Incidence & Predictors of Surgical Site Infections: A study at a Tertiary Care Hospital

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Abstract

Background: Surgical site infections (SSIs) are associated with substantial morbidity and mortality, prolonged hospital stay, and increased cost. The accurate identification of risk factors is essential to develop strategies to prevent these infections. **Objectives:** To analyze the incidence of surgical site infections & to identify associated risk factors. **Materials & methods:** During the study period, data were collected prospectively for 494 patients undergoing major surgery (abdominal hysterectomy, laparotomy, caesarean section) in the obstetrics & gynecology department of a tertiary care hospital. **Results:** Out of 494 patients, 21 patients (4.25%) developed SSI. The highest rate of SSI (50%) was found in age group 51-60 years. The rate of SSI for 0, 1, 2 & 3 basic risk indices was 1.59%, 3.15%, 5.85% & 25% respectively. Incidence of SSI was higher in elective surgeries ascompared to emergency surgeries, a paradoxical finding of our study. **Conclusion:** Age, Basic SSI risk index, & electivity of the procedure were identified as the main predictors of surgical site infections.

Key Words : Surgical site infection, Caesarean, Abdominal hysterectomy

Introduction

Besides harming patients, HAIs (Healthcare Associated Infections) can affect nurses, physicians, aides, visitors, salespeople, delivery personnel, custodians, and anyone who has contact with the hospital.[1] Despite many advances in infection control practices, including improved operating room ventilation, sterilization methods, barriers, surgical technique, and antimicrobial prophylaxis, SSIs still cause a substantial amount of morbidity and mortality among hospitalized patients.[2]

In the United States, SSIs number approximately 500,000 per year, among an estimated 27 million surgical procedures and account for approximately one quarter of the estimated 2 million nosocomial infections each year. [3] Rates of surgical site infection (SSI) reported from individual institutions have ranged from 0% to 15%, depending on the reason for the operation, the site, the approach, and the use of instrumentation. [4]

There are multiple reasons for SSIs, which have been validated and documented as risk factors. A risk factor is any recognized contribution to an increase in post-operative wound infection. They allow stratification of operations, making surveillance data more comprehensive; and the knowledge of risk factors before certain operations may allow for targeted prevention measures.[5]

Surveillance of these infections is a vital step as it provides an insight into the magnitude of problem and hence helps the authorities to take radical measures and therefore curtail these infections. [6] The aim of our study was to analyze the incidence of SSIs & to identify associated risk factors in major obstetrics & gynecology surgeries at a tertiary care hospital.

Materials & methods

A prospective study was carried out from January, 2009 to June, 2009. This study was conducted on a total of 494 patients who underwent major abdominal surgery (abdominal hysterectomy, laparotomy, caesarean section) in the Department of Obstetrics & Gynecology (OBGY) at a tertiary care hospital of Rajkot city, Gujarat. Out of which, 392 patients had undergone Lower Segment Caesarean Section (LSCS), 52 had undergone Abdominal Hysterectomy (AH) and 50 had undergone laparotomy. All obstetric hysterectomy & tuboplasty were considered as laparotomy in this study for practical reason. Vaginal hysterectomy was excluded from the study because of different site of incision which could involve isolation of colonizers & commensals from the cultures.

During the study period, data were collected as per a predesigned questionnaire for all the patients who underwent major surgeries in the OBGY department. Risk factors, like patient characteristics (age, any co-

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morbidity, indications of surgery, ASA score) & procedure characteristics (prophylactic antibiotics, post-operative antibiotics, date of surgery, type of surgery e.g. hysterectomy, type of anesthesia, type of wound, duration of surgery in minutes, necessary pre-op investigations) were analyzed to predict SSIs.

As per the institutional protocol, in elective surgeries, patients were usually admitted a couple of days before surgery & shaving done at evening on a day prior to the operation. Pre-operative antibiotics were usually administered at 8 am on the day of surgery to all the patients selected for elective surgeries & surgery was started at 9 am. In emergency surgeries, shaving of the patients & administration of pre-operative antibiotics were done just before shifting the patient to the operation theatre.

After surgery, the patients were monitored daily for any signs of SSIs as perthe CDC (Centre for Disease Control& Prevention) definition. [7] Patients were followed after discharge on OPD (Out Patient

Table 1: Distribution of Surgical Site Infections based on the Risk factors involved

Variables	Classification	SSI (+) n	SSI (+) %	Total (N)
Age (years)	11 to 20	3	3.75	80
	21 to 30	11	3.33	330
	31 to 40	3	5.77	52
	41 to 50	3	10.71	28
	51 to 60	1	50	2
	61 to 70	0	0	2
Type of operation	Emergency	15	3.58	418
	Elective	6	7.89	76
Basic SSI Risk Index	0	1	1.59	63
	1	7	3.15	222
	2	12	5.85	205
	3	1	25	4
Type of anesthesia	GA	2	16.67	12
	SA	19	3.94	482
Indications of LSCS	Previous caesarean section	0	0	77
	Meconium stained liquor	1	1.9	52
	Pre mature rupture of membrane	1	4.2	24
	Non progress of labor	1	5	20
	Obstructed Labor	1	7.1	14
	Oligohydramnios	1	10	10
	Pregnancy induced hypertension	5	15.6	32
ASA score	Score 2	6	3.41	176
	Score 3	12	4.17	288
	Score 4	2	8	25
	Score 5	1	20	5
Type of wound	Clean	0	0	16
	Clean Contaminated	19	4.21	451
	Contaminated/Dirty	2	7.41	27

Department) basis every weekly for up to 30 days to have a checkup for any signs of SSIs. Samples were collected from these patients & immediately transported to the Microbiology laboratory for culture. Wound class was defined by the surgeons accordingto the CDC criteria as clean, clean contaminated, contaminated, or dirty infected.[2, 8] The American Society of Anesthesiologists (ASA) score was recorded as 1(healthy), 2 (mild systemic disease), 3 (severe systemic disease), 4 (severe life-threatening systemic disease), or 5 (moribund).[2] For each patient, the Basic SSI risk index was calculated as an ASA score of more than 2, a wound class of contaminated or dirty infected, and a duration of the operation of more than T hours (T = 75th percentile), with each criterion adding one point to the index.[2]

Results & Discussion

Out of 494 patients, post-operative SSI developed in 21 (4.25%) patients. This lower rate of SSI in this study could be due to senior doctors who had performed all the surgeries, as during the study period post-graduation had not been started in OBGY dept. The skill of the surgeon has central role in surgical techniques. Filbert J M Pogoro et al. [9] reported that operations performed by an intern or junior surgeon increased the risk for SSI four fold, as shown by multivariate analysis. This could be explained by the fact that majority of junior surgeons made vertical incisions, had less experience in handling the tissue and control of blood loss, and the procedures were prolonged for more than 1 hour. Narasinga Rao Bandaru [10] reported that the rates of the post-operative wound infections were higher (17.54%) amongst the patients who were operated by the junior surgeons with lesser experiences than amongst those who were operated by senior surgeons (6.2%) with longer experiences.

In our study, out of 21 infected patients, 4 had deep incisional SSIs & 17 had superficial incisional SSIs. The infection rate was 3.57% (14/392) in LSCS, 6.0% (3/50) in laparotomy & 7.69% (4/52) in abdominal hysterectomy (AH). Out of 494 surgeries, 418 were emergency surgeries and 76 were elective. Various risk factors have been found to predict SSIs are presented in Table: 1.

Dao Nguyen et al [11] found that emergency surgeries (8.7%) had lower rates of SSI than elective surgeries (13.1%). This is counter-intuitive, as emergency operations should be at a higher risk because of sub-optimal preoperative preparation and because they are more likely to be dirty. In their study, emergency procedures had a shorter pre-procedure length of stay (0.6 days versus 4.5 days in elective procedures); this difference may explain the reduced risk of SSI in patients undergoing emergent procedures in their study. Seyd Mansour et al [12] also reported significant correlations between SSI incidence & duration of preoperative bed stay. They reported lower rates of SSI in emergency surgeries (14.9%) than elective surgeries (18.1%). In our study, the rate of SSI was lower in emergency surgeries (3.58%) as compared to elective surgeries (7.89%) (Table: 1). The probable reason behind this finding in our study could be following: Shaving to surgery interval was longer in elective surgeries, age group was older in elective surgeries, longer pre-operative hospital stay (2-3 days) in patients of elective surgeries v/s shorter pre-operative hospital stay (few hours) in emergency surgeries which decreases the exposure of the patients to the hospital environment.

Seropian & Reynolds [13] showed that shaving immediately before the operation compared to shaving within 24 hours preoperatively was associated with decreased SSI rates (3.1% vs. 7.1%); if shaving was performed more than 24 hours prior to operation, the SSI rate exceeds 20%.

The majority of the emergency surgeries in this study were LSCS, in which the patients were from younger age groups. The elective surgeries in this study included mainly AH, in which the patients were older. This finding may explain the higher rate of SSI in elective surgeries because of older age in elective surgeries in gynecology patients.

Basic SSI Risk Index is a score used to predict a surgical patient's risk of acquiring aSSI. The risk index score, ranging from 0 to 3, is the number of risk factors present. [2] Higher risk index was found to be a predictor of SSI in our study. The rates of SSI for 0, 1, 2 & 3 risk indices were 1.59%, 3.15%, 5.85% & 25%, respectively (Table: 1). This finding was similar to a retrospective study from Brazil, that reported a good correlation between the risk index and SSI. [14]

As mentioned in the Table: 1, the rate of SSI increased proportionately with ASA score. The rate of SSI with ASA score '2' was 3.41%. The rate of SSI with ASA score '3' was 4.17%. While rate of SSI with ASA score 4 & 5 were 8% & 20%, respectively. In our study the majority of patients had clean-contaminated wounds. The SSI rate was almost doubled with contaminated wounds as compared to clean-contaminated wounds as shown in Table:1. A longer duration of surgery was associated with higher rate of SSIs in our study in all surgeries (AH, LSCS & laparotomy.)

For most of the pelvic surgeries, spinal anesthesia (SA) is the right choice of anesthesia, but when other risk factors are present, the choice of anesthesia switches over to general anesthesia (GA). The above mentioned fact plus morbidity associated with general anesthesia increases the risk of infection. In this study, it was observed that SSIrate with GA (16.67%) was four times higher than the rate with SA (3.94%) as depicted in Table: 1. A Johnsonet al [15]in 2003 in his study on SSI surveillance in cesarean section showed that higher proportion of patients given general anesthesia than regional anesthesia, had infection (22% Vs. 10%).

In our study, the patients were divided in to six age groups as shown in Table: 1. As can be expected, the infection rate was highest (50%) in extremes of age (51-60 years). This was because increasing age is correlated with greater likelihood of certain chronic conditions, malnutrition and a fall in the body's immunological efficiency, causing more extensive SSI.[12] (In age group 51-60 years, the denominator was weak, only 2 patients of that age group were there & one was infected). The rate of SSI was lowest (3.33%) in 21-30 years of age where the immunity is good. Barwolff et al [16] (2006) found that maternal ages of <25 years and >45 years were significant risk factors for overall SSI in a multiple logistic regression analysis. Johnson et al [14] found increasing age a significant risk factor for overall SSI. Keith S. Kaye et al [17] studied 1, 44,485 patients and concluded that risk of SSIs increases by 1.1% per year, between age 18-65.

In this study, rate of SSI with PIH (Pregnancy Induced Hypertension) was higher (15.6%) as compared to those without PIH (2.5%). Out of 32 patients of PIH, 5 developed SSI (Table: 1); this is the major cause of SSIs in obstetrics. Thach son Tran et al [18] reported higher rate of SSI in cases of PIH. In PIH, patients are having albuminuria, high blood pressure and in some cases, convulsions. This affects the general condition of patient and ASA score and subsequently increases the SSI rate. Hill JA et al. [19] found that PIH increases risk of post-cesarean infection by a factor of two. He also found asymptomatic bacteriuria was documented more frequently among women with PIH (19%) as compared with controls (4.5%). In contrast to our study, N.Schneid-Kofman et al [20] conducted analysis of 19,416 patients of cesarean section and reported SSIs in 3.7% and reported PIH as an independent risk factor for SSI.

Twenty four patients had been operated for the indication of PROM (Premature rupture of membrane) & only one of them developed SSI (Table: 1). This finding might be attributed to the institutional protocol of starting antibiotics right at the onset of PROM or immediately on arrival to the labor room with the diagnosis of PROM.

Conclusion:

The rate of surgical site infection was 4.25% in the present study. At the extremes of age, patients are more likely to get SSIs. Increase in the Basic SSI risk index, increases the chances of surgical site infections. One contradictory finding in our study was that the rate of surgical site infection was higher in electively operated patients than in emergency operated patients. Elective surgery candidates may be treated on OPD basis until they are fit for surgery. So that the pre-operative hospitalization & thus, Health Care Associated Infections can be reduced.

In obstetrics population, Pregnancy induced hypertension is the leading associated risk factor for surgical site infections. Premature rupture of membrane does not seem to be a significant risk factor when prophylactic antibiotics are administered at a proper time. (As practiced at the institute).

The results of our study were comparable to all international studies; This credit should go to the Government National programs like NRHM (National Rural Health Mission), Janani Suraksha Yojna, RCH-II (Reproductive Child Health), EMRI (Emergency Management & Research Institute) which led to the improvement of basic infrastructure of the Institute, Antenatal & Gynecology Care Clinics, Operation Theatres & post-operative wards.

And also the Government's interest in collecting Hospital Infection Data to regulate Health Care Associated Infections has played a major role in controlling infections.

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