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ORIGINAL ARTICLE

SURVEILLANCE OF HOSPITAL ACQUIRED INFECTION IN SURGICAL WARDS IN TERTIARY CARE CENTRE AHMEDABAD, GUJARAT

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ABSTRACT

Present study was undertaken to know the rate of Hospital acquired infection in general surgical wards with special reference to surgical site infections with their antibiotic resistance pattern and to find out the source of the infection to develop preventive measures to reduce the risk of hospital acquired infection.

Prospective surveillance for hospital acquired infections was performed during period from January 2006 to June 2006 in the wards of general surgery. One day prevalence study was carried out to find out rate of various hospital acquired infections. Incidence rate for Surgical Site Infection (SSI) found out by monitoring all operated cases throughout their stay, and after discharge. All surgical operation theatres were studied in detail to find out various physical parameters, policies and procedures, various cleaning procedures and fumigation.

Over all prevalence rate of hospital acquired infections in surgical wards was about 21.9% comprising of 10.9% for SSI, 8% for local blood stream infection (i.e. thrombophlebitis) 2% for urinary tract infection (UTI) and 1% for the other infection (like bed sore). Incidence rate of surgical site infections was 12.72 %. Klebsiella spp. was the most common isolate responsible for SSI. The prevalence of HAI and incidence of SSI in our hospital has encouraged the development of recommendations for prevention of such infections in our hospital.

Key words: Hospital acquired infection, surgical site infection, nosocomial infection

INTRODUCTION

Nosocomial infection or hospital acquired infection refers to the infection occurring in patients after admission at the hospital that was neither present nor incubating at the time of admission. It is one of the public health problems throughout the world. The infection causes the patient's physical and mental sickness that makes the patient stay longer in the hospital without necessity.[1] Infections acquired in the hospital account for major causes of death, morbidity, functional disability, emotional suffering and economic burden among the hospitalized patients. These nosocomial infections (NI) occur among 7-12% of the hospitalized patients globally with more than 1.4 million people suffering from the infectious complications acquired in the hospital.[2]

The most frequent nosocomial infections are infections of surgical wound, urinary tract infections and lower respiratory tract infections.[3] Surgical site infections (SSI) are the third most commonly reported nosocomial infection and

they account for approximately a quarter of all nosocomial infections.[4] Surgical site infections are the most common nosocomial infections in surgical patients- accounting for about 24% of the total number of nosocomial infections.[5, 6, 7] It's rate has varied from a low of 2.5% to high of 41.9%.[4]

In the view of all above fact this study is undertaken to know the rate of surgical site infections and other nosoconial infections in general surgical wards with their antibiotic resistance pattern and to find out the source of the infection.

MATERIAL AND METHODS

This prospective study was carried out on patients admitted in the general surgical wards at one of the largest tertiary care centre hospital in Ahmedabad, Gujarat, West India, from January 2006 to June 2006. The teaching hospital is the major tertiary health institution offering diagnostic and therapeutic services to entire Gujarat state as well as the neighbouring states of Madhapradesh and Rajasthan. A total of consecutive 100 patients admitted in the surgical words were taken as a study group and assessed for any kind of nosocomial infection.

A preliminary visit of the hospital was done to identify various general surgical wards and among them two wards were selected for the study. For SSI patients were excluded from the study by following criteria: deficient medical records; having undergone surgical intervention at another hospital and then referred to our hospital; or death after surgery or within the following 30 days.

Data that recorded include; General data comprised of age, gender, operative procedure, date of admission, date of operation, date of discharge, discharge status; stratification and preoperative data comprised of any invasive procedure done on the patient, wound contamination class (cdc, 1999 – clean, clean contaminated, contaminated, dirty), multiple operating procedures done, duration of operation, type of surgery (urgent vs. elective), the American Society of Anaesthesiologists (ASA) physical status classification (healthy, mild systemic disease, sever systemic disease, incapacitating systemic disease or moribund patient), use of antibiotic prophylaxis, date of infection and causative microbial agent in culture positive results. CDC definitions were used to detect SSI. [8]

Prevalence rate was calculated by visiting every patient (100) on a single day, taking appropriate history, reviewing their medical and nursing charts, interviewing the clinical staff to identify infected patients as per definition given by 'WHO manual of prevention of Hospital acquired Infections.'

Among all 100 patients, operated once were further followed up to find out incidence rate of SSI by monitoring them. They were followed throughout their stay, and after discharge. Swabs were collected from appropriate site and were processed aerobically for culture. Isolate were identified by standard methods and the antibiotic susceptibility was determined by Kirby-Bauer disk diffusion method as per CLSI recommendations.[9, 10] The information from interviews and medical records were analyzed to search risk factors of nosocomial SSI.

To identify the source of SSI, pre and post fumigation swabs of operation theatres, where the patients operated were taken. All surgical operation theatres were studied in detail to find out various physical parameters, policies and procedures, various cleaning procedures and fumigation.

Informal interview with surgeon, anaesthesiologist and nursing staff was done to find out about the awareness of HAI and prevention of it.

RESULTS

Total 100 patients were studied; among which over all one day prevalence rate of hospital acquired infections in surgical wards was about 21.90%. 55 patients were operated among which 6 patients developed SSI during prevalence study, thus prevalence of SSI was 10.9%. Local blood stream infection (i.e. thrombophlebitis) was 8%, UTI was 2% and only 1% was of the other infection (like bed sore).

All operated patients were followed up further to find out incidence rate. It was found after follow up that 7 patients got SSI infection. Among which 4 patients were operated in Major surgical operation theatre (MOT) and 3 patients were operated in emergency operation theatre (EOT). Thus incidence rate of SSI was 12.72%.

Table 1 shows distribution of SSI based on risk factors. Table 2 shows results of direct observation of OTs and recommended solutions.

Investigating about microbiological reports of wound, organism, Klebsiella spp. was found in the most of the patients who were operated at MOT and organism, Staphylococcus was found in the patients who were operated at emergency OT.

Table 1: Distribution of surgical site infections based on risk factors

		SSI (n=7) (%)	No SSI (n=48) (%)	Total (n=55)
Age (years)	< 25	0 (0)	5 (10.48)	05 (100)
	25-60	2 (5.26)	36 (94.74)	38 (100)
	> 60	5 (41.66)	07 (58.33)	12 (100)
Gender	Male	5 (14.29)	30 (85.71)	35 (100)
	Female	2 (10.00)	18 (90.00)	20 (100)
Preoperative stay	< 7	1 (2.17)	45 (97.83)	46 (100)
	> 7	6 (66.67)	03 (33.33)	09 (100)
Wound class	Clean	0 (0)	19 (100)	19 (100)
	Clean Contaminated	2 (15.38)	11 (84.62)	13 (100)
	Contaminated	0 (0)	02 (100)	02 (100)
	Dirty/Infected	5 (23.81)	16 (76.19)	21 (100)
Type of intervention	Emergent	3(18.75)	13 (81.25)	16 (100)
	Elective	4 (10.26)	35 (89.74)	39 (100)
ASA score	1	0 (0)	04 (100)	04 (100)
	2	3(13.04)	20 (86.96)	23 (100)
	>/=3	4 (14.29)	24 (85.71)	28 (100)
Duration of operation	< 2 hours	2 (5.88)	32 (94.12)	34 (100)
	> 2 hours	5 (23.81)	16 (76.19)	21(100)
Surgical procedures	Cholecystectomy	0 (0)	02 (100)	02 (100)
	Colon surgery	5 (29.41)	12 (70.59)	17 (100)
	Appendecectomy	0 (0)	03 (100)	03 (100)
	Hernia	0 (0)	02 (100)	02 (100)
	Amputation	02(50)	02 (50)	04 (100)
	Renal stone operation	0 (0)	03 (100)	03 (100)
	Prostatectomy	0 (0)	04 (100)	04 (100)
	I & D	0 (0)	13 (100)	13 (100)
	Skin grating	0(0)	04 (100)	04 (100)
	other	0 (0)	03 (100)	03 (100)
Chronic diseases	Yes	1 (6.67)	14 (93.33)	15 (100)
	No	0 (0)	40 (100)	40 (100)

Reviewing pre and post fumigation report of MOT and emergency OT; organism Klebsiella was found from A.C. machine and OT self in prefumigation swab report of the MOT. These swabs were taken at the same week end day in which all the surgical site infected patients were operated.

One of the Limitations of our study was that we could not able to find reports of the emergency operation theatre because pre and post fumigation swabs were not taken on the regular bases.

Data of SSI with their risk factors were evaluated by chi square (X2 statistical test, $p \leq 0.05$ was considered to be significant).

DISCUSSION

Nosocomial infection is a major public health problem throughout the world. A one-day prevalence survey was conducted to estimate the prevalence of HAI in 100 patients present in a surgical wards for at least 24 hours and not due for discharge or transfer on the day of the survey. The overall prevalence of HAI was 21.90% including 10.9% of surgical wound infection, 8% of local blood stream infection (i.e. thrombophlebitis), 2% of urinary tract infection and only 1% of other infection like bed sore. No patient suffering from nosocomial respiratory tract infection or central blood stream infection.

Fifty five patients out of 100 were operated, followed up to find out incidence rate and it was also calculated by monitoring all operated patients included in this study, among them 7 patients were got postoperative surgical wound infection. So overall incidence rate of surgical site infection was (7/55) 12.72 %. Number of the studies carried out in India reported rate of SSI was ranging from 2.5 to 41.9%. 4 Our SSI rate was favorably compared with SSI rate of Shrivastava et al (10.19%), shaw et al (16.9%) and desa LA et al (18.92%).11, 12, 13

Table 2: Direct observation of operation theatres and recommended solutions

Attributed assessed	Identified problem	Solution
MOT and EOT	1. Only four suites were available for 400 surgical beds. 2. Ill structured and ill equipped OT. 3. Zoning are not present 4. Basic infrastructure for staff like changing rooms, toilets, refreshment is suboptimal.	• According to Rao committee (1968)16 one operation suite/50 beds required. So more numbers of OTs required according to number of surgical beds strength. • Renovation should be done
	1. Overcrowding 2. Not much restriction on movement of personnel in and around OT	• Glass chamber should be constructed above the OT for viewing of the students without actually entering the OT for reducing overcrowding. • Strict traffic protocols should be employed. • Restricted entry should be there
	1. Improper ventilation 2. Air conditioning is not adequate and present in only one suit and in EOT it is not at all. 3. Air changes – not present and Air filters (HEPA filters) – not present	• Air conditioning must be present in each operation suit and in working condition. • Air filters should be there solution
	1. Elbow operated taps are not there	• There should be elbow operated taps in scrub station
	1. OT cleaning, disinfection not up to the mark. 2. Improper fumigation 3. Swabs are not taken regularly	• It must be done at the beginning and at the end of the day and also in-between the surgeries. • Fumingation should be done in proper way. • Before and after fumigation, swab must be taken weekly on regular bases
	1. Proper use of barrier is not then	• Sterilized cap, mask and gown must be worn by each and every person entering inside the OT.

So far as wound type was concerned, we found clean wounds in 19 cases (34.55%); clean-contaminated wounds in 13 cases (23.64%); contaminated wounds in 2 cases (3.64%) and dirty infected wounds in 21 cases (38.18%). In our study SSI rate for clean surgery was 0%, for clean contaminated surgery was 15.38%, for contaminated surgery was 0% and for dirty surgery was 23.81%. We could not find any SSI in clean and contaminated surgery. Reason behind it is only few numbers of patients (19) were operated for clean surgery and very few numbers (2) were operated for contaminated surgery. According to other studies carried out in India, overall infection rate for clean surgeries was 4.04 to 30% and for clean contaminated surgeries was 10 to 45%.4 A study carried out by Lilani SP et al showed rate of SSI was 3.03% and 22.41% for clean surgeries and clean contaminated surgeries respectively.4 Our study is well correlated with this study.

Describing risk factors of SSI, majority of SSI (41.66 %) occurred in the age group of more than 60 years followed by 5.26 % in the age group of 25 to 60 yrs and 0% in the age group of less than 25 yrs. This indicates the role of immunity system in control or development if infection.[14] Male (71.43%) were more infected than female (28.57%) as more number of male candidates (35) was operated than female (20) candidates. Infection rate was minimum (2.17%) when preoperative hospital stay was less than 7 days and maximum (66.67%) when preoperative hospital stay was more than 7 days. Longer preoperative stay increases colonization in patients with nosocomial strains of bacteria which are most resistant to antibiotics, and also it indirectly increases infection rate by lowering resistance of patients.[15] Surgical procedures were classified as emergent in 16(29.09%) and elective in 39 (70.91%), among which, 3 patients got infection during emergent procedure and 4 got infection during elective procedure. It was observed that wound infection rate is influenced by duration of operation. The finding in present study is in agreement with the reported literature. Infection rate was maximum (23.81%) when the duration of operation exceed 2 hrs whereas only 5.88% of patients acquired SSI when duration of operation less than 2 hrs. This study confirmed the association between SSI and age of the patients, preoperative day, duration of procedure and CDC wound class. ($p < 0.5$) Though SSI increased with high ASA score, emergent intervention and in male sex, there was no association found with SSI and these factors in our study because very low difference was found among patients having SSI with and without risk factors in our study. As an antimicrobial prophylaxis (AMP), for clean wound, injection cefotaxime alone or with combination with gentamicin single dose was given at the time of the incision or total three doses were given; for clean-contaminated surgery same antimicrobials with addition of metrogyl if anaerobic organisms suspected with duration of 3-5 days given, for contaminated and dirty wound surgery cefoparazone-sulbactum/piparacillin-tazobactum with amikacin and metrogyl were given. The AMP used here was not according to the standard guideline.[3]

Culture report from the wound site showed that Klebsiella spp. was isolated from 57.14% (4/7) of the SSI cases, where as Staphylococcus aureus was isolated from 42.86% of the SSI cases. Klebsiella spp. was isolated from those who were operated in major operation theatre and Staphylococcus was isolated from those who were operated in emergency operation theatre. All isolated of Klebsiella spp. were ESBL producing strains and they were resistance to third generation cephalosporin, ciprofloxacin, gentamycin, chloramphenicol, co-trimoxazole and tetracycline. Staphylococcus aureus were resistance to penicillin, ampicillin, amoxicillin, tetracycline, and co-trimoxazole. One strain of Staphylococci was methicillin resistance (MRSA). Pre and post fumigation report of MOT showed that organism Klebsiella was found from A.C. machine and OT self, confirmed the Klebsiella spp. as a source of infection among the patients operated in MOT. These swabs were taken at the same week end day in which all the surgical site infected patients were operated. We could not able to find reports of the emergency operation theatre because pre and post fumigation swabs were not taken on the regular bases in emergency OT.

As shown in table 2 we had also visited both of the operation theatres to observe planning & design, work load, utilities, equipments used and policies & procedures. Necessary suggestions were noted to improve physical structure of operation theatres as well as certain policies regarding sterilization and disinfection of it to minimize the nosocomial infection. These includes need of adequate numbers of OT suits depending on bed strength, properly structured OTs, proper zoning of OTs, basic infrastructures nearby OT, proper ventilation facilities including air conditioning and air filters inside OTs, requirements of elbow operated taps, requirements of policies for OT cleaning and disinfection and pre and post fumigation swabs, restricted entry to solve problem of overcrowding and proper use of barrier to minimize infections.

In conclusion, nosocomial infections especially surgical site infection is a considerable problem in our hospital. Identification of risk factors for surgical site infections and study of operation theatres in detail has encouraged the development of recommendations for prevention of such infections. Also appropriate active surveillance and infection control measures should be introduced during preoperative, intra-operative, and postoperative care to reduce infection rates.

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