Original Research Paper

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EFFECTIVENESS OF SURGICAL SITE INFECTION PREVENTION QUALITY IMPROVEMENT PROTOCOL (SSIPQIP) IN REDUCING SURGICAL SITE INFECTIONS AMONG SURGERIES FOR GYNAECOLOGICAL AND OBSTETRICAL INDICATIONS – A STUDY IN RURAL SETUP.

Dr. Poonam Shivkumar Varma — Professor and HOD Dept. of Obstetrics and Gynaecology, Mahatma Gandhi Institute of Medical Sciences , Sevagram

Dr. Jatkala Rajani* — Senior Resident Dept. of Obstetrics and Gynaecology, Mahatma Gandhi Institute of Medical Sciences , Sevagram *Corresponding Author

ABSTRACT **Objectives:** To find out the incidence, risk factors and microorganisms responsible for of surgical site infections and Quality Improvement Protocol in reducing Surgical Site Infections among Surgeries for Gynaecological and Obstetrical surgical Indications. **Material and Methods:** The prospective observational study was carried out in the tertiary care teaching hospital over a period of two years Consecutive 100 cases of surgical site infections (SSI) following obstetric and gynecological abdominal surgery were analyzed using Statistical Package of Social Sciences. **Results:** The incidence of surgical site infections was 2.8 percent among 3498 surgeries performed during study period. Overweight, previous laparotomy scars, emergency surgery and caesarean section following prolong labour were the common risk factors associated with the development of SSI. Suboptimum peri-operative conditions related to preparation of patient for surgery, below ideal operation theatre conditions, humidity, long list of operations, practice of shaving of part day prior, water scarcity in summer and casual approach by health professionals while surgical scrubbing and donning and uncontrolled movement of patient's relatives in the postoperative ward predisposed patients for development of SSI. Staphylococcus aureus and gram negative bacilli like E. Coli and pseudomonas were mainly isolated from the wound specimens. **Conclusion:** Surgical site infections can be prevented by proper pre-operative assessment of cases, strict compliance with scrubbing and donning protocols, skillful surgery, avoiding overcrowding in operation theatre and post operative wards and by maintaining conducive theatre environment.

KEYWORDS : Antibiotic prophylaxis, Burst Abdomen, Surgical site infections (SSI), Wound dehiscence, Surgical Site Infection Prevention Quality Improvement Protocol (SSIPQIP)

INTRODUCTION

Surgical site infection (SSI) is a type of healthcare-associated infection, in which a wound infection occurs after an invasive (surgical) procedure. Surgical site infections are frequent; the incidence varies from 0.5 to 15% depending on the type of operation and underlying patient status.1,2,3 It limits the potential benefits of surgical procedures. The impact of SSI on hospital costs and postoperative length of stay (between 3 and 20 additional days) is considerable.4,5,6,7 Infection of abdominal wound following surgery is due to its contamination from the air, from organisms on patients' skin, or from infectious foci in abdominal cavity. It can also be the result of inadequate aseptic technique by the theatre staff (including surgeon) or of the secondary infection of a hematoma. Fever without apparent cause should always awaken suspicion of infection in the wound. The common causes of wound dehiscence are infection at the wound, pressure on sutures, sutures too tight, injury to the wound area, weak tissue or muscle at the wound area, incorrect suture technique used to close operative area, use of high-dose or long-term corticosteroids, severe vitamin C deficiency (scurvy). There are some known risk factors associated with the surgical wound infection and disruption. Important amongst them are overweight, increasing age, poor nutrition, diabetes, jaundice, smoking, malignant growth, presence of prior scar or radiation at the incision site, non-compliance with post-operative instructions (such as early excessive exercise or lifting heavy objects), surgical error, increased pressure within the abdomen due to: fluid accumulation (ascites); inflamed bowel; severe coughing; straining; or vomiting, long-term use of corticosteroid medication, other medical conditions such as: diabetes; kidney disease; cancer; immune problems; chemotherapy; radiation therapy.1,2

Surgical site infections are treated with higher antibiotics, as per the culture sensitivity report of the wound discharge. When appropriate, frequent changes in the wound dressing to prevent infection or wound exposure to air to accelerate healing and allow growth of new tissue from below. Few cases require surgical intervention in the form of removal of contaminated, dead tissue, re-suturing, placement of a temporary or permanent piece mesh to bridge the gap in the wound. The present study aimed at finding out the incidence and risk factors for surgical site infection (SSI) following abdominal surgery and to study the microorganisms related with it.

MATERIALS AND METHODS

This prospective observational study was carried out in a 750 bedded tertiary care teaching hospital located in rural area of central India over a period of two years (October 2019 to September 2021). On an average, approximately 2500 major and minor abdominal surgeries are performed per year in the hospital. Women, who had undergone gynecological abdominal surgery for different indications, either by laparotomy or by laparoscopic technique during the study period, were included as study subjects. Complicated cases that were recently operated at other hospitals and required repeat laparotomy were excluded from the study. Consecutive one hundred cases of SSI and or dehiscence, those who fulfilled inclusion and exclusion criteria, among all abdominal surgeries (laparoscopy or laparotomy) performed during study period were identified as study subjects.

Patients posted for major or minor gynecological elective surgery were admitted three days or one day prior to date of operation respectively. Complete physical examination was carried out to rule out any local or systemic infections. Blood and serological investigations were performed as pre requisite for anesthesia. Shaving of the abdominal wall was done on previous night by nursing staff on duty. All operations were performed either under general anaesthesia or regional anaesthesia by same team of doctors working in the hospital. Being a postgraduate training institute, minor surgeries were performed by trainee resident doctors, under supervision of senior doctors. A single dose of prophylactic antibiotic in the form of Inj. Cefotaxime 1 gram and Inj. Metronidazole 500 mgs at 8 am on the day of surgery was advocated. Surgery usually started at 9 am in the morning. Pre-operative skin disinfection was done with germicidal solution (3%) having combination of chlorhexidine gluconate, cetrimide and isopropyl alcohol solution. Skin was then treated with Povidone iodine solution (10%). Following surgery, abdominal wall was closed in layers. Rectus sheath was closed with delayed absorbable suture material (Vicryl 1) and skin was closed with nylon (00 Ethilon) suture material. Antibiotics in the form of Inj. Cefotaxime 1 gram intravenously every 12 hourly and Inj. Metronidazole 500 mg every 8 hourly would be continued for 24 to 36 hours and then same drugs by oral route for next 7 days. Following surgery, patients were given analgesic drugs as per individual need and intravenous fluids for first 24 hours. In addition to the antibiotics, all cases received anti-inflammatory drugs in the form of combination of diclofenac sodium-50 mg twice daily and tablet vitamin –C 500 mg once daily from second to seventh day after the operation. Bladder was catheterized till patient was able to go to toilet on her own. Patients were encouraged to be out of bed after 24 hours of surgery. They were encouraged to perform deep breathing exercises and leg movements in bed. Patients were monitored for the evidence of infective morbidity by measuring oral temperature every 4 hourly and for clinical or bacteriological

evidence of surgical site infection (pain, discharge-serous or blood stained, tenderness, redness at surgical site, wound dehiscence, leucocytosis, isolation of organisms in discharge or blood etc). Following criteria were used to diagnose SSI , wound dehiscence or febrile morbidity.

a. Febrile morbidity - This was defined as febrile episodes of > 38°C, occurring on two occasions, at least 4 hours apart, after the first 24 hours following the operation.

i. Surgical site infection - This was defined and graded as (a) erythema and or induration (b) serous oozing (c) the presence of pus
ii. Wound dehiscence – Separation of edges of suture line by more than 1cm- superficial or deep or complete abdominal wall (Burst abdomen) as per CDC guidelines.8

In case of occurrence of febrile morbidity or surgical site infections, necessary laboratory investigations (hematological and microbiological) were carried out. In case of occurrence of severe infection, decision regarding change of antibiotics was taken in the interest of the patient. Skin stitches were removed on fifth day of minor surgeries and seventh day of major surgical procedures .In the absence of complication, patients were discharged on second postoperative day of laparoscopic minor surgery, third postoperative day of laparoscopic major surgery and eighth day of laparotomy. Cases operated by laparoscopic technique were asked to come for stitch removal on seventh post-operative day. All patients were advised to return for follow-up visit after two weeks from the date of discharge from hospital.

Data related to various outcome variables like age, body mass index, associated risk factors, indication and nature of surgery-emergency or elective, route and technique of surgery, duration of surgery and anesthesia, intra -operative complications, infective morbidity, surgical site infections, hospital stay, wound related complications was collected from hospital records (admission discharge register, operation theatre register, anesthesia register, indoor case file, treatment register). Information was collected in structured pro-forma and then entered in Microsoft office excel sheet for analysis using statistical package for the social sciences (SPSS) version 16. Data was compared among different variables using percentages and Z-test of difference between two proportions. P value less than 0.05 were considered significant.

Results

It was observed that, majority of cases (70%) belonged to lower socio economic class, with poor health awareness, from rural residence and education up to primary schooling. Seventy percent cases had mild anaemia at the time of surgery. More than 25% cases had BMI below 18 and 15% cases had BMI above 25. Pre-operative shaving of abdomen was routinely performed one day before surgery. Prophylactic antibiotics were not administered as per the set protocol .Operation theatre environment (humidity and temperature) was not ideal during summer season due to electricity and scarcity of water. Antiseptic and aseptic precautions were not observed by some of the members of surgical team. There was excessive movement of staff in the operation theatre during surgery. The theatre door remained open to corridor during surgery .Skin disinfection before incision was done hurriedly by the surgeon. Hand scrubbing practices, proper covering of face and head, by operating surgeon were below standard. Many cases were operated in single theatre per day. It did not give sufficient time for the theatre staff to prepare the theatre for next case. There was overcrowding of cases in post operative ward.

Incidence of SSI was highest following laparotomies (11.40%) and was lowest with laparoscopic tubal ligation (1.63%). (Table-1)

There was significant difference between proportions of SSI in cases undergoing exploratory laparotomy as compared to overall incidence of SSI. ($p<0.05$)Over weight (46%) and previous laparotomy scar (23%) were the significant risk factors associated with post-surgical infections and or wound dehiscence. (i.e. $p<0.05$) (Table-2).

Incidence of SSI and or dehiscence was highest (5.38%) with vertical midline incision and was lowest (0.87%) with laparoscopic port site incisions. (Table-3).

Staphylococcus aureus was the commonest organism isolated in the wound swab culture .There was statistical significance between the number of wound cultures positive for Staphylococcus aureus and cultures positive for other microorganisms ($p<0.05$). Thirty cases had febrile morbidity related to surgical site infection or wound dehiscence.

Table 1: Incidence of Surgical Site Infection (SSI) / Dehiscence

S. No	Type of Surgery	Total number of cases (n=3498)	Number of cases of SSI (n=100)	(%)
1	Exploratory laparotomy	114	13	11.40%
2	Total abdominal hysterectomy	201	22	10.94%
3	Tubal ligation	653	21	3.21%
4	LSCS	2416	43	1.77%
5	Laparoscopic sterilization	61	1	1.63%
6	Total laparoscopic hysterectomy	53	0	0%
	TOTAL	3498	100	2.85%

Table 2: Risk Factors Associated With Surgical Site Infection (SSI) / Dehiscence

S.No	Risk Factor	Number of cases of SSI (n=100)	%
1	Over-weight / obesity	46	46
2	Previous surgical scar	23	23
3	Anaemia	13	13
4	Under nutrition	11	11
5	Gynecological malignancy	09	09
6	Wound hematoma	06	06
7	Infective focus	06	06
8	Second stage LSCS	03	03
9	Immuno-compromised state	03	03
10	Diabetes	02	02
11	Chronic diseases (Tuberculosis)	01	01
12	Post- chemotherapy	01	01
13	Unknown	22	22

Table 3: Distribution of Cases of Surgical Site Infection (SSI) / Dehiscence In Relation To Type of Abdominal Incision

S. No.	Type of Incision	Total cases (n=3498)	Number of cases (n=100)	Incidence of SSI (%)
1	Vertical Midline (for laparotomy for large tumours, ectopic, caesarean section	669	36	5.38
2	Pfannensteil (for caesarean section)	1936	34	1.75
3	Transverse infra-umbilical (for puerperal sterilization)	488	18	3.68
4	Transverse supra-pubic (for hysterectomy, interval sterilization)	291	11	3.78
5	Laparoscopic port entry (Lap Sterilization, TLH)	114	01	0.87

Discussion

Hospital acquired infections occur worldwide and affect both developed and resource-poor countries. Infections acquired in health care settings are responsible for increase in morbidity and mortality. They are a significant burden both for the patient and for public health. A prevalence survey conducted under the auspices of WHO in 55 hospitals of 14 countries representing 4 WHO Regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) showed an average of 8.7% of hospital patients had nosocomial infections. At any time, over 1.4 million people worldwide suffer from infectious complications acquired in hospital.8 The highest frequencies of nosocomial infections were reported from hospitals in the Eastern Mediterranean and South-East Asia Regions (11.8 and 10.0% respectively), with a prevalence of 7.7 and 9.0% respectively in the European and Western Pacific Regions.9 The most frequent nosocomial infections are infections of surgical wounds, urinary tract infections and lower respiratory tract infections. The WHO study, and others have also shown that the highest prevalence of nosocomial

infections occurs in intensive care units and in acute surgical and orthopedic wards. Infection rates are higher among patients with increased susceptibility because of old age, underlying disease, or chemotherapy. Hospital-acquired infections add to functional disability and emotional stress of the patient and may be in some cases, lead to disabling conditions that reduce the quality of life. Nosocomial infections are also one of the leading causes of death.10 The economic costs are considerable.11,12 The increased length of stay for infected patients is the greatest contributor to cost.13-15 Coella's16 study showed that the overall increase in the duration of hospitalization for patients with surgical wound infections was 8.2 days, ranging from 3 days for gynaecology to 9.9 for general surgery and 19.8 for orthopaedic surgery. Prolong stay not only increases direct costs to patients or payers but also indirect costs due to lost work. The increased use of drugs, the need for isolation, and the use of additional laboratory and other diagnostic studies also contribute to costs.

Survey of post-operative wound infection in 150 cases out of 6639 cases was carried out for 12 months at Kandang Kerbau Hospital, Singapore by Chia et al. They reported that the general incidence of wound infection was 2.26% and the incidence of wound infection in Ceasarean section was 2.29%.17 Operations with lowest wound infection rates were laparoscopy and sterilization operations. Highest rate of infections was seen in Radical and extended hysterectomies. James et al reported 2.3% incidence of wound infection in their study.18 Pandit et al in their retrospective study carried from March 2002 to January 2003, reported the incidence of 2.76%.19 Incidence of wound infection following Ceasarean section studied by Piret et al in his cross sectional survey carried out in tertiary care obstetric and gynaecological center was 6.2%.20 According to Demisew et al surgical site infection rate in his prospective study on 770 women from April 2009- March 2010 was 11.4%.21 Infection rate was more following caeasarean section as compared to hysterectomy. In the present study, the overall incidence of wound infection was 2.85%, of which incidence of wound infection in exploratory laparotomy was the highest (11.40%), followed by abdominal hysterectomy (10.94%) and the incidence of wound infection being least in laparoscopic surgeries like laparoscopic tubal ligation (1.63%) and laparoscopic hysterectomy (0%)

In a retrospectve study of risk factors in 15 cases of post surgical wound infection by John et al in Messologi, COPD was noticed in 10 cases (66.66%), obesity in 6 cases (40%), malnutrition in 5 cases (33.33%), anaemia in 6 cases (40%), diabetes in 6 cases (40%), history of previous radiotherapy or chemotherapy in 6 cases (40%) and 3 cases (20%) were on steroids.22 Waqar et al from Pakistan institute of medical sciences studied 117 cases from 1st Jan 2002 – 31st Dec 2002, out of which obesity was found in 13%, anaemia in 17% cases, undernutrition in 13% cases and Malignancies in 15% of cases.23In the present study the common risk factors found were obesity and overweight in 46%, previous scar 23%, anaemia 13%, undernutrition in 11%, malignancies in 9%, previous chemotherapy in 1% cases.

Amongst 150 cases of wound infection studied by Chia et al, 22.8% showed no bacterial growth in wound discharge sent for culture and sensitivity and 77.2% cultures were positive for bacterial growth.17 Among the pathogenic organisms, staphylococcus aureus was isolated in 58.1% cases ,of which 49.5% were Methicillin sensitive staphylococcus aureus and 8.6% were methicillin resistant staphylococcus aureus. This was followed by streptococcus species (10.5%) and klebseilla (9.5%). Most of these organisms showed sensitivity to cloxacillin. Shittu et al in their study of 120 cases, at University teaching hospital in Nigeria, reported 62% of positive cultures from wound infection.24 Of these 62% cases, 38.23% were mono-microbial and 53.92% were poly-microbial. Staphylococcus was the predominant organism isolated in 25% cases, followed by E.coli in 12%, pseudomonas aeruginosa in 9% and staphylococcus epidermidis in 9% cases.In the present study, wound culture report showed bacterial growth in 62% cases. Out of those showing bacterial growth, 90% were mono-microbial and 10% were poly-microbial. Predominant micro-organism isolated was staphylococcus aureus in 39% cases, klebseilla in 7%, E. coli in 5%, pseudomonas aeruginosa in 3%, and acinobacter, diptheroid, streptococcus and enterococci each in 1% cases. Staphylococcus aureus was found sensitive to penicillin group of drugs, mainly cloxacillin and erythromycin. Gram negative organisms were sensitive to gentamycin.

The reported incidence of burst abdomen in a study of 3500 operated cases by John et al was 0.43%.22 Age over 75 years, diagnosis of cancer, chronic obstructive pulmonary disease, malnutrition, sepsis, obesity, anemia, diabetes, use of steroids, tobacco use and previous administration of chemotherapy or radiotherapy were identified as risk factors. Incidence of burst abdomen in cases studied by Afzal et al was 8.13%.25 In the present study, there were 6 cases (0.17%) of burst abdomen. The risk factors associated with these cases were malignancy in two cases, obesity, obstructed labour and prolong PROM, under-nutrition, chronic PID and immuno-compromised state in one case each. Wound cultures obtained from 3 cases were sterile and those from other 3 cases showed growth of Staphylococcus aureus. All cases of burst abdomen required exploratory laparotomy. The hospital stay was prolonged upto 21 to 64 days. There was no mortality in these cases.

CONCLUSION

Surgical site infections (SSI) are common in both developing and developed world. The incidence of SSI in the present study was similar to that of other published reports. Presence of patient related high risk factors like overweight, anemia, previous laparotomy scars and factors responsible for sub optimal operation theatre environment, like high humidity, large patient turnover, below standard sterilization of the equipments and poorly followed aseptic and antiseptic measures by health care workers, were responsible for development of SSI. The majority of surgical site infections can be prevented by the pre-, intra- and postoperative phases of care. Surgical site infections have a significant effect on quality of life of the patient. They are associated with considerable morbidity and extended hospital stay. In addition, surgical site infections result in a considerable financial burden to healthcare providers. Regular surveillance for SSI and ongoing periodic sensitization programmes for all categories of health care workers regarding SSI would go a long way in reduction in the rate of SSI.

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