



## Post-operative surgical site infection among general surgery patients: Rate and risk factors.

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**ABSTRACT... Objectives:** High rate of post-surgical infections are reported with scanty effort for controlling them. The objectives were to evaluate frequency of surgical site infections in patients undergoing general surgery. **Study Design:** Cross Sectional Observational Study. **Setting:** Naz Memorial Hospital. **Period:** March 2019 to March 2020. **Material & Methods:** This study was conducted in general surgery ward for 1 year. All patients over 18 years admitted in surgery ward either as elective or emergency case were included while patients having any wound infection, operated in other hospital or diabetic foot and all those operated for incision and drainage of abscess were excluded. All patients that were operated during the study period were followed for any wound infection development till one qAqmonth. SPSS was used for data entry and analysis keeping p-value of <0.05 as significant. **Results:** 75 from 200 patients developed surgical site infection, 46 (61.3%) were operated in emergency. Among 24 contaminated surgeries type, 70.8% were reported having SSI (p-0.05) while from 28 dirty types of surgeries 78.6% of patients had a SSI (p-0.03). 25% were anemic, 21% diabetic while (20%) were reported to be hypertensive, 13 (17%) gave positive history of smoking while 12 (16%) were obese. **Conclusion:** Higher proportion of surgical site infection was observed in patients undergoing contaminated and dirty type of surgeries. Most patients with SSI were operated in emergency setting and anemia and diabetes were the most common risk factor reported in the infected patients.

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## INTRODUCTION

Post-operative surgical site infections are not only a cause of high mortality and morbidity; in addition they exert a severe economic burden as well in the developing as well as developed world.<sup>1</sup> Patients having being exposed to invasive procedures or surgeries are at a substantially higher risk for infection. Any intact skin that is breached along with lining of the mucosa after operations offer a breeding ground for nosocomial pathogen for invading internal milieu of the tissues.<sup>2</sup>

Infections of the surgical sites also known as surgical site infection (SSI) have become an alarming problem for surgeons, being considered as a major concern for infection control post-operatively throughout the globe.<sup>3</sup> In the western countries, annually around 2-5 % of patients attain

surgical site infection, amounting to a minimum of 500,000 SSI, estimated 3.7 million in excess, i.e. extra length of stay in the hospital and around \$ 1.6 billion in excess of hospital charges.<sup>4</sup> A key factor in managing SSI fruitfully is to keep post-operative patients under surveillance for infection, which is pivotal since it can provide insight into patient's post-operative problems and therefore help surgeons or care-givers to undertake necessary measures and control SSI.<sup>5</sup> In various developing populations which include Pakistan, a specific surveillance systems exist which could keep SSI and other routine nosocomial infections in check.<sup>6</sup>

In patients that have undergone surgery, SSI's are highly common nosocomial infections that account from about 16% to 38% of all infections.<sup>7</sup>

SSI has a debilitating effect on the patients with not only hampering their recovery and rehabilitation but also exerting a significant financial burden, especially in low-resourced setups.<sup>8</sup> SSI are regarded to be a leading reason for readmission of patients, which could cause further nosocomial complications such as delay in healing of wound, even revision surgery and with prolong stay at the hospital that could possibly render patients more susceptible to hospital acquired infections.<sup>9</sup>

According to the Center for Disease Control (CDC), any surveillance for SSI takes into account three wound infection classes; superficial, deep incisional or organ / space SSI. The incidences of post-operative SSI have been markedly increased since the ancient times.<sup>10</sup> Even though they can be largely preventable, yet they tend to remain a major source for morbidity. For minimizing post-operative SSI, it is pivotal to maintain a safe and aseptic environment through control of four main infection sources, i.e. equipment, personnel, environment and the risk factors of the patient.<sup>11</sup> Proper knowledge of certain SSI risk factors is equally important for creating a specific SSI risk stratification index, in order to develop specific strategies for limiting rate of infection.<sup>12</sup>

Since the best step in management of SSI is to prevent it, as prevention is much simpler, easier, cheaper and highly rewarding for patients for quick recovery from surgery. It is approximated that one third of infections can be easily prevented by pertaining to certain measures.<sup>13</sup> Therefore, it is important for hospitals to have an effective infection control program in place. Any failure in lack of implementation of infection control measures or lack of awareness is confounding factors that increase SSI rate and morbidity.<sup>14</sup> On the contrary, researches have reported that a substantial decline in SSI rates have been observed after implementation of infection control interventions.<sup>15</sup>

According to the National Research Council of USA, a system for categorizing and differentiating incisions on the basis of degree of contamination of incision was developed. It states that original classification is based upon 04 main categories:

clean, clean-contaminated, contaminated and dirty.<sup>16</sup> Nonetheless later dirty and contaminated categories were amalgamated and combined into "dirty". In hospitals, high rates of nosocomial post-surgical infections are reported with scanty effort for controlling them and more importantly, preventing them.<sup>17</sup> The objectives of this present study were to determine and evaluate the frequency of surgical site infections in patients undergoing general surgery at a secondary care hospital.

## MATERIAL & METHODS

This retrospective cross sectional study using non-probability convenient sampling technique was conducted at the general surgery department of Naz Memorial Hospital for a period of 1 year from 15<sup>th</sup> March 2019 to 15<sup>th</sup> March 2020. All surgical patients over 18 years of age admitted in surgery ward of the hospital either as elective or emergency case were included in the study while patients having any sort of wound infection, operated in any other hospital or with diabetic foot and all those patients operated for incision and drainage of an abscess were excluded from the study. All patients that were operated during the study period were followed for any wound infection development. Any patient who underwent multiple admissions or was operated more than once for complications was counted as one.

Before including patients into the study, informed consent was taken. All details collected from the patients was recorded including history, indication for surgery, type of surgery, co-morbidities and all investigations done during hospital stay. Operative details included type of surgery, surgery duration and use of prophylactic anti-biotic. Wounds for infection were examined right from post-operation. SSI was determined with inflammation, redness, pain, localized heat, temperature 38 Celsius or above and septic discharge from incisional site till 30 days post-operatively, in accordance with WHO guidelines.

Management of infection was done using the standard protocol which involved repeated dressings, draining of pus if needed and use of

broad spectrum antibiotics. Pre and post-operative length of stay at the hospital was recorded and the infected wounds were regularly inspected at reach follow up until healing was complete. Data was entered and analyzed using SPSS version 23.0. For demographic and qualitative variables, frequency and percentages were recorded and tabulated.

## RESULTS

According to the results of the study, from the total of 200 patients registered for undergoing surgeries, 75 developed surgical site infection making the overall rate of surgical site infections recorded at 37.5%. 120 (60%) of the patients in the study were males while 40% were females. Among the infected patients, majority, i.e. 55% were males.

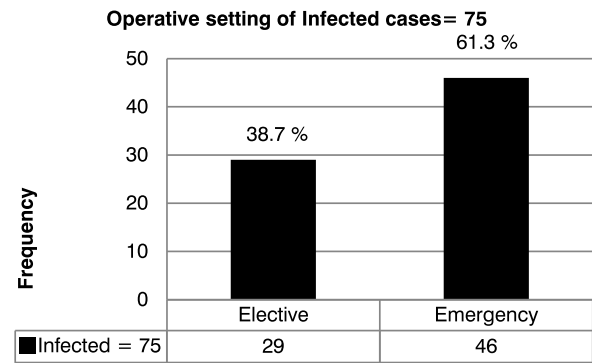
Among the 75 infected patients, 46 (61.3%) were operated in emergency setting while 29 (38.7%) in elective setting Figure-1.

From 96 clean type of surgery, 20 (20.8%) developed surgical site infection (SSI) having a non-significant p-value of 0.09. In 52 clean-contaminated surgeries, 16 (30.8%) of the patients had SSI having an insignificant difference of 0.56. Among 24 surgeries that were contaminated type, 17 (70.8%) were reported to have SSI with a significant difference of 0.05 while from 28 dirty type of surgeries, 22 (78.6%) of patients were found to have a SSI having a significant difference of 0.03 Table-I.

From the 75 infected patients with SSI, 19 (25%) were found to be anemic, 16 (21%) were diabetic, 15 (20%) were reported to be hypertensive, 13 (17%) gave a positive history of smoking while 12 (16%) were found to be obese Table-II.

Type of Surgery	Total Patients n=200	Infected Patients n= 75	P-Value
Clean	96 (48)	20 (20.8)	0.09
Clean-contaminated	52 (26)	16 (30.8)	0.56
Contaminated	24 (12)	17 (70.8)	0.05
Dirty	28 (14)	22 (78.6)	0.03

**Table-I. Surgical site infection rate with regards to different procedures.**



**Figure-1. Operative setting of infected cases (n=75).**

Co-morbid	Frequency (%)
Anemia	19 (25.3)
Diabetes	16 (21.3)
Hypertension	15 (20)
Smoking	13 (17.3)
Obesity	12 (16)

**Table-II. Distribution of co-morbidities in infected patients (n=75).**

## DISCUSSION

The rate of surgical site infection (SSI) reported in our study was significantly higher than reported in other studies. Complications in surgical procedure include SSI which is one of the most common forms of nosocomial infections. Therefore it is essential that surveillance be done for controlling and preventing SSI. Other studies such as one done at a tertiary care center of the same city where this study was done, i.e. Karachi reported an overall rate of SSI of 11%.<sup>18</sup> A Kashmir study reported rate of SSI at 11.3%.<sup>19</sup> Another study one in Iran reported an infection rate of 17.4%.<sup>20</sup> The incidence rates recorded in researches done in the west have been extremely low when compared with the incidence rates reported in eastern studies. Researches done in USA and other European countries have observed SSI rates at 2.6 % and 2.5% respectively.<sup>21,22</sup> Similarly, studies done in Philippine, Nepal and Brazil reported incidence rates at 7.8%, 7.3% and 5.1% respectively.<sup>23-25</sup> A study in Jamshoro, Pakistan recorded SSI rates of 13%.<sup>18</sup> Hospitals having inappropriate and ineffective infection control system, poor practice and indiscriminate

usage of antibiotics without considering proper guidelines tend to reported higher frequencies of complications. On top of this, another important factor is characteristics of the patients where majority of the patients visiting or being operated at secondary care low-budgeted hospitals belong to lower socio-economic status having a immune system which is compromised and with unhygienic practices, making a breeding ground for infection.<sup>26</sup>

Yet another cause of high SSI rates in our population might be because of overcrowding where high turnover of patients lead to higher work load and compromised patient care.<sup>27</sup> Moreover, high SSI rates are also observed when moving from clean to dirty surgical procedures that are in concordance with other researches as well; however even then such class specific rates seen in our study are higher in comparison to NNIS (National Nosocomial Infection Surveillance) standards.<sup>28</sup>

Other studies have reported no relationship between developments of SSI against the gender of patients. SSI rate analysis in respect of age has shown slightly higher rates of SSI with increasing age; however most studies have reported an insignificant difference with regards to SSI development and age.<sup>29</sup> Nonetheless, the usual age above which a higher SSI rates have been reported is 40 years. The probable reason behind this increase could be partially because of greater likelihood of chronic illnesses and reduced or compromised immunity with delay in healing in older individuals.<sup>20</sup> Similar to our study in which emergency surgeries reported higher frequency of SSI as compared with elective surgeries, other studies have also recorded a higher incidence of SSI in patients that underwent emergency procedures when compared with elective surgeries. This shows that even an improper or lack of planning and preparation prior to a surgical procedure is also a vital aspect of post-operative patient's care.<sup>21</sup>

A study reported that health care professionals who did not perform post-discharge surveillance for SSI on patients were found to have a 13-61

% higher chance of infection which was only apparent after being discharged from the hospital. Therefore it is also important to observe the omission of post-discharge infection which could falsely report lower rates of SSI. In addition, dirty-contaminated and dirty surgeries are highest to report frequencies of SSI. In our study, population was small where sub-population groups made for example on infection rates according to type of surgery, etc. Therefore conclusions drawn from such conditions may be of limited value.<sup>30</sup>

Follow up time period in various studies as well as ours was 04 weeks after surgery. Additionally those patients which could not come for follow up were telephonically followed. Non-quantifiable risk factors for SSI include duration of surgery, prophylaxis of antibiotic as well as preparation of skin has been denoted to be vital in other researches, however these factors are difficult to retrospectively quantify and therefore were not included or part of this study. In addition to these limitations, this study was not immune from selection and observer bias and the fact that the study was conducted in a single center with limited sample size.

## CONCLUSION

According to the results of the study, higher proportion of surgical site infection was observed in patients undergoing contaminated and dirty type of surgeries. Most patients with SSI were operated in emergency setting and anemia and diabetes were the most common risk factor reported in the infected patients.

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4	Sulhera Khan	Final approval for version.	<i>sulhera</i>
5	Amir Hussain Khan	Data analysis write up and proof reading.	<i>Amir khan</i>
6	Anas Bin Tariq	Data analysis write up and proof reading.	<i>Anas tariq</i>