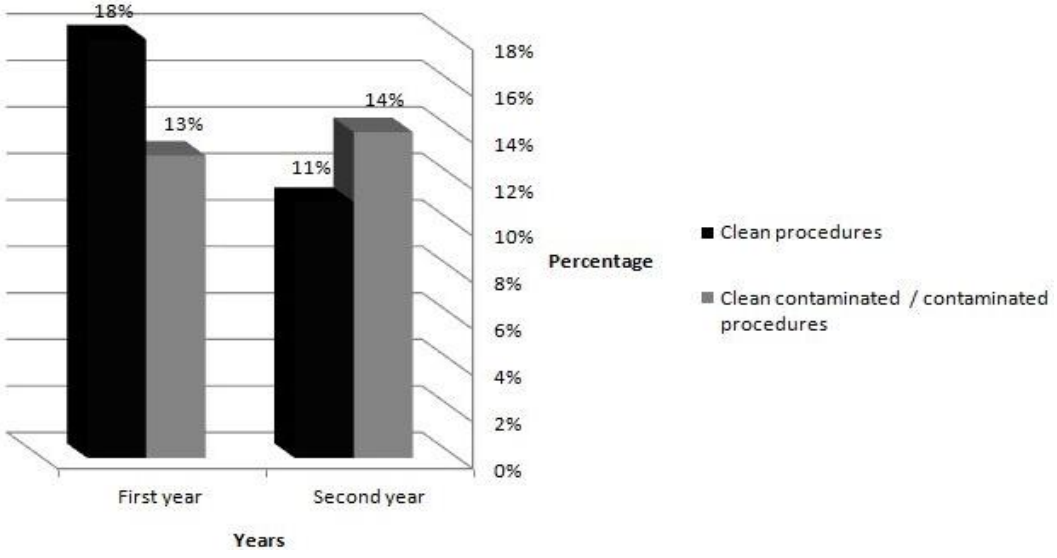

Fig. 1 Incidence of surgical site infections among post cardiothoracic surgery patients by type of wound.

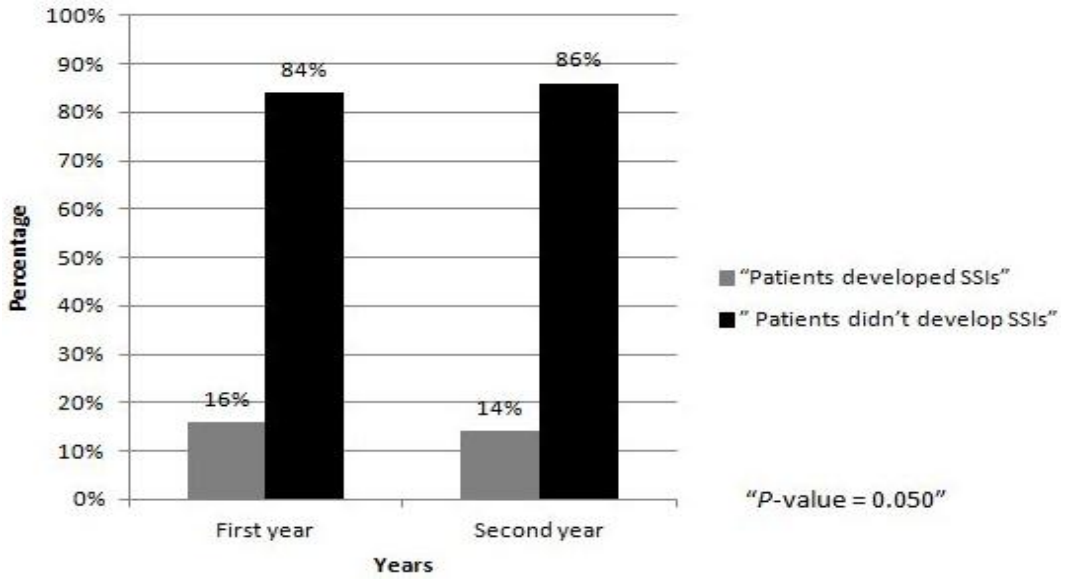

Fig. 2 Incidence of surgical site infections among post cardiothoracic surgery patients.

do not regularly use protective equipment such as gloves, or other practices (e.g., hand washing). The result of the study indicates that the majority of staff cannot access eye wear and aprons and all HCWs and cleaner cannot access utility gloves.

Despite this and a universally favorable attitude, we found that adherence to UP was reported as low by most HCWs. It is important to improve the knowledge and attitude of HCW to occupational blood-borne exposure. Comprehensive understanding and favorable attitudes to occupational risk will enhance adherence to UP standards. This study also challenges the concerned department management to remedy the short supply of PPE (personal protective equipments) and to develop strategies allowing staff to work safely in a high stress/urgent response setting.

Regarding the compliance with proper and frequent hand washing by HCWs and the availability of hand hygiene facilities by observation, there were inadequate and inconveniently located hand hygiene facilities. Hand washing sinks were with hand taps. No elbow, wrist, sensor, mixer and foot-operated taps were available, except in the operation theatre. The study indicates that most of the study group (76%) doesn't usually wash their hands on arrival at work place and before leaving it (65%), and healthcare workers who wear gloves while treating patients are much less likely to clean their hands before and after patient contact. From the point of view of infection prevention, hand hygiene practices (hand washing and surgical hand scrubbing) are intended to prevent hand borne infections by removing dirt and debris and inhibiting or killing microorganisms on skin. This includes not only most of the organisms acquired through contact with patients and the environment, but also some of the permanent ones that live in the deeper layers of the skin.

Our observation show that the design of ICU and ward don't facilitate the appropriate area of hand washing, and it has been shown that all the hand-washing sinks are close to a toilet and it can be considered to be the leading cause of infections. One of the important problems the study found was the absence of a central sterilization unit. The surgical instruments and wraps were sterilized in the operating area. The limited area and space will affect the instrument processing steps. Establishing an independent center for sterilization is needed.

The results of this study indicate that no training or improvement program is conducted to improve infection control and prevention practice. The study results also show that 55% of the study group did not

receive infection prevention training and those (91%) who received had only theoretical lectures.

We believe that the study results demonstrate that training gave participants an adequate knowledge of infection control practices as well as promoting positive attitudes concerning implementation and use of infection prevention practices. There is no doubt that all the participants are now attempting to put improved infection prevention practices into place. Yet, the challenge remains to sustain infection prevention practices and avoid the return to previously observed inadequate practices and habits.

This study demonstrates a decrease in infection rates with the implementation of a comprehensive educational and training infection prevention/control program.

The surveillance of incidence rates is essential to outbreak investigation, and one of our study objectives was to assess the effect of the interventional program on the incidence of postoperative infections. We found that there was no surveillance program in the hospital. Absence of such a program has a number of consequences since it is a secondary measurement tool for the effort of infection prevention and control practice. The study briefly reported the most important activities at Tehran Heart Center's Infection Control Committee and reflected the importance of a well designed regular surveillance program. They stated that the second priority of that committee in the last year was the issue of SSI outbreaks, in March and April 2007, which coincided with the yearly holidays in their country. The first impression was that the quality of patient care was reduced because of the long duration of the holidays and possible hurry in evacuation of wards. With regards to this hypothesis, ICC (Infection Control Committee) significantly increased both supervision on ICUs and proper education of the nurses and physicians. After this supervision and retraining measures, the rate of postoperative infection was significantly reduced and no further outbreak was observed in the following year [7]. In our study, we found that the rate of all cardiothoracic SSIs was 16% in the first year (before intervention) and 14% in the second year (after intervention). Over the same year, the rate of SSIs among clean procedures decreased from 14% to 11%, *P*-value = 0.051. This reflects the outcome of implementation of comprehensive education and training infection control program.

Standardizing the stages of preoperative preparation of patients for surgery with the use of clippers should replace routine shaving the night before surgery. Besides a surveillance program, appropriate aseptic technique, use of personal protective equipment and instrument processing in a central sterilization unit will help in fighting the high rate of surgical site infection [6]. It was not only important to develop initial action plans, but the follow up of success and challenges with all participants in the final training sessions was also helpful in identifying where further program efforts should be focused to support infection prevention activities depending on departmental strategies. Based on the above, we believe that the project goal has been met. We plan to continue to place emphasis upon infection prevention practices with the hope of developing the outcome of ongoing and consistent infection prevention practice.

5. Conclusions

This study focused on situation analysis and then measuring the effectiveness of training of HCWs to improve infection control practices in the operating room at Elsha'ab Hospital in Khartoum. In conclusion, surgical site infections in post cardiothoracic surgeries were found to be high. Staffs are at risk of infections, especially blood borne diseases.

We observed significant reductions in SSI rates of clean surgery procedures following implementation of a comprehensive infection control program. The differences of infection rates in the first and second year remained significant when adjusted for potential confounding variables so the decrease in infection rates reflected the success of the implementation of a

comprehensive education and training about infection prevention and control program.

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