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"INCIDENCE OF POST-OPERATIVELY SURGICAL SITE INFECTION AND CAUSATIVE PATHOGE IN EMERGENCY SURGERIES AT JINNAH HOSPITAL LAHORE''

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Abstract:
Introduction*: Infections that occur in the wound created by an invasive surgical procedure are generally referred to as surgical site infections (SSIs). SSIs are one of the most important causes of healthcare-associated infections (HCAIs). The prevalence studies tend to underestimate SSI because many of these infections occur after the patient has been discharged from hospital. SSIs are associated with considerable morbidity and it has been reported that over one-third of postoperative deaths are related, at least in part, to SSI (Eriksen HM et. al., 2003). However, it is important to recognise that SSIs can range from a relatively trivial wound discharge with no other complications to a life-threatening condition. Other clinical outcomes of SSIs include poor scars that are cosmetically unacceptable, such as those that are spreading, hypertrophic or keloid, persistent pain and itching, restriction of movement, particularly when over joints, and a significant impact on emotional wellbeing. The development of an SSI depends on contamination of the wound site at the end of a surgical procedure and specifically relates to the pathogenicity and inoculum of microorganisms present, balanced against the host's immune response.*

Methodology: *This was a prospective observational study conducted at Jinnah hospital Lahore during the time period between January 2019 and December 2019. The study population consisted of 200 patients who underwent surgery were included. Operated patients were followed up regularly, during the post-operative period.*

Results: *The patient having haemoglobin less than 10 gm/dl) had 35.7% of infected surgical site cases. The patients who had loss of more than 6 Kg body weight was considered to be malnourished had 25% of infected cases Smoking (more than 10 cigarettes/day) had 40% increased incidence of wound infected cases. Diabetes mellitus patient had 48.4% of operation site infected wound whereas malignancy had 54.5 cases of post operation surgical wound infection. Chronic illnesses such as ischemic heart disease and stroke has 55.5% of surgical site infection. Other cases which include obesity (more than 10% of ideal body weight), hypertension, urinary tract infection and dehydration account for 61.9% increased incidence of wound infection post operation.*

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INTRODUCTION:

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as surgical site infections (SSIs). SSIs are one of the most important causes of healthcare-associated infections (HCAIs). 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 (Anderson DJ et.al. 2009). However, prevalence studies tend to underestimate SSI because many of these infections occur after the patient has been discharged from hospital. SSIs are associated with considerable morbidity and it has been reported that over one-third of postoperative deaths are related, at least in part, to SSI (Eriksen HM et. al., 2003). However, it is important to recognise that SSIs can range from a relatively trivial wound discharge with no other complications to a life-threatening condition. Other clinical outcomes of SSIs include poor scars that are cosmetically unacceptable, such as those that are spreading, hypertrophic or keloid, persistent pain and itching, restriction of movement, particularly when over joints, and a significant impact on emotional wellbeing. The development of an SSI depends on contamination of the wound site at the end of a surgical procedure and specifically relates to the pathogenicity and inoculum of microorganisms present, balanced against the host's immune response (Lilani SP et. al., 2005). Since skin is normally colonised by a range of microorganisms that could cause infection, defining an SSI requires evidence of clinical signs and symptoms of infection rather than microbiological evidence alone. 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. Although the outcome measure for SSI used by many studies is based on standard definitions such as those described by the Centers for Disease Control and Prevention (CDC) or the Surgical Site Infection Surveillance Service,10 other valid measures based on clinical signs and symptoms have been described such as the Southampton11 and ASEPSIS12 methods (Russell RCG et. al., 2004).

The CDC definition describes three levels of SSI:
• Superficial incisional, affecting the skin and subcutaneous tissue. These infections may be indicated by localised (Celsian) signs such as redness, pain, heat or swelling at the site of the incision or by the drainage of pus.
• Deep incisional, affecting the fascial and muscle layers. These infections may be indicated by the presence of pus or an abscess, fever with tenderness of the wound, or a separation of the edges of the incision exposing the deeper tissues.
• organ or space infection, which involves any part of the anatomy other than the incision that is opened or manipulated during the surgical procedure, for example joint or peritoneum. These infections may be indicated by the drainage of pus or the formation of an abscess detected by histopathological or radiological examination or during re-operation. Organ infection is not included within the scope of this guideline (Hedrick TL et. al., 2006).

The microorganisms that cause SSIs are usually derived from the patient (endogenous infection), being present on their skin or from an opened viscus. Exogenous infection occurs when microorganisms from instruments or the theatre environment contaminate the site at operation, when microorganisms from the environment contaminate a traumatic wound, or when microorganisms gain access to the wound after surgery, before the skin has sealed. Rarely, microorganisms from a distant source of infection, principally through haematogenous spread, can cause an SSI by attaching to a prosthesis or other implant left in an operative site. Practices to prevent SSI are therefore aimed at minimising the number of microorganisms introduced into the operative site, for example by:
• removing microorganisms that normally colonise the skin
• preventing the multiplication of microorganisms at the operative site, for example by using prophylactic antimicrobial therapy
• enhancing the patient's defences against infection, for example by minimising tissue damage and maintaining normothermia
• preventing access of microorganisms into the incision postoperatively by use of a wound dressings. The significance of the microbial flora normally colonising the operative site in the subsequent risk of SSI has been recognised for many decades. The wound classification developed by the National Academy of Sciences in the 1960s distinguishes four levels of risk, from clean, where the procedure involves a sterile body site, to dirty, where the procedure involves a heavily contaminated site (Bratzler DW et. al., 2006).

AIM AND OBJECTIVES

- To determine the incidence and types of surgical site infections (SSIs) following elective surgeries.
- To study the associated risk factors encountered in patients who developed SSI.

- To study the causative organisms, their sensitivity patterns and the outcomes following treatment.

METHODOLOGY:

This was a prospective observational study conducted at Jinnah hospital Lahore during the time period between January 2019 and December 2019. The study population consisted of 200 patients who underwent surgery were included. Operated patients were followed up regularly, during the post-operative period. Risk factors of patients were also taken into consideration. The wound was checked on 4th post-operative day routinely and earlier and later according to the complaints of patients. Wound beds were prepared before specimen collection, where the wound immediate surface exudates and contaminants were cleansed off with moistened sterile gauze and sterile normal saline solution.

Two wound swabs were taken from each wound at a point in time to reduce the chance of occurrence of false-negative cultures and to increase the chance of recovering bacterial pathogens. It is also indicative of contamination in that if the two swab samples differ in types of organisms during presumptive test. All the swabs collected were sent to the department of microbiology for microbiological processing. The specimens were inoculated on blood, chocolate and Mac Conkey agar plates and incubated aerobically for 24 to 48 hours at 37°C. Bacteriological culture and examination was done following standard microbiological techniques.

Inclusion criteria:

1. Patients who underwent emergency surgeries.

Exclusion criteria:

1. Immunocompromised patients
2. Firearm injuries
3. Homicides

All patients received a prophylactic antibiotic at the time of incision. The antibiotic given was a third-generation cephalosporin, given intravenously. Along with metronidazole. Surgical site was cleansed with povidone iodine and surgical spirit. Sterile dressings were changed after 48 hrs. .in patients diagnosed to have SSI, pus for culture and sensitivity was taken using a sterile swab and sent to lab.

RESULTS:

Table-2 showed clean wound also called as category 1 was considered to be a surgical site wound with no inflammation stumbles upon and the gastrointestinal (GI), respiratory, genital & urinary tract is not involved had 12.5% of total infected surgical site wound. In Clean-contaminated (category 2) operative method involved a colonized viscera or cavity (opening) of the body, although with controlled and elective situations with nominal spillage. Category 2 wound was found to be in 20% of infected surgical site wound. Contaminated category III wound result in operative procedures are carried out with major Interruption, breaks in desolate, aseptic or sterile method (like open cardiac massage) or gross, foul spillage or drain from the GI tract, access into genitourinary or biliary system in the existence of contaminated bile/urine contents and incisions with non-purulent, sensitive and acute inflammation are integrated into this group. This accounted for 25% of infected surgical site wound cases.

Dirty category IV wounds are demonstrated with surgical processes mainly involved active infections prior to surgery. Dirty wound were 70% of the infection cases.

Following comorbities factors of the patients undergoing procedures were studied before the operation. The patient having haemoglobin less than 10 gm/dl) had 35.7% of infected surgical site cases. The patients who had loss of more than 6 Kg body weight was considered to be malnourished had 25% of infected cases Smoking (more than 10 cigarettes/day) had 40% increased incidence of wound infected cases. Diabetes mellitus patient had 48.4% of operation site infected wound whereas malignancy had 54.5 cases of post operation surgical wound infection. Chronic illnesses such as ischemic heart disease and stroke has 55.5% of surgical site infection. Other cases which include obesity (more than 10% of ideal body weight), hypertension, urinary tract infection and dehydration account for 61.9% increased incidence of wound infection post operation.

Staphlococococcus aureus was isolated in 37.5% of the infected cases. Whereas pseudomonas aeruginosa and escherichia coli were isolated in 20% and 10% cases of surgical site infection of the patients.
The various peri operative risk factors which were included in our study were

- Duration of surgery <2 hrs or > 2hrs
- Wound irrigation with povodine iodine or saline.

Duration of surgery:
Duration of surgery < 2 hrs total 120 patients out of which 18 (15%) developed SSI. Whereas duration of surgery > 2 hrs total 80 patients out of which 22(27.5%) developed SSI.

Wound irrigation:
For 100 patients pyodine iodine was used as a wound irrigation out of which 13 (13%) developed SSI. Whereas only saline was used for 100 patients

as a wound irrigation out of which 35(35%) developed SSI.

Time of diagnosis of SSI:

5 of the 40 patients in this study were diagnosed with SSI as early as the 3rd post-operative day and majority were diagnosed on the 4th and 5th post-operative days. No case was diagnosed with SSI after the 9th post-operative day in this study.

Table.1: Incidence of post-operative infection in various surgeries

Type of surgery	Total no.of surgeries(n=200)	Post-operative infection
ADHESIONLYSIS FOR ACUTE INTESTINAL	14	6
UMBILICAL HERNIA	10	1
OBSTRUCTION	20	3
APPENDICECTOMY FOR ACUTE APPENDICITE	26	1
COLOSTOMY FOR CA COLON	13	1
BLUNT INJURY SPLENECTOMY	5	0
BLUNT INJURY LAVAGE (HEMOPERITONEUM)	4	1
INCISIONAL HERNIA	7	0
INTESTINAL OBSTRUCTION WITHOUT GANGRENE	30	7
EARLY INTESTINAL PERFORATION	21	6
RESECTION & ANASTOMOSIS INTUSSUSCEPTION	11	1
SECONDARY SUTURING FOR BURTST ABD	8	1
INTESTINAL OBSTRUCTION WITH GANGRENE	21	7
LATE INTESTINAL PERFORATION	14	4
RUPTURE LIVER ABCESS	3	1
RUPTURE SPLENIC ABCESS	3	0
Total	200	40 (20%)

Table 2: Infection rates related to wound types.

Type of wound	**No.**	**No. of Infections (%)**
Clean	95	5 (12.5)
Clean contaminated	55	8 (20)
Contaminated	26	10 (25)
Dirty	24	17 (70)
Total	200	40

Table 3: showed the percentage of infected cases with predisposing factors.

Predisposing factors	Total n o. of cases	No. cases of infected	Percentage
Anemia	42	15	35.7
Malignancy	22	12	54.5
Diabetes	33	16	48.4
Malnutrition	20	5	25
Chronic illness	18	10	55.5
Smoking	25	10	40
Others	21	13	61.9
(Others include Hypertension, dehydration, UTI and obesity)			

Table 4 showed the percentage of pathogenic organism in infected cases.

Organism	No. isolated (%)
Staphylococcus aureus	15 (37.5)
Coagulase neg. Staphylococcus	2 (5)
Pseudomonas aeruginosa	8 (20)
Escherichia coli	4 (10)
Klebsiella pneumoniae	3 (7.5)
Proteus mirabilis	1 (2.5)
Proteus vulgaris	1 (2.5)
Citrobacter species	1 (2.5)
Beta haemolytic Streptococci	2 (5)
Bacteroides species	2 (5)
Peptostreptococcus species	1 (2.5)
TOTAL	40

DISCUSSION:

Despite the introduction of meticulous antiseptic regimen in surgical practice, post-operative wound infections do occur in the patients and a number of exogenous and endogenous factors play an important role in the occurrence of these infections. In the present study, out of 800 patients 116 got contaminated post operatively giving the post-usable contamination pace of 14.5%. A few specialists have cited the level of post-usable injury contaminations in scope of 10% to 76.9% (Singh R et. al., 2014). He present pace of post-usable injury diseases in the investigation could be ascribed to the dynamic pattern towards working the more established patients and performing progressively confused techniques remembering tasks for sullied and grimy careful locales. Surgical Site Infection has been increased over the past few years. World Health Organization (WHO) documented that 66% of establishing countries have no imprinted data related to the burden of SSI and also the data based on the surgical prophylaxis is insufficient. For the information regarding SSI few pilot studies are carried out in a single place. WHO recommended that in a particular country the studies carried out in a single setup is not measured as representative for the Epidemiology of the infections related to health care (Smith RL et. al., 2004). Literature reported in Pakistan illustrates the incidence rate of SSI may be outdated because various factors influences the infection rate For instance, Ahmed et al. conducted a study in Surgical Unit, showed that the incidence rate of SSI was 11% (Colling KP et. al., 2015). While Khan et al. reported in their study that the infection rate was found to be 9.294%. Globally, the incident rate of SSI is 2.6% documented in the USA, Tanzania reports 19.4% of cases, multi-center Italian study shows 2.7% SSI, while the Belgian study documented 1.47% cases of SSI. In various investigational studies, based on routine examination of multiple clinical scenarios, a wider magnitude of risk factors and their burden related to the occurrence of SSI can be evaluated. Such studies have focused multi variant patient groups, in relation to the particular type of risk factors within various clinical trials (catanzarite T et. al., 2015). Two models including Efficacy of the National Nosocomial Infections Surveillance (NNIS) index and the Nosocomial Infection Control (SENIC) index were developed to control the strategies and reduce the morbidity and mortality rates in consequence of post-surgical infection. Multi factorial risk coupled with SSI in which Patient correlated factors include diabetes mellitus, obesity, anaemia, immune-suppressant drugs, use of corticosteroids, malnutrition. Similarly, other factors include the duration of surgery, poor postoperative glycemic control; prolong post-operative stay, duration of surgery, different type of surgery, preoperative stay and surgery techniques employed. Infection at remote sites, preoperative temperature and presence of drains also key elements in the progress of SSI (Anand M et. al., 2014). Literature survey shows that American Society of Anaesthesiologists (ASA) score is also associated with post-surgical infection. ASA>2 is most likely associated with post-surgical patient [22]. Table 2 illustrates the classification of ASA. Three studies were identified that examined the association of wound classification with SSI incidence. In a retrospective analysis of a large infection surveillance data set, the SSI incidence rate per 100 operations was 2.1, 3.3, 6.4, 7.1 for clean, clean-contaminated, contaminated and dirty wound classes, respectively (Prokopovich P et. al., 2013).

Pathogens microorganisms may contain or distribute poisonous substances that expansion their capacity to attack a host, create harm inside the host, or get by on or in host tissue. Numerous gram-negative microscopic organisms deliver endotoxin, which animates cytokine formation. Thus, cytokines can activate the systemic inflammatory reaction disorder that occasionally escorts to several framework organ malfunctions. In the light of CDC reports, the most widespread organism responsible for the occurrence and progress of SSI is Staphylococcus aureus, followed by Escherichia coli, Coagulase-Negative Staphylococci (CNS), Pseudomonas aeruginosa, Enterococcus species, Enterobacter species, Klebsiella pneumoniae, Proteus mirabilis, Candida albicans and Streptococcus. Enlarged numbers of SSI cases have been reported with Methicillin-resistant Staphylococcus aureus (MRSA) species. Clean surgeries, in which abdomen or genital tract is not involved such as neurosurgeries, cardio thoracic, ophthalmic, orthopaedic, and breast surgeries, Staphylococcus aureus (MRSA) is the predominant isolate causing SSI and related to poor outcome (Martov A et. al., 2015).

Recommendation and suggestions:

Isolation and identification of causative agent are the prime concern, followed by the specific antibiotic prescribing in controlling and treating SSI. External visitors to the patient should be restricted in order to prevent the progress of the infection. Categorize all factors (basic events) leading to an SSI. A preliminary list of essential events should be formulated depending on the most important risk factors documented in the existing literature for SSIs. Then identification of interactions and dependencies among various risk points must be rationalized. Events (basic) may be divided into different components of the core process including pre-operative, operative, & post-operative, and should be scrutinized for the associations (dependencies and interactions) between the numerous risk points to determine how they may lead to SSIs. Furthermore, appropriate control strategies in the light of these events should need to be formulated and imposed in efficient way.

CONCLUSION:

Post-operative wound infections are a serious medical problem that has to be tackled due to its increased morbidity, mortality and medical care costs. An active surveillance program is recommended.

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