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Original Article

Evaluation of patient factors for surgical site infection in Elective Ear, Nose, Throat and Head-Neck Surgery

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Abstract:

Background: *Surgical site infection (SSI) is one of the most common health care associated infection and still among the most common serious complications of surgery and have serious consequences for outcomes and costs. Different patient factors may be involved for SSI, including advanced age, diabetes, smoking, alcoholism, steroid/ immunosuppressive medication, poor nutritional state, obesity, anemia, jaundice, chronic infectious disease and malignancy. SSI previously called postoperative wound infection, results from bacterial contamination during or after a surgical procedure. SSI are incisional (superficial or deep) and organ space infection. A successful outcome after ENT and Head-Neck surgery is highly dependent on the postoperative complications. There is little information regarding patient factors for surgical site infection in elective ear, nose, throat and head-neck surgery.*

Objectives*: The aim of our study was to identify risk factors for developing Surgical Site Infections (SSI) among patients having Ear, Nose, Throat (ENT) and Head-Neck surgery.*

Materials & method: *This prospective type of observational study was conducted in ENT and Head-Neck surgery departments of Dhaka Medical College Hospital, Dhaka, during the period of March, 2018 to September, 2018. A total 250 patients were selected after they have enrolled for elective operation in ENT and Head-Neck surgery department. All relevant data was collected from patients' history, clinical examination, investigations and hospital records and those was recorded in prescribed form (Data collection sheet). After preoperative preparation specific operation was done. All patients were followed up for development of any postoperative wound infection. All information recorded in data collection sheet. Data was processed and analysed with the help of computer program SPSS and Microsoft excel. Quantitative data expressed as mean and standard deviation and qualitative data as frequency and percentage.*

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***Result**: Mean age of the participants was 32.79 (SD ±18.96) years. Among 250 patients, 7(2.8%) patients developed postoperative SSI. SSI is significantly higher in older age group (p value <0.05). SSI was developed in 3 (10.7%), 1 (0.5%) and 3 (10.0%) among Underweight, Normal weight and Obese patients respectively. Statistically significant higher infection rate was observed in underweight group (p <0.05). Among the diabetic, 13.3% developed post operative SSI, and significant infection was found in lower Hb level (anaemia) (<0.05). Among patients with Chronic infectious diseases (20.0%) and malignancy (3.4%) developed SSI which was statistically significant (p <0.05).*

***Conclusion**: These results support the consideration of older age, anemic, underweight, malnourish and diabetes as an independent risk factor for SSIs. Subtype of infection was found as superficial SSI 4(57.1%) cases, deep SSI 2(28.6%) cases and organ/ space SSI 1(14.3%) cases. As a result of these problems, routine surveillance for hospital acquired wound infections, including surgical wound infections, is recommended.*

***Key words:** Postoperative wound infection, Patient Factors, Surgical site infection.*

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Introduction:

It is well established that SSI results in extended and unexpected hospital stay, added burden of pain and sufferings to the patients as well as relatives, increased cost for the individual and hospitals, deprivation of treatment for deserving patients. Surgical site infection (SSI) is defined as a proliferation of pathogenic micro-organisms which develops in an incision site either within the skin and subcutaneous fat (superficial), musculofacial layers (deep), on in an organ or cavity, if opened during surgery. Surgical site infections (SSI) constitute a large burden of disease globally. Worldwide, prevalence rate is 2%–20% of patients after operation[1]. Surgical site infections are the most common infectious complications among hospitalized patients in developing countries, with a pooled cumulative incidence of 5.6 infections per 100 surgical procedures[2]. The incidence differs depending on the mode of surgery, degree of contamination and patient's factors like age, sex, comorbidity, diabetes mellitus, malnutrion, and anemia.

Surgical site infections (SSI) are defined as infections that occur during one month after a surgical operation or one year after implant surgery and affecting either the injury site or near surgical injuries. It is considered as a major problem in health care centers, resulting in extended length of stay, substantial associated morbidity and mortality, and high excess hospital cost[3]. Despite the technical advances in infection control and surgical practices, SSI still continue to be a major problem, even in hospitals with most modern facilities[4]. These infections are usually caused by exogenous and/or endogenous microorganisms that enter the operative wound either during the surgery (primary infection) or after the surgery (secondary infection).

Since the skin is normally colonized by bacterial flora, an SSI cannot have diagnosed by the microbiological evidence alone but conjunction with clinical signs which include; redness, heat, pain, swelling and separation of the suture line (dehiscence) on the presence of an abscess in the deeper tissues[5]. Different patient factors may be

involved for SSI, including advanced age, diabetes, smoking, alcoholism, steroid/ immunosuppressive medication, poor nutritional state, obesity, anaemia, jaundice and chronic kidney disease.In the majority of cases only cause minor superficial inflammation. Rarely, SSIs can be life threatening; for instance, haemorrhage resulting from an anastomotic dehiscence following infection of prosthetic vascular graft[5].

Usually post-operative wound infection appears between 5th to 10th postoperative days. But they may appear as early as 1st post-operative day or even years later.[6]In 2002, the Nosocomial Infection National Surveillance Service (NINSS) reported an incidence of hospital acquired infection relating to surgical wounds as high as 10% based on a five year survey of hospitals in the United Kingdom.[7]A prevalence survey undertaken in 2006 suggested that approximately 9% of patients who had undergone a surgical procedure were found to have developed an SSI.[8]

In a study by Metais et al. found SSI incidence rate about 9.7% after surgery of the salivary glands.[9] Bastier et al. (2016), in their study 'Early and late surgical site infections in ear surgery' mentioned overall SSI rate 10.8%. They found early SSI rate was 3.9% between 3 and 30 days after surgery[10]. The symptoms were mainly purulent otorrhoea and scar inflammation. In univariate analysis, pre-operative antibiotic therapy, wet ear at pre-operative examination, class III (contaminated) in surgical wound classification, NNIS score >1 and, oral post-operative antibiotic use was significantly correlated with early SSI. Late SSI was diagnosed for 7.1% between 90 and 160 days after surgery. The most common presentation of late SSI was purulent otorrhoea. In univariate analysis, the following factors were significantly correlated with late SSI: ot-orrhoea during the 6 months before surgery, surgery duration d"60 minutes, canal wall down technique and use of fibrin glue.[10]

Kattipattanapong et al. (2012) mentioned that Surgical site infections (SSIs) are the most common nosocomial infections, which can lead to revision surgery, delayed wound healing, increased antibiotic usage, longer hospital stays, and higher health care costs.[11]Kirkland et al.[12] calculated a relative risk of death of 2.2% attributable to SSIs, compared to matched surgical patients without infection.

It is well known that diabetes patients are more prone to infection. Increasing age is correlated with greater likelihood of certain chronic conditions, malnutrition and a fall in the body immunological efficiency, causing higher SSI rate.[13]Smokers who undergo general and orthopedic surgery have a higher incidence of wound infections than nonsmokers. The proposed mechanism is a detrimental effect of smoking on tissue oxygen, which impairs the reparative processes of wound healing and the neutrophil defense against surgical pathogens.[14] Patients who are receiving steroids or other immunosuppressive drugs preoperatively may be predisposed to developing SSI. In contrast, other investigators have not found a relationship between steroid use and SSI risks.[15]

Severe surgical illness results in metabolic responses that mobilize substrate (amino acids and fatty acids) from body stores to support vital organs enhance resistance to infection and ensure wound healing. Central to this process is the redistribution of body protein, which moves from skeletal muscle to support the central viscera. If unsupported, this protein wasting state could result in prolonged convalescence, diminished immunity and poor wound healing.[16]Most common signs of post operative SSI include redness, heat, pain, swelling and separation of the suture line (dehiscence). Measure can be taken at the preoperative, intraoperative and postoperative stage to reduce the risk of developing an SSI.

Methods:

This prospective type of observational study was conducted in ENT and Head-Neck surgery departments of Dhaka Medical College Hospital, Dhaka, during the period of March, 2018 to September, 2018. A total 250 patients were selected after they have enrolled for elective operation in ENT and Head-Neck surgery department. Sample was selected by purposive sampling technique. Informed written consent was taken from the patient. Detailed history of each patient, important and relevant findings on thorough physical examination was recorded and in all cases relevant investigations were done. The patient information was recorded and included in data collection sheet. The demographic indices, for example, age, sex, and residence, along with clinical data, including the associated symptoms, vital signs, and general and systemic examination, were recorded. The data were collected and statistical analysis was performed using SPSS software version 23. The results were represented as categorical data, and chi-square test was used. We reported statistically significant *P* values ($P \leq 0.05$) and their 95% confidence intervals.

Results:

According to the questionnaire, history of all the selected cases were taken, the clinical examination was carried out meticulously. Result & observations are given below,

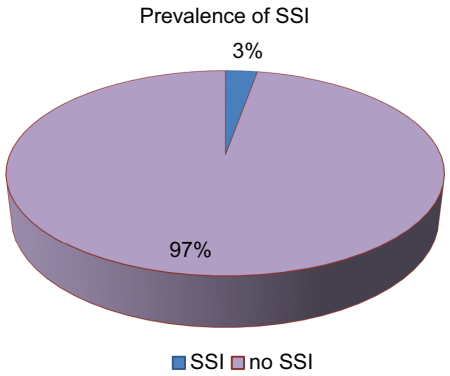

Figure- 1: *Prevalence of Surgical Site Infection (SSI) in the study subjects (n=250)*

Among 250 patients, 7(2.8%) patients developed postoperative SSI (Surgical Site Infection) (Figure 1).

Table-I: *Demographic characteristics of Study population (n=250)*

Variables	Surgical Site Infection		Total
	Frequency	Percent	
Age group			
< 30 years	1	0.8%	128
30 – 50 years	2	2.9%	70
> 50 years	4	76.9%	52
Gender			
Male	4	2.68%	149
Female	3	2.97%	101
Nutritional status			
Underweight	3	10.7%	28
Obese	3	10.0%	30
Normal	1	0.5%	192

Table-II: Evaluation of comorbidity (n=250)

Variables	Surgical Site Infection		Total
	Frequency	Percent	
DM			
Present	2	13.3%	15
Absent	5	2.1%	235
Anaemia			
Anaemic	5	3.85%	130
Non- Anaemic	2	1.67%	120
Chronic infectious diseases			
Present (Hepatitis B)	1	20.0%	5
Absent	6	2.4%	245
Malignancy			
Present (Papillary thyroid carcinoma, lymphoma)	2	3.4%	58
Absent	5	2.6%	192

Table-III : *List of interventions with frequency and Surgical Site Infection (SSI) rates (n=250)*

Interventions	Frequency	Percent	Total
Ear Surgery Myringo plasty-2 MRM-1	3	7.5%	40
Nasal SurgerySeptoplasty-1	1	1.8%	56
Throat SurgeryTonsillectomy-1	1	1.2%	84
Head Neck SurgeryTotal Thyroidectomy Incision biopsy	2	2.9%	70
Total	7		250

In this study, Ear, Nose, Throat and Head Neck surgery were 40 (16.0%), 56 (22.4%), 84 (33.6%) and 70 (28.0%) respectively and 3 (7.5%), 1 (1.8%), 1 (1.2%) and 2 (2.9%) postoperative SSI were developed among Ear, Nose, Throat and Head Neck surgery respectively (Table-III). MRM- Modified Radical Mastoidectomy.

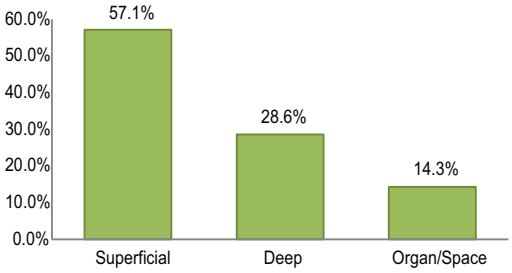

Figure-2: *Types of post-operative SSI (n=250)*

According to Types of post-operative SSI, 4(57.1%), 2(28.6%) and 1(14.3%) were Superficial, Deep and Organ/Space SSI (Figure 2).

Discussion:

In this prospective type of observational study, 250 patients were selected after they have enrolled for elective operation in Ear, Nose, Throat (ENT) and Head-Neck surgery departments of Dhaka Medical College Hospital, Dhaka. In this study, mean age of the participants was 32.79 (SD ± 18.96) years. Bastier et al. conducted a study at ENT and Head and neck surgery department, Bordeaux University Hospital, Bordeaux, France in the year of 2016. There were 62 men and 40 women with a mean age of 34.5 ± 19.5 years. This was similar with the finding of the present study.[10]But in another case control study conducted by Metais et al. fifty-six patients were studied: 66% males and 34% females. In the infected patients, the mean age was 60.9±10.3 years and in the controls the mean age was 57.7±17.1 years (range: 18—85 years).[9]

Among 250 patients, 7(2.8%) patients developed postoperative SSI (Surgical Site Infection). In another study, the overall infection rate for the 250 consecutive patients studied was 10.4%.[17]Bastier et al. found over all SSI rate 10.8%.[10]

In this study SSI is significantly higher in older age group (p value <0.05). Age proved to be an important factor in some other studies. It was found that the rate of wound infection for 15 to 24-year-old patients was only10% but increased significantly for those over 65 years of age.[13]

In this study SSI was developed in 3 (10.7%), 1 (0.5%) and 3 (10.0%) among underweight, normal weight and obese patients respectively. Statistically significant higher infection rate was observed in underweight group (p <0.05). Inonestudy in Bangladesh, mean BMI of patients were 21.6 kg/m^2,inarangeof15.8-33.8, which reflect the nutritional status of people of this region.[17] Nutritional state is regarded as an important

factors in wound healing[19]. Being under weight indicates poor nutritional status of patients. Inanother study statistically significant higher infection rate was observed in under weight group.[17]

In this study, 15(6.0%) were diabetic. Among the diabetic, 2(13.3%) developed post operative SSI, and that was statistically significant (p value < 0.05). In one study, it was observed that 17(5.2%) were diabetic. Among them 4(23.5%) patients developed postoperative SSI. Among the non-diabetic infection rate was 9.4%. This observation was statistically significant. Similar observation was reported in some other literature.[18]

In this study among 5 patients with Chronic infectious diseases, 1 (20.0%) developed SSI, which was statistically significant (p <0.05). In a study 17(5.2%) were chronic infectious disease. Among them, 3(13.6%) patients developed post-operative SSI. Among others infection rate is 10.1%. This observation is not statistically significant.[17]

Among the malignant patients, 2 (3.4%) developed postoperative SSI and it was statistically significant (p <0.05). adija S et al. reported in their study, malignant disease erupted as the most important risk factor for SSI.[19] In one study, it was shown that 17(5.2%) were malignant case. Among them, 8(13.8%) patients developed post-operative SSI. Among the non-malignant case infection rate is 9.4%. This observation is not statistically significant. [17]

According to Types of post-operative SSI, 4(57.1%), 2(28.6%) and 1(14.3%) were Superficial, Deep and Organ/Space SSI. It was supported by another study. Of the 26 cases of SSI, most 17(65.4%) of the SSIs involved only skin or subcutaneous incision. In 7(26.9%) of the SSIs involved deep fascia/ muscle of the incision. In 2 cases (7.7%) SSI involved organ/space manipulated during operation.[17]

Conclusions:

These results concluded that postoperative wound infection after ENT surgery was 77 (2.8%). Subtype of infection was found as superficial SSI 4(57.1%) cases, deep SSI 2(28.6%) cases and organ/space SSI 1(14.3%) cases. Mean postoperative hospital stay in over all patients was 3.8 days, but additional postoperative hospital stay in patients who developed wound infection was 16.2 days. Underweight, anaemia, diabetes mellitus and older age group were found to be independent risk factors for SSI in multivariate analysis.

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